Avoncliff Weir Determination Report

Appendix 1

We have highlighted a number of factors from our Competing hydropower schemes guidance that we believe are relevant to our decision and we have compared the North Mill scheme and the Weavers Mill scheme against those factors.

We have concluded that in four areas the Weavers Mill scheme is more desirable than the North Mill scheme. These four areas are not included in this Appendix but are discussed in detail in the Decision Statement.

In this Appendix we have outlined all other factors and areas of comparison where our conclusion is that there is no significant difference between the schemes.

Additionally we have included relevant comments received from the applicants during the consultation on our minded to decision and our response to these comments. All other matters that are relevant to our decision including full details of the applications, how we have advertised and consulted upon the applications and how we have had regard to our statutory duties and to the views of members of the public are also set out.

1.0 Summary of the proposal

The two competing hydropower schemes at Avoncliff weir are located at North Mill (north side) and Weavers Mill (south side).

1.1 North Mill

The North Mill scheme comprises alteration works to the existing river weir to facilitate the inclusion within the weir of one 3.6 metre diameter 4-blade variable speed Archimedes turbine and a fish pass.

Alteration works to the existing mill wheel pit structure are also proposed to include within the wheel pit one 2.7 metre diameter 4-blade variable speed Archimedes turbine.

An eel pass is proposed.

The two turbines would have a combined maximum water capacity of 10.033 cubic metres per second (m^3/s). Please see section 8 for further information on the capacity of the turbines. It is proposed that they will operate all year and will be subject to a local hands-off flow (HOF) constraint.

All of the water used will be returned to the River Avon immediately downstream of the scheme. The proposal does not include raising the remaining weir above current levels.

The North Mill applicant has been advised that a transfer abstraction licence application was unnecessary because his scheme does not include a transfer of water. The North Mill applicant declined our request to withdraw his transfer abstraction licence application.

1.2 Weavers Mill

The Weavers Mill scheme comprises alteration works to the existing river weir sluice gate to facilitate the inclusion within the weir of a single Kaplan turbine, intake fish screen and a fish by-wash.

An eel pass and fish pass is proposed.

The turbine will have a maximum water capacity of 7.9m^3/s. It is proposed that it will operate all year and will be subject to a local HOF constraint.

All of the water used will be returned to the River Avon immediately downstream of the scheme. The proposal does not include raising the remaining weir above current levels.

2.0 Application history

We received applications from two applicants for competing hydropower schemes on the same weir.

On 16 July 2010 we granted a licence to the Weavers Mill applicant. The North Mill applicant appealed to the Planning Inspectorate and his applications were deemed refused under provisions of the WRA1991. He then issued judicial review proceedings challenging our decision to grant a licence to the Weavers Mill applicant.

On 11 April 2012 the Court ordered, by consent, that our previous licence determination decisions were quashed and the applications were returned to us for re-determination.

On 22 June 2012 we consulted with both applicants on our proposed decisions on a "minded to" basis. At this time we were minded to grant licences to both applicants on a split-scheme basis, having provisionally concluded that there was sufficient water to support both schemes; allowing them to operate whilst sharing the water resource equally.

However, following consultation and having received comments from both applicants and having taken expert advice, we determined that it was now no longer possible to issue licences to both applicants on a split-scheme basis. The applications would now be regarded as competing applications (and would be compared in accordance with our Competing hydropower schemes guidance). This necessitated the gathering by us of additional information from both applicants, in order to inform an independent expert assessment by AMEC Environment and Infrastructure UK Ltd ('AMEC').

On 30 April 2013 we consulted both applicants on our minded to determination report providing them with a reasonable opportunity to comment upon the way in which we had applied our guidance. Both applicants submitted comments and we have considered these.

On 19 July 2013 the Weavers Mill applicant submitted revised drawings relocating his intake structure to be within the footprint of the weir and included a fish pass in his scheme design. In all other aspects the Weavers Mill design remains as first applied for.

On 30 August 2013 we undertook a site visit to the manufacturing premises where the Weavers Mill applicant proposes to manufacture the Kaplan turbine he proposes to

install. This was done in response to concerns expressed by the North Mill applicant as to the Weavers Mill applicant's ability to manufacture the turbine to an appropriate standard.

In October 2013 we were informed by the North Mill applicant that Weavers Mill was being advertised for sale. This necessitated further enquiries by us, which have now been completed; we consider this matter further at section 14.15 below.

3.0 Application details

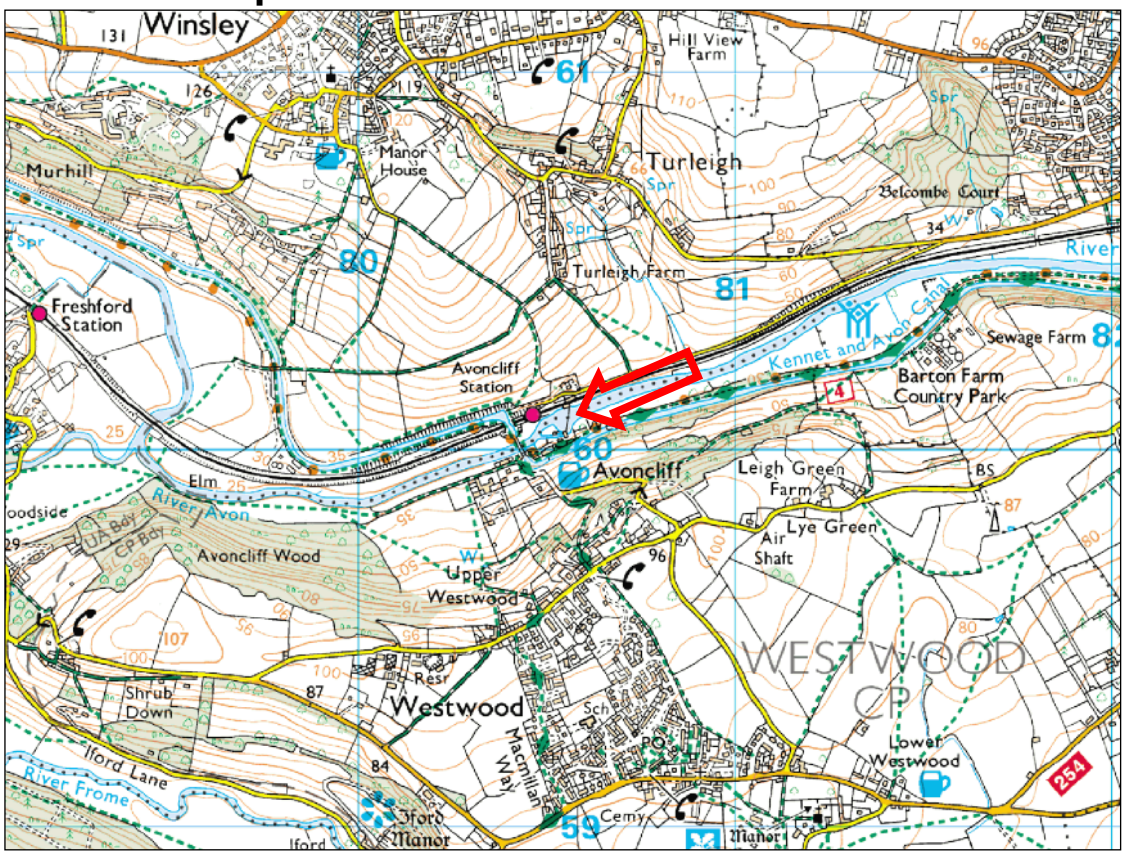
Administrative details – EARL	
Applicant name and address	Mr Ewan EARL 46 Lower Westwood, Bradford-on-Avon, Wiltshire, BA15 2AQ
Application contact details	Mr Brendan Barrow eWaterpower, 1st Floor, Broad House, Broad Lane, Bracknell, Berkshire, RG12 9BJ
Application reference numbers	NPS/WR/002511 & NPS/WR/003126
Catchment	C053001C Avon Bristol Upper Reach Tribs
Agency Region & Area	South West Region (Wessex Area)

Proposed abstraction / impoundment details – EARL	
Proposed location of abstraction / impoundment	Existing weir structure and associated mill wheel pit at North Mill, Avoncliff, near Bradford-on-Avon, Wiltshire.
Watercourse	River Avon
Proposed points of abstraction / impoundment (National Grid Reference)	Between NGR ST 80561 60112 and ST 80560 60103
Proposed purpose of the impounding works	To alter the existing weir and wheel pit to accommodate one 3.6 metre diameter 4-blade variable speed Archimedes turbine and one 2.7 metre diameter 4-blade variable speed Archimedes turbine and fish and eel pass.
Proposed period of operation of the hydropower scheme	All year subject to a local flow constraint
Proposed turbine maximum rate	10.033m^3/s
Proposed means of operation	Gravity feed to the two turbines controlled by the variable speed of the two turbines and the adjustable sluice gates.
Proposed method of measurement of water use	Via the generated output of the two turbines

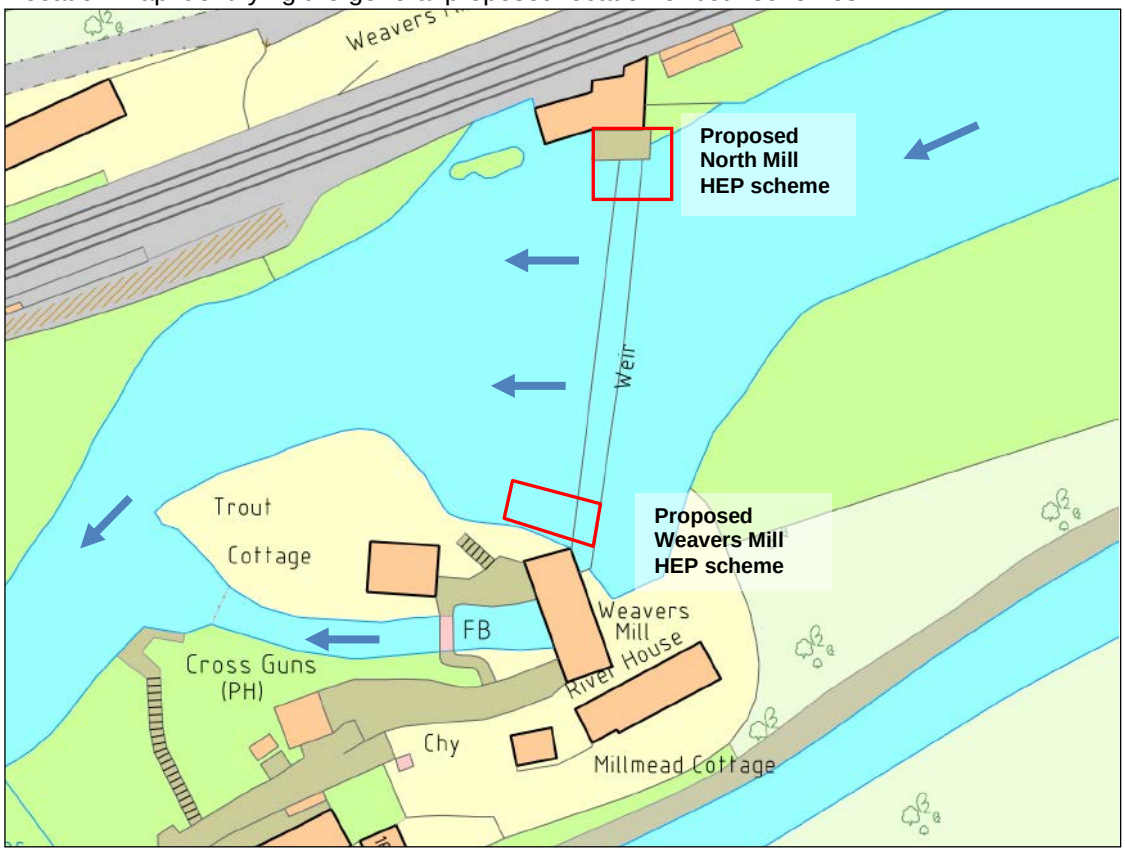
Administrative details – TARRANT	
Applicant name and address	Mr Martin TARRANT Weavers Mill, Avoncliff, Bradford-on-Avon, Wiltshire, BA15 2HB
Application contact details	As above
Application reference numbers	NPS/WR/001709
Catchment	C053001C Avon Bristol Upper Reach Tribs
Agency Region & Area	South West Region (Wessex Area)

Proposed impoundment details – TARRANT	
Proposed location of impoundment	Existing weir structure at Weavers Mill, Avoncliff, near Bradford-on-Avon, Wiltshire
Watercourse	River Avon
Proposed points of impoundment (National Grid Reference)	Between NGR ST 80555 60045 and ST 80555 60054
Proposed purpose of the impounding works	To alter the existing weir to accommodate a single Kaplan hydropower turbine and a fish pass, fish by-wash and eel pass
Proposed period of operation of the hydropower scheme	All year subject to a local flow constraint
Proposed turbine maximum rate	7.9m^3/s
Proposed means of operation	Gravity feed to the turbine controlled by adjustable wicket gates.
Proposed method of measurement of water use	Via the generated output of the turbine

4.0 Location Maps



Location map identifying the general proposed location of both schemes.



Location plan. The red scheme outlines are indicative only; not to scale.

5.0 Water Framework Directive (WFD), RAM resource assessment, and licensing strategy

Category	Comments/Name
Name of licensing strategy	Bristol Avon and North Somerset Streams
Licensing strategy Assessment Point (AP)	AP9 Middle River Avon
Current resource status and surface water licensing strategy (or other strategy) for this location	Resource availability at least 95%
WFD Integrated Water Body (name/ID)	GB109053027370 R Avon (Brist) - conf Semington Bk to Netham Dam
Unit Status/2nd cycle licensing strategy surface water availability colour (@ Qn95% flows)	Grey: FL flows >10% above natural flows
Artificial or Heavily Modified Water Body?	Heavily modified
WFD Surface Water Ecological Potential 2009 Baseline	Poor
WFD Surface Water Ecological Potential most recent (2012)	Poor
Morphology Status 2009 baseline	Not high
Morphology Status most recent (2012)	Not high
Hydrology Status 2009 baseline	Not high
Hydrology Status most recent (2012)	Not high

Licensing strategy

A licence to impound water or to make modifications to an impounding structure is not assessed under the licensing strategy methodology.

WFD assessment

An assessment has been carried out to isolate the potential impacts and likely significant effect of the installation of a hydropower scheme on Avoncliff weir, please refer to section 13.

6.0 Conservation impacts (designated and/or wetland sites)

Nearest Conservation Sites (distance or downstream) and Potential Impacts			
Designation Types	**Name of Site**	**Potential Impact**	**Distance & Direction**
National Conservation Designations			
Special Area Conservation (SAC)	None	No	-
Ramsar	None	No	-
Special Protection Area (SPA)	None	No	-
Site of Special Scientific Interest (SSSI)	None	No	-

Nearest Conservation Sites (distance or downstream) and Potential Impacts			
Designation Types	**Name of Site**	**Potential Impact**	**Distance & Direction**
Groundwater Dependent Terrestrial Ecosystems (GWDTEs) GW only	None	No	-
Other Conservation Designations			
National Nature Reserve (NNR)	None	No	-
Local Nature Reserve (LNR)	None	No	-
Ancient Woodland	Becky Addy Wood Avoncliff Wood	No	~80m ~617m
Scheduled Ancient Monuments (SAMs)	None	No	-
ESA	None	No	-
Local Wildlife Site	Avoncliff Aqueduct, Bristol Avon River*, Kennet & Avon Canal, Becky Addy Wood Becky Addy Meadows, Avoncliff Wood	No	Circa 147m site within 72m 240m 58m 613m
National Landscape Designations			
National Parks	None	No	-
Area of Outstanding Natural Beauty (AONB)	Cotswolds AONB*	No	Within
Heritage Coast	None	No	-
Others			
Restoring Sustainable Abstraction Programme (RSAP)	None	No	-
Protected Species	European Eel migratory route European Water Vole Bullhead Threatened bryophyte record	No, see section 14.1.	Within

*Bristol Avon River LWS & Cotswold AONB

We consider that the proposed hydropower schemes at Avoncliff fall within the environmental criteria that are our responsibility and due care has been taken to minimise the impact on conservation designations and upon the biodiversity, ecological and fisheries interests. There are a number of matters which are promoted by the AONB Board that will additionally come under the planning process itself e.g. design, materials and tranquillity.

There is no statutory consultation process for these sites.

7.0 Water Resources (Environmental Impact Assessment Regulations) 2003 as amended by the Water Resources (Environmental Impact Assessment) (England and Wales) (Amendment) Regulations 2006.

We are satisfied that neither proposal is a "relevant project", as defined by the Regulations. No environmental statement is therefore required to be submitted in respect of any of these applications and project proposals.

8.0 Justification of water requirements

Both applicants have estimated their water requirements based on the design capacity of their chosen turbine(s) and their understanding of the hydrology of the river at Avoncliff weir.

The North Mill applicant initially requested maximum turbine water usage of 10.600m^3/s for the two Archimedes turbines, however supporting information from the manufacturer for these turbines stated maximum turbine usage of 10.033m^3/s. Subsequently the North Mill applicant requested maximum turbine water usage of 10.390m^3/s and then further information provided by the applicant suggested 10.300m^3/s. Only the 10.033m^3/s figure has been substantiated with supporting information and therefore our assessment is based on a turbine maximum of 10.033m^3/s. In any event even if the larger turbine maximum value of 10.300m^3/s was used we are advised that it would not alter the conclusion on which scheme has the potential to generate the most electricity.

The Weavers Mill applicant has stated that the maximum turbine water usage for the Kaplan turbine is 7.900m^3/s. Within our assessment of the Weavers Mill scheme we have used the stated 7.900m^3/s figure.

Our assessment for the North Mill scheme is based on a figure of 10.033m^3/s (which we consider to be substantiated by the supporting information provided) and that for Weavers Mill is based on a figure of 7.900m^3/s.

The licence we issue to Weavers Mill will contain a condition limiting the maximum water usage to the design capacity of the turbine.

Both of the proposed schemes return all of the water used within the turbine(s) immediately downstream of the weir and as such are considered to be non-consumptive in terms of water use.

9.0 Advertising

The applications were initially advertised in the local press independently of each other. The North Mill application was advertised in the Wiltshire Star on 10 December 2009 and the Weavers Mill application in the Wiltshire Star on 11 February 2010.

We received a total of 23 representations to the North Mill advertisement.

We received a total of 9 representations to the Weavers Mill advertisement.

Following concern about economic viability of a split scheme and change to the North Mill applicant's scheme, it became apparent that we would have to compare the applications using our Competing hydropower schemes guidance. Therefore, before we reached a final decision we decided to advertise both of the competing schemes in one combined advertisement.

Accordingly, the competing applications were advertised in the local press on 3 January 2013 and 4 January 2013 in the Wiltshire Star and the Wiltshire Times respectively.

Application was advertised	**Comments**
Date when advertised	3 January 2013 & 4 January 2013
Name of local paper	Wiltshire Star & Wiltshire Times
Public inspection address	Environment Agency Rivers House East Quay Bridgwater Somerset TA6 4YS
Notice served to: Internal Drainage Board (IDB)	No. Not applicable at this location.
Navigation Authority (NA)	No. Not applicable at this location.
Harbour Authority (HA)	No. Not applicable at this location.
Conservancy Authority (CA)	No. Not applicable at this location.
Statutory Water Undertaker (SWU)	Wessex Water PLC was sent a copy of the press notice on 21 December 2012. No response was received.
Number of representations received in writing	173
Representation Decision Statement	A Decision Statement will be sent to each person who made a representation informing them of our licensing decision. The Decision Statement and supporting documents will also be published on our website.

How we have had regard to the comments made in the representations received is detailed in the sections below.

10.0 Representations Received

A significant number of representations were received in response to this press advertisement; highlighting the local interest and strong feeling concerning the development of a hydropower scheme at Avoncliff.

We received a total of 173 representations to the January 2013 advertisement.

The representations received have been grouped into a number of common themes. These are shown in the table below. Many of the themes raised were made in both the positive and the negative with respect to each of the two schemes. The table also shows how we have had regard to each of the themes in reaching our decision; or references the section within this report where that particular theme is discussed.

Theme (points raised in representation)	How have we had regard to this in reaching our decision?
Flood risk – development of the scheme increasing upstream flood risk.	To see how we have considered the potential flood risk posed by each of the competing schemes please refer to the Decision Statement.
Noise and vibration – generated by the scheme during operation.	To see how we have considered the potential for noise and vibration to be a determining factor when considering the competing schemes please refer to section 14.10 of this report.
The scheme design – covers all points made with regard to the choice of turbine(s); the location of the turbine(s); turbine efficiency; generating potential; intake / trash screening and screen maintenance, operation of the scheme and signage.	The two competing scheme designs are discussed in detail within the AMEC assessment attached to this report. For our conclusions on the choice of turbine and the generating potential of the two proposed schemes please see the Decision Statement.
Land ownership and access – with particular relevance to the building and maintenance of the schemes. Access to land; access to the watercourse; access to the weir.	To see how we have considered land ownership and access please refer to section 14.16 of this report.
Fisheries – the direct impact upon fish (and eels) interacting with the turbine(s); the upstream and downstream fish passage arrangements and the indirect impact upon the local fish habitat.	To see how we have considered the potential for impact on fish to be a determining factor when considering the competing schemes please refer to section 14.1 of this report.
The visual amenity – how the scheme will look in the landscape.	To see how we have considered landscape and visual amenity please refer to the Decision Statement.
Ecology, biodiversity and conservation designations - the direct impact of the scheme upon the weir pool ecology and the local habitat.	To see how we have considered ecology and biodiversity please refer to section 6 and 14.1 of this report.
Health & safety – in particular that of swimmers, boaters and other water users.	To see how we have considered health and safety please refer to section 14.17 of this report.
Consultation by applicants with other bodies / organisations with regard to the proposed development.	To see how we have considered applicant consultation with external bodies and interest groups please refer to section 14.18 of this report.
Timescale, determination cost and application history – the length of time taken to determine the applications and the cost to the public.	We have reached our determination decision based upon the merits of the schemes. Determination costs are not a relevant factor for us in considering the merits of each scheme in reaching that decision. Section 2.0 of this report provides a brief application history for both of the competing schemes.
Tourism – benefits and disbenefits of the scheme.	This is generally a land use issue which will also be for the local planning

Theme (points raised in representation)	How have we had regard to this in reaching our decision?
	authority to consider. However, we have had regard to it with respect to our general duties (see section 14.12).
Protected rights.	To see how we have considered water resources protected rights (& lawful uses of water) please refer to section 15.0 of this report.
Localised upstream bank erosion.	The North Mill scheme could increase the risk of localised bank erosion more than the Weavers Mill scheme, due to predicted increases in upstream water level. Flood induced bank erosion has been considered as part of the Flood Risk section of the Decision Statement.
Choose the best scheme – some representors made no distinction between the two schemes but wanted to see the best possible scheme installed. Particularly in terms of turbine efficiency and the potential to generate the most electricity.	The two competing scheme designs are discussed in detail within the AMEC assessment attached to this report. For our conclusions on the appropriate choice of turbine for the weir and on the generating potential of the two proposed schemes please refer to the Decision Statement.
Lack of local consultation. Some felt the local residents and stakeholders should have been consulted directly on both competing schemes.	The established route for alerting interested parties to an application for a water resources licence is through the local press advertisement and our website. This gives everyone an equal opportunity to make representations should they wish to do so. Should an interested party wish to find out more about either proposal copies of both competing applications and supporting information were also made available to the public on our public register at our Bridgwater office between 3 January and 1 February 2013. Each person that has made a representation to this and the previous advertisement will have received an acknowledgement and will be sent a copy of our Decision Statement which will outline how we have reached our final decision. Copies of our full determination report and supporting appendices will also be placed on our website.
The content of the public register documents and the press advertisement.	Copies of both competing applications and supporting information were made available to the public on our public

Theme (points raised in representation)	How have we had regard to this in reaching our decision?
	register at our Bridgwater office between 3 January and 1 February 2013. The Bridgwater public register was viewed by the North Mill applicant and one other. The public register documentation correctly comprised documents provided by each of the competing schemes so as to enable members of the public to assess the applications. To see how we have considered land ownership and access please refer to section 14.16 of this report. To see how we have considered the generating potential of each scheme please refer to the Decision Statement. To see the reasons why we advertised all the applications in January 2013 please refer to section 9.0 of this report.

Subsequent to the advertisement period ending 2 representations were withdrawn. One for ill health reasons and the other as their details were provided without their knowledge.

11.0 Hydrology

11.1 Background information

The Bristol Avon has a large catchment covering an area of approximately 2,220km². It is a slow-flowing lowland clay river, which has been modified by impoundment, land drainage and flood defence work. The Avon flows in a south west direction over Oxford Clays and Kellaways Clay until the town of Melksham. It then flows west through Bradford on Avon to the Avoncliff weir. 1.2km downstream of the Avoncliff weir the Somerset Frome, a significant tributary, joins the Avon before it turns in a northerly direction to flow over the Great Oolite. After this the river turns west / northwest again to flow through Bath and Bristol where it becomes tidal at Netham Weir. Ultimately it flows into the Severn Estuary at Avonmouth.

The Kennet & Avon canal runs parallel to the main river for a distance upstream before crossing it by means of an aqueduct circa 130m downstream of the weir.

11.2 Estimation of flow data for the site

We used the flow estimates derived using data from our flow gauging stations in the catchment to determine the hands-off-flow (HOF) value (the amount of water required to pass over the weir so as to protect the weir pool) and to assess the impact of each application.

We created a river flow sequence from 1990-2007 (this period of record is in line with our Catchment Abstraction Management Strategy methodology and is considered representative of the long term average) using Bradford-on-Avon and Bathford gauging stations. Bradford-on-Avon is the closest and therefore most appropriate gauging station, however this opened in 2005 therefore limited data was available from this site. We then established a relationship between the data from these two gauging stations which enabled us to complete the sequence. We then scaled the data sequence to Avoncliff.

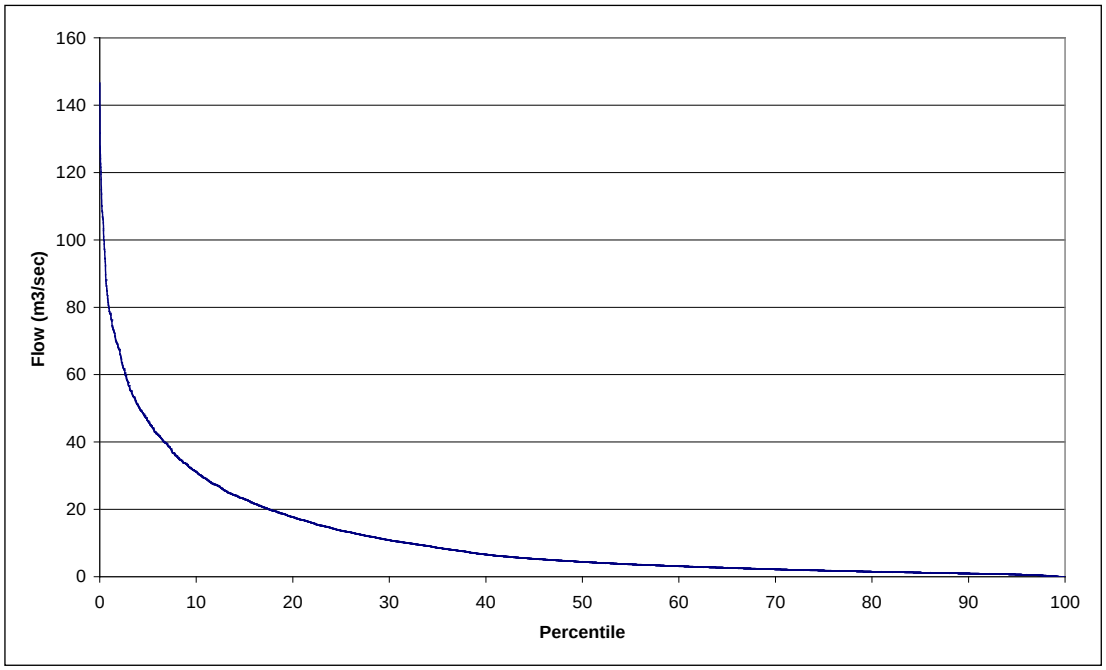
To meet the objectives of the Water Framework Directive requires an assessment against natural flow; therefore in most cases using actual flow estimates is not appropriate as it will not meet Water Framework Directive objectives. However in rivers where actual flow is higher than natural flow this is not the case. When higher, actual flow estimates provide greater protection for the environment, and therefore ensure Water Framework Directive compliance. As this river's actual flow is higher than the natural flow it is appropriate to use actual flow estimates in order to meet Water Framework Directive standards.

We have applied the resultant hydrological data in our assessment of both schemes.

The table below shows the flow statistics derived for Avoncliff.

Percentile	**Avoncliff Flow (m^3/s)**
5	46.170
10	31.160
20	17.728
30	10.925
40	6.712
50	4.559
60	3.310
70	2.421
80	1.739
90	1.233
95	0.951
98	0.603
99	0.400
99.9	0.095
Qmean	11.520

The Qmean flow is the average of all the flow measurements taken over a period of time at a particular point in a river.



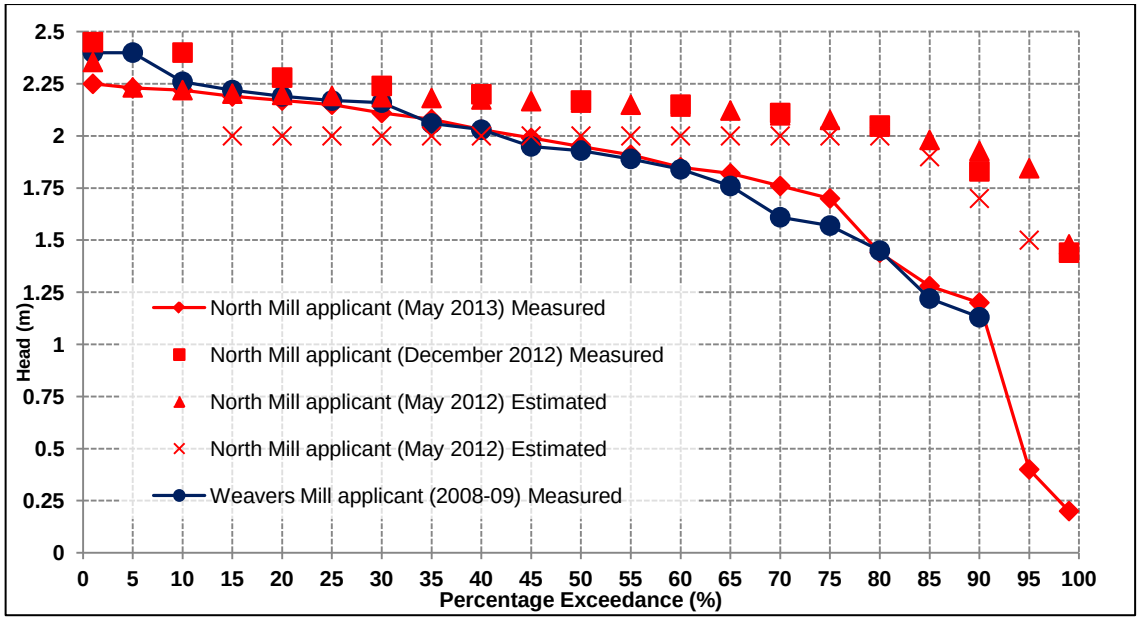
Flow duration curve at Avoncliff

The Q95:Qmean ratio = 0.08 meaning the river has low base flow. Note that Q95 means the flow exceeded for 95% of the year; usually taken as the characteristic value for the natural low flow in the river. The Q95:Qmean ratio provides a measure of how much of the river flow is affected by stored sources, such as permeable rock, which enables the base flow in the river to be sustained in dry conditions.

11.3 The water level data set used within this re-determination

Electricity generating capability at hydropower sites is sensitive to water level (head) and flow fluctuations. Generally we would expect on-site water level data collection over at least a 6 month period (or longer if required) to demonstrate a representative range of river levels. Electricity generation estimates based on representative river flow and water level data are more likely to be accurate than those based on periods of measurement that do not include an adequate range of river level and flow conditions at a site. At Avoncliff this sensitivity is increased due to downstream constriction of the river channel by the Weavers Mill island and the aqueduct, which causes the water level downstream of the weir to rise disproportionately. This in turn reduces the amount of head available, and thus accurate water level data is important to us and to the applicants.

The different water level (head) data provided by the applicants are shown in the graph below.



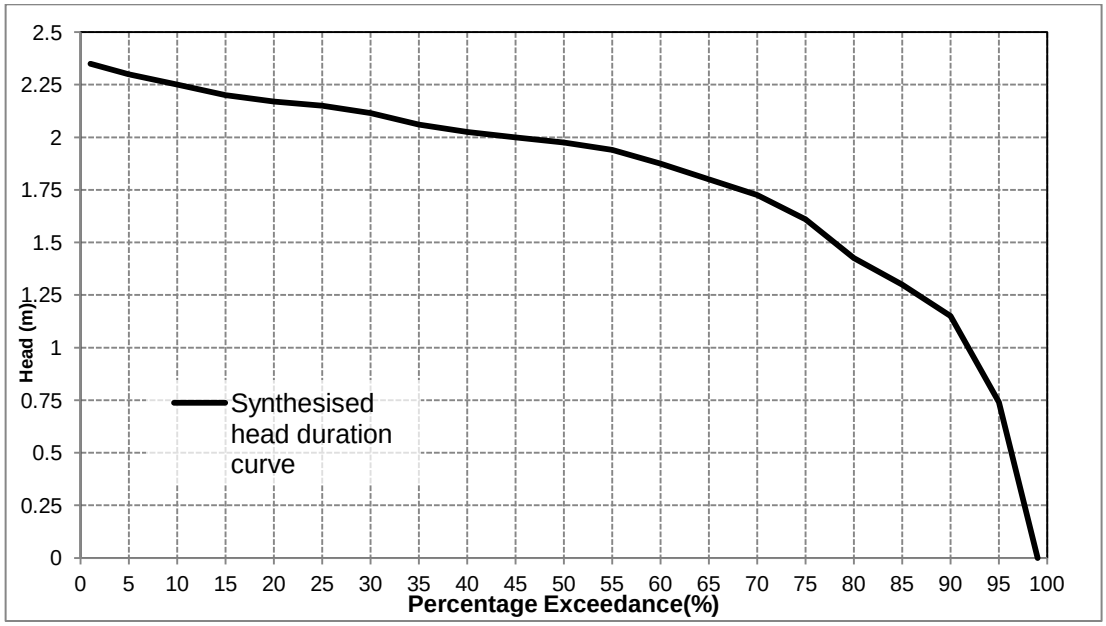
The water level data provided by the North Mill applicant (May 2013), following a suggested period of daily water level measurements, and the data collected by the Weavers Mill applicant in 2008-09 show a good fit with one another and corroborate well across a range of flows. These data also agreed with the anecdotal and evidenced behaviour of the weir at high river flow; that is that the available head reduces significantly due to the backing up of the downstream river because of the constriction of the river channel. This is further demonstrated by the noticeable difference between the North Mill applicant's initial estimated water level datasets and his May 2013 measured water level dataset.

Although the data have been collected on opposite sides of the weir at different times both applicants have essentially measured the same aspect; the head of water at the weir. It makes little or no difference as to which side of the weir the measurements are taken. Given a sufficient period of water level monitoring it is likely that both applicants would eventually arrive at the same level duration relationship; as suggested in the graph above.

From the graph, for the 80th percentile, both the North Mill (May 2013) and the Weavers Mill data agree that the head is ~1.45m. This is the head of water at the weir that we would expect to be exceeded for 80% of the time. So in any typical year for 292 days it could be expected that the head of water would be 1.45m or greater.

The North Mill (May 2013) and the Weavers Mill (2008-09) datasets have been used by AMEC to determine the most appropriate data (synthesised head duration curve) to compare the schemes. This is considered a reasonable method given the obvious similarities between the two sets of data. The explanation of how the synthesised head duration curve is calculated is set out in full in the AMEC report in Appendix 4 at page 23.

The synthesised head duration curve is shown in the graph below:



Electricity generation assessments in subsequent sections of this report are derived from using the water level head data from the synthesised head duration curve dataset.

11.4 Control of water level and flow

Both applicants own and could operate sluices that could at times potentially control and change the upstream water level and flow distribution over the weir.

Weavers Mill has a single undershot sluice under the mill and two sets of undershot sluices in the weir structure. North Mill has a single lowering sluice at the wheel pit.

Until very recently, there was no flow through the North Mill wheel pit, which had for many years been blocked with several tonnes of silt and debris. However, shortly after we provided the parties with our draft determination report of 30 April 2013, indicating our preference (subject to consultation) for the Weavers Mill scheme, a flow through the wheel pit recommenced. The North Mill applicant subsequently stated that the North Mill water wheel sluice had been 'reinstated' to its original design and partially restored the water wheel. This does not, in our view, accord with the plans submitted for the North Mill hydropower scheme, in particular because the water wheel appears to have been located in the position where it was proposed to install one of the two North Mill turbines. Neither does it, in our view, accord with his impounding licence application.

In the light of these recent events, it is now our understanding that (1) the North Mill applicant can operate his sluice so as to potentially adversely affect the Weavers Mill hydropower scheme (if licensed and built); (2) the Weavers Mill applicant can also operate any of his sluices in such a way as to potentially adversely affect the North Mill scheme (if licensed and built). Thus, neither party has complete control over the water level at the weir.

Our preference in considering which (if any) scheme to license would be that the proposed licensee should have complete control over the operation of the scheme

(including the water level at the weir). That is not possible in the present case and we have considered whether we should refuse to license any scheme as a result.

We have decided that, on balance, it is preferable for us to grant a licence notwithstanding the acknowledged difficulties over the control of the river flow distribution and river level. We have reached the view that these difficulties are not insurmountable. They might be overcome, for example, by cooperation between the parties (including as a result of them coming to a commercial agreement). Looking at the matter more broadly, we do not believe that it would be right to grant the disappointed party a 'veto' over the licensing of a competing scheme simply because of a threat by the former to divert the flow so as to undermine the latter.

12.0 Consideration of the impact of both schemes upon the site hydrology

In considering the potential for each of the schemes to impact upon the local environment we have modelled how the available river flow will be distributed around the location of the weir under the operating regimes of both schemes. The modelling uses the turbine operating parameters supplied by each of the applicants and our hydrology data, as described above.

The results of this analysis can be found in Appendix 2, Avoncliff Flow Data Analysis, which is attached to the determination report.

12.1 Results of the flow modelling

From the flow modelling carried out it is possible to assess the impact on the weir flow of each scheme.

The North Mill scheme starts operating at ~Q89 and maximum turbine capacity is reached at ~Q30.

The Weavers Mill scheme starts operating at ~Q84 and maximum turbine capacity is reached at ~Q34.

For each scheme it was important to establish the period of time that the main river weir would be experiencing HOF conditions (Q95/0.951m^3/s). That is the period of time that the weir would be at the minimum flow required and any additional water would be allocated for electricity generation and the flow to the leat channel (0.162m^3/s).

Looking at the impact upon the flow duration curve the data show that for:

The North Mill scheme the weir would be at the HOF for 59% of the time.

The Weavers Mill scheme the weir would be at the HOF for 50% of the time.

The data show that the North Mill scheme starts to operate sooner (at a river flow of ~Q89) than the Weavers Mill scheme (at a river flow of ~Q84); this is due to the lower start up flow (160l/s; as confirmed by the North Mill applicant) required to start to operate the Archimedes turbines. The North Mill scheme has a larger maximum turbine flow than the Weavers Mill scheme and so the operation of the North Mill scheme will extend higher up the flow regime (North Mill ~Q30 v Weavers Mill ~Q34).

An assessment has also been made of the maximum number of consecutive days that the weir would be experiencing HOF conditions. This gives an indication of how long the weir would be at a non-variable flow, with no higher flow events providing flow variation, due to the operation of each scheme. The analysis does not include periods when the flow over the weir is below the HOF due to natural low flow conditions in the river. These flow variations are important within a weir pool. They ensure that channel shaping flow events, and flows of a magnitude sufficient to actively move and 'flush through' bed material deposits will continue.

This assessment was completed for the historically wet, dry and average years.

The North Mill scheme - in a wet year a maximum of 74 consecutive days operating at HOF conditions.

The Weavers Mill scheme - in a wet year a maximum of 42 consecutive days operating at HOF conditions.

The North Mill scheme - in a dry year a maximum of 76 consecutive days operating at HOF conditions.

The Weavers Mill scheme - in a dry year a maximum of 39 consecutive days operating at HOF conditions.

The North Mill scheme - in an average year a maximum of 82 consecutive days operating at HOF conditions.

The Weavers Mill scheme - in an average year a maximum of 57 consecutive days operating at HOF conditions.

Analysis of the data has shown that the North Mill scheme results in the flow over the main river weir being at the minimum required (HOF) for longer periods than the Weavers Mill scheme. This is due to the lower turbine start-up flow and the higher turbine maximum flow. In the three indicator years looked at the North Mill scheme consistently resulted in a greater period of consecutive days at HOF conditions at the weir and weir pool. These are periods when the weir and weir pool would have no flow variation; such as during natural periods of low flow or provided by peak flow events.

In accordance with our Competing hydropower schemes guidance we have compared the two schemes with regard to the impact of the resultant flow over the weir. The North Mill scheme, by operating over a longer period of time in a year, reduces flow, and flow variation, over the weir to a greater extent than Weavers Mill (see above figures).

However, either scheme is acceptable in terms of the potential for impact upon the site hydrology.

13.0 Water Framework Directive (WFD) assessment

An assessment has been carried out to isolate the potential impacts and likely significant effect of the installation of a hydropower scheme on Avoncliff weir.

The relevant water body is currently at poor ecological status under WFD, there is no current WFD fish classification for this water body. We are obligated to ensure no

further deterioration to this water body and to improve to good ecological status by 2027. Our WFD assessment has indicated that there is little risk of further deterioration as a result of either hydropower scheme. It is also necessary to consider the impact of the schemes on upstream and downstream water bodies, however as the length of river impacted is such a small percentage of the whole water body (less than 1%) it is unlikely that either scheme will have any significant impact.

There is no WFD requirement for a fish pass to be included as part of any scheme. As stated above there is no current WFD water body classification for fish and the Agency is required to ensure that no further deterioration in the status of water bodies occurs.

Both schemes now offer a fish pass as part of their proposal, and this is to be welcomed.

In assessing both applications a number of factors have been considered. These include:

13.1 Sediment transport

Avoncliff weir currently acts as a sediment trap, where sediments settle behind the weir to form silt deposits in the bed of the river and along the banks; rather than allowing sediments to travel downstream. Either of the proposed schemes will equally likely change flow dynamics and therefore result in an increase in sediment movements through the turbines rather than settling behind the existing weir structure. Changes in sediment transport are likely to have a limited short-term impact immediately downstream of the weir, but will be expected to establish a new regime in the medium-term. This short-term impact is not considered to be a significant differentiating factor when considering the two competing schemes.

13.2 Hydromorphology

The volume of water flowing directly over the existing weir is expected to change significantly, particularly during low to moderate flows. This will result in changes to the existing weir pool habitat. These changes may result in the development of one or more smaller pools and the formation of a mid-channel bar or island forming sediment deposits, rather than the current larger, deep water pool. Any loss to the habitat of the existing weir pool is likely to be offset by the establishment of the smaller weir pools.

The downstream banks are at risk of some localised erosion due to flow changes. This is the river naturalising to the changes and any attempt to avoid this through revetment works will likely result in shifting the erosion issue further downstream rather than resolving it. The best course of action would be to simply allow the river to naturalise to the new flow dynamics where it should then stabilise to a satisfactory position.

The hydromorphology assessment has indicated that there is little risk of a negative impact occurring within the weir pool areas or on the downstream river banks as a result of either scheme and as such is not considered to be a significant differentiating factor when considering the two competing schemes.

13.3 River continuity

It is not anticipated that there will be any far reaching impacts up and downstream of this site as a result of the suggested works. The area impacted should be limited to that in the immediate vicinity to the works which should itself adapt to the changes in flow regime. Whilst it is likely that there will be a small loss of habitat, no significant loss of habitat is anticipated.

13.4 Cumulative impact

This section of the river is already considered to be heavily modified and there is a great deal of pressure which may prevent future improvement to good ecological potential. Therefore it is unlikely that the proposed works will, even when considered in combination with other impacts, have any effect on the status of the water body.

The proposal here is within the weir structure so will not create a deprived reach; there will be a requirement in any licence issued to maintain a HOF of Q95 (0.951m³/s) at all times that either turbine is operating.

AMEC advises that the changes to the weir pool morphology will be greater as a result of the Weavers Mill scheme when compared to the effect of the North Mill scheme but that the changes are not significant enough for this to be a significant differentiating factor between the two proposed schemes.

13.5 WFD assessment conclusion

The potential for geomorphological changes to the weir pool habitat to occur apply equally to both schemes. Similarly the ability of the downstream weir pool and river bank environment to stabilise and adapt to the new flow distribution is equally applicable to both schemes.

Potential for impact upon geomorphological interests is not considered to be a significant differentiating factor when considering the two competing schemes.

14.0 Competing hydropower schemes assessment

This section describes factors considered (including site specific factors additional to those contained in our Competing hydropower schemes guidance) where we conclude there is no significant difference between the schemes.

In addition to our statutory duties when reaching our decision we have had regard to our Competing hydropower schemes guidance. This supplements advice given in our Guidance for run-of-river hydropower development (December 2013).

Our overall approach when we are determining an application for a hydropower scheme is to make careful judgments about the desirability of licensing that particular scheme. This is specifically so where we are aware of an alternative or a potential future alternative proposal. We recognise that such schemes are likely to remain in situ for many years and as such our decision to license such a scheme will have long term implications for the local community and the environment. This means that any scheme we license must be well designed, be of high quality and must be sustainable. The guidance requires us to choose the best possible sustainable hydropower scheme for that location and the scheme that offers the greatest public benefit. We will consider which scheme is in the best interests of the environment, other water users, the wider community and climate change and we will look for a well designed scheme that makes optimum use of the available water resource for electricity generation.

The following table shows where evaluation of factors listed in our Competing hydropower scheme guidance can be viewed in the determination report:

Competing hydropower scheme guidance factor	Where and how these factors have been considered in this determination?
Optimum use of water (paragraphs 3, 4, 15, 16, 17a, and annex 1a and b).	Decision statement Electricity Generation section 1. Determination Report Appendix 1, section 8, and sections 14.3 and 14.5.
Environmental effects (paragraphs 3, 4, 5, 6, 15, 16, 17b and annex 1a and 1b).	Determination Report Appendix 1, section 5, section 6, section 12, section 13 and section 14.1, 14.3, 14.11 and 14.19.
Flood Risk (paragraphs 3, 16, 17c, and annex 1b).	Decision statement Flood Risk section 3.
Electricity generation (paragraphs 5, 16, 17a, 17e, and annex 1a and 1c).	Decision statement Electricity Generation section 1. Determination Report Appendix 1 section 11, 14.13, and 14.21.
Impact on other water users (paragraphs 4, 6, 15, 16, 17d and annex 1d)	Determination Report Appendix 1, section 14.1, 14.8, 14.10, 14.11, and 14.12.
Climate change impacts (paragraphs 5, 17e and annex 1d)	Decision Statement Carbon Savings section 2.
Fish passage (paragraphs 5, 17b, 17d and annex 1a and 1b).	Determination Report Appendix 1 section 14.1.
Turbine type (annex 1a)	Decision statement Electricity Generation section 1. Determination Report Appendix 1 section 14.19.
Hydromorphological impacts (Paragraphs 17b and annex 1b).	Determination Report Appendix 1 section 13.
Aesthetic impacts (annex 1b)	Decision statement Visual impact on the landscape section 4. Determination Report Appendix 1 section 14.9 and 14.12.
Connection to the grid (paragraphs 17a, 17e and annex 1c and 1d)	Determination Report Appendix 1, section 14.13.
Community involvement (annex 1d)	Determination Report Appendix 1, section 9, section 10, section 14.12, 14.17 and 14.18.
Land ownership/legal issues (annex 1d)	Determination Report Appendix 1 section 14.15 and 14.16.
Construction (annex 1d)	Determination Report Appendix 1 section 14.14 and 14.20.
Economic viability (paragraph 11c)	Determination Report Appendix 1 section 14.22.

In November 2012 we commissioned AMEC Environment and Infrastructure UK Ltd to undertake an independent assessment of the two competing schemes. AMEC was asked to provide advice on the relative advantages and disadvantages of the schemes at Avoncliff weir with particular reference to our Competing hydropower schemes guidance; in particular using the criteria listed within Annex 1 of the guidance and site specific factors. AMEC was also asked to consider specific points of contention raised by both applicants (see Appendix 4).

14.1 Fisheries and Biodiversity

In our 'minded to' decision of April 2013, a factor in favour of the North Mill scheme was that it included a fish pass while the Weavers Mill scheme did not. The Weavers Mill applicant has amended his proposal to include a fish pass. As indicated in our 'minded to' decision even if the Weavers Mill scheme had not included a fish pass we would have preferred the Weavers Mill scheme because other factors in its favour outweighed this factor that was in North Mill applicant's favour.

Both schemes now offer a fish pass, and an eel pass. Weavers Mill also includes a fish by-wash because it uses a fish screen. The detailed design for these structures has not yet been finalised in either case. The final fish pass design is achieved and agreed through the fish pass application and Flood Defence Consenting processes.

Any licence issued will include conditions to ensure compliance with our Guidance for run-of-river hydropower development, in particular the annexes on screening requirements and fish passage. The standard of protection at the intake to the Weavers Mill scheme will be equivalent to a 12.5mm screen aperture. Additionally any licence issued will include a condition that requires provision of an effective eel pass.

In terms of biodiversity in particular the impact on water voles, otter, birds, reptiles, invertebrates, macrophytes, trees and river habitat modification we have concluded that neither scheme will have an unacceptable impact.

14.2 Environment Management (monitoring of licence compliance)

To visually monitor compliance with the HOF the licence we issue will include a condition that requires the installation and maintenance of a gauge board.

14.3 Hydrology

We have concluded the mean river flow is 11.520m^3/s and the Q95 river flow is 0.951m^3/s.

The licence we issue will include a condition to ensure that no hydropower generation shall occur unless there is a HOF of 0.951m^3/s over the weir.

14.4 Asset Performance (maintenance of flood defences and in-river works)

Our responsibilities for routine maintenance stop just upstream of the weir e.g. for in-river debris removal. At the weir the responsibility for debris removal will remain with the riparian owners.

We expect weir owners to maintain their structure in a good state of repair; this may include both applicants removing debris from the weir.

14.5 Water Resources (location on watercourse; level of the weir)

Both schemes are to be located 'on weir' and this is to be preferred. An on weir scheme takes water from above the weir and discharges to the weir pool. In this situation there is no deprived river reach created.

We have considered the positioning of the turbines with respect to the location of preferential river flow in the river. The turbines operate on a difference in head of water (water level) being available. Although there is likely to be a preferential distribution of flow to the north of the river this will not significantly affect the head of water available to either scheme.

This is not a case where either applicant has complete control over the flow of water over the weir, and we have considered this issue in detail at section 11.4 above. In summary, we have concluded on balance that it is nevertheless desirable to grant a licence in this case, noting that the problems are not insurmountable and could be resolved, amongst other things, by concluding an agreement between the parties.

The weir crest level varies from ~25.99mAOD on the southern side to ~25.91mAOD on the northern side. The weir crest has a low point of ~25.88mAOD. Anecdotally as the upstream water level reduces at times of low river flow the weir crest dries progressively from south to north. Under low flow conditions it is likely that neither scheme could operate as there would be insufficient flow to meet the HOF requirement.

The turbine intake structures for both schemes are located below the weir crest level and will not be affected by the small variation in the level of the weir crest.

14.6 Water Quality

A water discharge permit will not be required to regulate either scheme. Flood defence consent will be required by both applicants and will address any water quality concerns during construction.

Water quality impacts that may arise e.g. through the construction phase or as a result of disturbance and redistribution of sediments are expected to be short term, of low impact and equally applicable to both schemes.

14.7 Conservation Designations

There are no designated nature conservation sites that could be impacted by either scheme.

14.8 Recreation

We received a representation that canoeists use the North Mill as a portage point enabling them to carry canoes around the Avoncliff weir. Navigation in the vicinity of either scheme may only operate with permission of the riparian owner. This requirement would also apply to canoeists accessing private land in the vicinity of either scheme.

We received representations about use of the river for swimming. Whilst this activity is reported to be mainly in the vicinity of the Weavers Mill scheme, it could occur at any point along the weir. Swimming and canoeing in many rivers and lakes in England and Wales requires permission from the riparian owner. The health and safety implications of this activity at this site are covered in section 14.17 of this report.

The Bristol Avon main river is a good quality coarse fishery popular with pleasure and match anglers. Fishing in the vicinity of either scheme should be with permission of the riparian owner. Fish protection measures are addressed in section 14.1 of this report.

Recreational impacts arising from either scheme are considered to be small and there are no significant differences between the schemes on this point.

14.9 Cultural Heritage

Both schemes have the potential to disturb local archaeological water management structures (sluices, water wheel pit etc.) that may detract from the current historical setting. The North Mill scheme has the larger footprint and would involve the loss of

historic fabric within the unlisted North Mill building. The Weavers Mill scheme would involve the loss of the existing weir sluice structure.

Located downstream of both schemes is the Avoncliff Aqueduct, a Grade II listed structure and the Cross Guns Inn, also a Grade II listed building.

Cultural heritage impacts arising from either scheme are considered to be small and there are no significant differences between the schemes on this point.

14.10 Noise and Vibration

Consideration has been given to our duty to promote the conservation and enhancement of the natural beauty and amenity of inland and coastal waters and the land associated with such waters, and the conservation of flora and fauna which are dependent on an aquatic environment. A number of representations expressed concern about noise impact.

We have considered whether either scheme when it is operating will cause noise and vibration to be emitted (although we acknowledge that these would be issues that the Local Planning Authority would also consider in greater detail at the planning application stage). The Weavers Mill applicant provided the results of an acoustic study at Artern Hydropower Installation by Acouplan for a screw turbine installation in Germany. This has limited value because it is not site-specific to the circumstances at Avoncliff.

The North Mill scheme is likely to create more noise than the Weavers Mill scheme simply because the Archimedes turbines are open to the air (not enclosed) and water passes audibly through the turbines whereas the Weavers Mill turbine is enclosed and submerged. However, there is already significant level of background noise from the weir and the nearby railway at this location.

Either scheme would be a new source of noise at Avoncliff weir and change the distribution of noise along the weir. We are aware of noise complaints at some Archimedes turbine sites. The issue appears to be the throbbing sound as water pulses from the turbine. We are not aware of noise complaints at Kaplan turbine sites.

We expect the impact of noise from the North Mill turbines to be greater than from the Weavers Mill turbine, although the difference is likely to be minimal.

14.11 Navigation

Navigation is one of the key features of water use in this catchment. Although the lower Bristol Avon is navigable, upstream of Bath where the Kennett and Avon Canal joins the river there is no public right of navigation. Navigation in the vicinity of both schemes may only operate with permission of the riparian owner. This requirement would also apply to canoeists accessing private land in the vicinity of the schemes.

There are no navigation issues relevant to either scheme.

14.12 Community and Tourism Benefits

The general benefits to the community of providing electricity from a renewable source of energy are common to both applications. The Weavers Mill applicant has proposed to supply nearby premises with electricity. The North Mill applicant proposes to supply the mill and holiday cottages with electricity and to use the scheme as a visitor attraction.

Community and tourism benefits arising from either scheme are considered to be small and there are no significant differences between the schemes on this point.

14.13 Grid Connection

The North Mill applicant proposes to connect to the existing cable that runs alongside the adjacent railway track. He also provided information on a possible alternative grid connection to a transformer located in a field to the north of the railway line. He has confirmed that he is in discussion with the relevant Distribution Network Operator (DNO).

The Weavers Mill applicant has confirmed that the grid connection would be to a new tee joint in an existing 3-phase cable which is buried in land near the eastern side of the southern end of the aqueduct. He states that he has also been in contact with the relevant DNO and that there is a wayleave across a neighbour's land. The connection at the turbine end will be to the transformer, G59 board and switchgear located near to the control cabinet on shore.

AMEC advise that OFGEM regulations require that until the DNO has made a formal connection offer and the applicant has formally accepted it by paying a deposit the connection is still subject to change both technically and financially or it may lapse and the applicant will have to apply again. AMEC advise that there are no material differences in the grid connection options for either scheme.

Neither applicant has clarified that any formal agreements have been obtained from the relevant DNO or whether all wayleaves or other agreements necessary are in place.

We are satisfied that either applicant has the potential to connect their scheme to the distribution network and therefore there is no significant difference between the schemes on this point.

14.14 Construction

We believe that each scheme has challenging construction issues. Both schemes are likely to cause significant disturbance to those living in close proximity to either development during the construction phase.

Construction of either scheme presents equally onerous logistical challenges to both applicants. However, both applicants are satisfied that they can move all the necessary machinery to site and build their scheme.

Flood Defence Consent will be required to enable construction of either scheme. To date neither applicant has applied for consent for their scheme. We would expect to receive applications for both temporary and permanent works closer to the time of commencement of construction.

As an added precaution and having regard to our guidance, and in particular the long term nature of hydropower developments, the licence we issue will include a condition that ensures that the water resource at Avoncliff remains available in the long term public interest. Such a condition will require that if the hydropower generation authorised by the licence has not commenced within 3 years of the date of issue of the licence, the licence shall cease to have effect.

14.15 Effect of placing Weavers Mill on the market

In October 2013, the North Mill applicant brought it to our attention that the Weavers Mill applicant had put his property on the market.

We accordingly sought clarification from the Weavers Mill applicant as to his intentions in relation to the proposed hydropower scheme. He informed us that (i) he did not intend to withdraw his application and that (ii) if granted, the Weavers Mill hydropower scheme would proceed as planned.

Subsequently, in response to further requests for information and clarification by the Environment Agency, the Weavers Mill applicant has informed us of his intention that any sale of the property would be subject to a condition enabling him to have a 100 year lease to construct and operate his proposed scheme.

The prospective purchasers of Weavers Mill have also been in contact with the Environment Agency and have confirmed that they would support, subject to a suitable agreement, the Weavers Mill application, and would allow access by the Weavers Mill applicant to build and maintain the scheme.

The North Mill applicants have made a number of representations to us on this issue, including to the effect that the Weavers Mill applicant has provided no acceptable or credible assurance that he will be able to install his project if Weavers Mill is sold.

We have given careful consideration to this difficult issue. The following points are considered by us to be of relevance.

First, we note that it is in the nature of the water resources licensing regime that there is no guarantee that any scheme which is licensed will in fact be built. A licensee is under no obligation to build a licensed scheme – he is merely permitted (subject to other necessary consents) to do so.

Further, a licensee may fail to get other necessary consents, for example he may be refused planning permission, so that the permitted scheme may never be built.

A licensee, having obtained a licence, may change his mind about his desire to build the scheme; may run into financial or other practical difficulties; or may have a change in personal circumstances. He may decide to sell his property without transferring the licence; and any new owner may not wish to proceed with the scheme or to allow it to be built.

Thus, while the Environment Agency can provide for a ‘self-destruct’ condition in the licence, so as to avoid the water being tied up for too long without development taking place, the Environment Agency cannot compel the building of any particular hydropower scheme.

In the present case as in any other, there is no guarantee that either scheme will be built. There would be nothing to stop the North Mill applicants, if granted a licence, from deciding not to proceed with their hydropower project. Indeed they too might decide to sell their property. And there are a number of ways (some of which are referred to above) in which the Weavers Mill applicant may develop his scheme as planned even if he does sell his property.

We have had to decide whether to grant a licence for the scheme which (as we have concluded) is clearly preferable in terms of a number of key indicators including

electricity generated; efficient use of water; carbon savings; flood risk (but where there is the added complication of the property having been placed on the market); or whether, instead, to refuse a licence to that scheme on the basis that the property is now for sale.

This has not been an easy decision for us to make but given the assurances we have now received from both the Weavers Mill applicant and the prospective purchasers, we have decided that - on balance - it is in the public interest to grant a licence to the Weavers Mill applicant for the Weavers Mill scheme despite this added complication. That is because, in summary, we think that there is at least a reasonable prospect of this beneficial scheme coming to fruition.

Had we concluded that there was no realistic possibility of the Weavers Mill scheme being built; our decision in the present case might have been different. But that is not the view we have reached.

14.16 Other land ownership and access issues including riparian rights and ownership of the river bed

Both applicants have cited concerns with regard to the land ownership of the other party. In particular the extent of the ownership of the weir structures itself and the lands and watercourse around the weir.

The issue of access rights and ability of the Weavers Mill applicant to build and maintain their proposed scheme has also been raised by the North Mill applicant and representors, including the owners of the property adjacent to Weavers Mill.

Section 35 of the Water Resources Act 1991 requires, in relation to abstractions, that a person is entitled to make an application if he has or will have a right of access when a licence takes effect. Having such a right of access is not a requirement for making an application for an impoundment licence.

We are satisfied that both applicants can construct (and access) their own scheme on parts of the weir within their ownership for which an impoundment licence is necessary. We accept the assurances of the Weavers Mill applicant that sufficient access rights will be made available for him to construct his scheme; as we also accept the same assurances from the North Mill applicant on these matters. Here as in other areas, there may be a number of commercial agreements that either applicant can or is willing to negotiate and enter into to ensure their scheme can be built.

After consideration of the conveyancing history we have concluded that:

(i) Weavers Mill: the Kaplan turbine and associated infrastructure are proposed to be located within the footprint of the weir, within the ownership of the Weavers Mill applicant;
(ii) North Mill: the two Archimedes turbines and associated infrastructure are proposed to be located within the existing wheel pit (part of the impounding structure) and within the weir itself, which are within the ownership of the North Mill applicant.

We have considered the conveyancing history and other relevant matters as to riparian rights and ownership of the riverbed. In our view both Weavers Mill and North Mill have the riparian rights to the land upon which their proposed schemes are to be constructed.

As an added precaution and having regard to our guidance, in particular, and the long term nature of hydropower developments the licence we issue will include a condition that ensures that the water resource at Avoncliff remains available in the long term public interest. Such a condition will require that if hydropower generation authorised by the licence has not commenced within 3 years of the date of issue of the licence, the licence shall cease to have effect.

14.17 Health and Safety – swimmers and other river users at the weir

A number of representations express concern about swimming near to the Weavers Mill scheme, in particular the owner of the adjacent property.

The Weavers Mill applicant has expressed concern that the rotating end sections of the North Mill turbines pose a risk to kayakers and other river users; along with the risk of children playing on the exposed turbine structure. In response the North Mill applicant has confirmed that the turbines would be encased in a mesh screen to minimise access to the rotating blades.

Similarly the North Mill applicant has raised concern with regard to the automated screen cleaner proposed at Weavers Mill. The Weavers Mill applicant has confirmed that he has taken health & safety aspects into account when designing his intake screen. He has located the screen cleaner within the footprint of the weir, within his ownership.

We publish Water Safety Advice on our website and warn against swimming near to weirs as they are often associated with strong currents, slippery surfaces and underwater hazards.

Our Water Safety Advice goes on to say that parents and guardians should not let children go into the water alone, or unsupervised.

Swimming and canoeing in many rivers and lakes in England and Wales requires permission from the riparian owner, who in granting such permission, will be subject to a duty of care to the swimmer under the Occupiers Liability Act 1957 and 1984. However an occupier of ordinary water where there are no hidden dangers may be relieved of this duty under the Act for injuries sustained by persons engaged in dangerous activities; such as swimming and canoeing.

A copy of our advice is published at http://www.environment-agency.gov.uk/homeandleisure/recreation

Swimming and canoeing in rivers and lakes is an activity that is inherently dangerous. These risks appear at both Weavers Mill and North Mill, but swimming predominantly occurs closer to Weavers Mill than North Mill. Canoeists report using the buttress of the North Mill wheel pit for portage. We are not aware of consent being given by the applicants for these activities. The risks associated with swimming and canoeing activities apply to both North Mill and Weavers Mill.

We expect applicants to take measures to mitigate against health and safety risks associated with their schemes and therefore do not differentiate between the schemes for health and safety reasons.

14.18 Discussions with external bodies and interest groups

The North Mill applicant has confirmed that he has had pre-planning meetings with Wiltshire Council and has sought Environmental Impact Assessment (EIA) scoping

opinions for developing either a single 3.6m diameter screw turbine located within the existing wheel pit or a single 3.6m diameter screw turbine located within the weir with a refurbished waterwheel. The North Mill applicants' consultation with the local planning authority is to be welcomed as this is an important step in the development of a hydropower scheme at Avoncliff. To the best of our knowledge the Weavers Mill applicant has not sought a similar scoping opinion from Wiltshire Council.

The North Mill applicant states that he has also had discussions with Winsley Parish Council, Climate Friendly Bradford, West Wilts Heritage / Historical Society, local canoeists and anglers.

We understand that the Weavers Mill applicant has discussed his proposal with Climate Friendly Bradford, the Bradford on Avon Preservation Trust, canoe and angling groups and Avoncliff residents.

From the information we have available however we do not consider that these discussions raise any new information not provided through our advertising of the applications.

By advertising the applications we have also sought the views of the local community and interest groups and these have been taken into consideration in the determination of these applications.

14.19 Environment Agency endorsement of Archimedes screw turbines

It is stated by the North Mill applicant that the type of turbines proposed at North Mill, two Archimedes screw turbines, are recommended by the Environment Agency and that they are 'fish friendly'.

We do not recommend one type of turbine in preference to another. It is the responsibility of all applicants to ensure that their choice of turbine technology is fit for purpose and a suitable turbine solution for their location (based on a sound understanding of the hydrology and site characteristics).

The Archimedes screw turbine type is not considered to be 'fish friendly'; it can however be 'less damaging' than other turbine types. The term 'fish friendly' is often quoted by developers and manufacturers but the term is no longer endorsed by us nor does it appear in our Guidance for run- of- river hydropower development (December 2013), or its Annexes. The Screening Requirements Annex states that Archimedean screw turbines 'have been shown to cause minimal damage to fish, as long as there is appropriate protection on the leading edge of the screw and they are designed within acceptable limits'.

Any licence issued will include conditions requiring screening to prevent damage to fish occurring in line with our Screening Requirements Annex.

14.20 The undercut weir

The North Mill applicant has stated that the weir structure is 'undercut' on the North Mill side of the weir (the flow of water passing over the weir can create a cavity beneath the weir crest).

We are not aware of any information on whether the weir on the Weavers Mill side is undercut. The detailed structural integrity of the whole weir has not been confirmed by either applicant, although the Weavers Mill applicant has confirmed that he has undertaken an underwater survey. We are however aware from recent photographs

that parts of the weir are in need of repair. It is to be welcomed that as part of both schemes repair works to the weir are proposed.

The long term integrity of the weir is a matter for both the Weavers Mill applicant and North Mill applicant and should be considered by both parties when proposing to build a hydropower scheme on their section of the weir.

It is the responsibility of the weir owner to maintain their section of the weir in good order and thus the risks and consequences of a weir failure are a matter for each applicant equally.

Both applicants should be aware of the provisions of section 109(2) WRA 1991 that provides that before they carry out any work of alteration or repair on the weir that is likely to affect the flow of water in the watercourse they must obtain our consent.

14.21 The turbine control system

The Weavers Mill applicant has stated that the control system used to operate the North Mill scheme will cause flow 'pulsing'; where the turbine operates for short periods around the start up conditions causing unwanted level fluctuations in the river upstream. There is also concern that the North Mill applicant does not live at North Mill and will be unable to undertake physical checking of the turbines. He asserts that the single sluice gate controls to each of the North Mill turbines are unable to make the 'minute' adjustments required to effectively control the scheme.

In response the North Mill applicant confirmed that the control system will be supplied by ANDRITZ and that the flow to the turbines is controlled by the variable speed system.

The Weavers Mill applicant states that the control system for his Kaplan turbine is more sophisticated in that flow to the turbine is controlled via multiple adjustable wicket gates which can make small adjustments effectively controlling the scheme and the upstream water level. During the site visit on 30 August 2013 the Weavers Mill applicant confirmed that the control system is from a supplier experienced in computer based control systems and the control system is using bespoke closed-loop control software in an industrial PLC module.

We would expect the operator of any hydropower scheme to control the operation of their scheme in a proper and efficient manner in order to minimise detrimental effects on the watercourse; such as turbine pulsing. The licence we issue will include a condition requiring the operator to restrict the operation of their scheme unless a minimum operational flow is available. This, along with suitable operational protocols, should help to prevent such instances occurring.

Consequently the choice of turbine control system is not a differentiating factor between the schemes.

14.22 Economic Viability

As a matter of principle economic viability is for the applicant to consider in promoting their scheme. In comparing the competing schemes in accordance with our guidance we have considered the viability of the schemes is so far as we would wish to ensure, so far as possible, that any scheme we license has at least a realistic prospect of being built and that any such scheme makes the best use of the available water resource. Economic viability forms part of this consideration. Both applicants have

given assurances that they will be able to construct and operate their scheme. For detailed consideration of the position in relation to the sale of Weavers Mill, see above.

Consequently economic viability is not a differentiating factor between the schemes.

15.0 Protected rights and lawful use

By s.39 WRA 1991, the Agency may not (without the consent of the person entitled) grant a licence authorising abstraction or impoundment so as to derogate from any 'protected rights'. These rights are exhaustively listed in s.39A(1) WRA.

By s.40 (and s.21) WRA 1991, when dealing with a licence application, the Agency is obliged to have regard to the requirements of 'existing lawful uses of the inland waters, whether for agriculture, industry, water supply or other purposes'. There is, however, no prohibition on granting a licence so as to prejudice any such use.

Where a use of water amounts to neither a 'protected right' nor an 'existing lawful use', the statute neither obliges the Agency to have regard to it nor prohibits it from doing so.

After receipt of our minded to decision in April 2013, it appears that the North Mill applicant made some alterations to an existing derelict lowering sluice at the site so as to create a preferential flow of water through his wheel pit (see the discussion of control issues at the site above). The North Mill applicant has confirmed that the top of the sluice is located 350mm or 400mm below the general level of the weir.

Additionally, works carried out previously included the removal of '3-4 tons' of debris from the wheel pit. For many years prior to that time there was "almost a complete barrier to flow"; the water wheel had not been used for around 40 years and only leakage water flowed through the derelict sluice.

There has been some suggestion on behalf of the North Mill applicant that the Environment Agency is not entitled to grant a licence to the Weavers Mill applicant in such a way as to derogate from (or otherwise interfere with) this new flow through the wheel pit.

We have considered this suggestion but we do not agree with it. There is no relevant protected right here and (contrary to the view of the North Mill applicant) we do not consider the flow through the wheel pit to amount to an existing lawful use, given that no lawful purpose (such as agriculture, industry, etc) has been identified for it (and in any event it is unlicensed).

But even if we were wrong about this and the new flow through the wheel pit *did* amount to an 'existing lawful use', there would be no prohibition on derogating from that existing use (provided that we had regard to it in making our decision).

We have now had regard to the new flow through the wheel pit, but we do not think that in the circumstances it should lead us to refuse the Weavers Mill application. We consider that the Weavers Mill scheme is a good, sustainable scheme which it is in the public interest to licence. No lawful purpose or good reason has been identified for the new flow over the wheel pit, which is (moreover) incompatible with the North Mill applicant's own proposed scheme.

We consider that it is in the public interest to license the Weavers Mill scheme notwithstanding the new flow over the wheel pit. More generally, we do not think that it

would be right to allow a disappointed applicant to 'sabotage' a licensed scheme and/or to exercise a veto over that scheme. This is for the reasons we have already given in relation to control issues.

The North Mill applicant claims to have extant planning permission for the reinstatement of the waterwheel; however this does not remove the need for him to apply for the necessary impoundment licence to carry out the impounding works.

We received a representation in response to the press advertisement that expressed concern that the North Mill scheme would cause an upstream rise in water level that could impact upon another hydropower scheme located at Kingston Mill in Bradford-on-Avon in terms of electricity generation (due to a decrease in head) and because of any resulting flood risk to installed equipment.

We have considered the potential for an increased risk of flooding as a result of either scheme being built, see our Decision Statement. Our conclusion is that the North Mill scheme could result in a water level rise of 10cm at Barton Bridge (Bradford-on-Avon); and by 1cm as a result of the Weavers Mill scheme.

The Kingston Mill scheme is located ~750m upstream of Barton Bridge and it is likely that the North Mill scheme would on occasion result in an increase in the downstream water level at the site. It is also likely that the Weavers Mill scheme would not result in a similar increase in the downstream water level at Kingston Mill.

Neither scheme will impact upon the Kingston Mill scheme in terms of the quantity of water available; the abstraction of water originates from upstream of the Kingston weir. However we recognise that the North Mill scheme may affect the effective head of water available to the Kingston Mill scheme, and thus it's generating potential. Detail of the scale and consequences of any effect have not been provided by Kingston Mill.

16.0 Habitats Regulations and Wildlife and Countryside Act.

The schemes are not likely to have significant effect on sites designated under the Conservation of Habitats and Species Regulations 2010 nor likely to damage sites designated under the Wildlife and Countryside Act 1981.

17.0 Cost benefits and environmental mitigation or gain

We are required to consider the costs and benefits of a scheme and in so doing we have had regard to the fact that these applications propose schemes where there is a low risk of environmental damage. The inclusion of a Hands Off Flow condition will ensure there is enough water for the weir pool environment and accords with local water resources policy and that it is considered to be environmentally sustainable.

Furthermore the scheme supports Government's targets for renewable energy and reducing the carbon footprint.

Benefits arise from the availability of water for generating electricity. Importantly there will also be an environmental benefit from being able to generate electricity from a renewable energy source.

Either applicant would incur the costs of installing and maintaining the turbine and associated infrastructure and for monitoring and measuring equipment that we require.

In reaching our decision we have considered the effect of both schemes on the social and economic well being of the local community.

18.0 Biodiversity and sustainable development

The Government has issued guidelines to the Environment Agency under section 4(2) of the Environment Act 1995 with respect to our objectives and contribution towards achieving sustainable development.

The principles of sustainable development are recognised by the government as the guiding philosophy for all future development. Any hydropower scheme at this site will contribute to the provision of electricity for the future and will contribute to the reduction of carbon emissions and other harmful gases and will reduce the dependency on non renewable energy sources. In tandem the provision of suitable eel passage arrangements and 'hands off flow' will ensure the protection of eel movement and will ensure minimal impact on the local ecology and biodiversity.

The Government Energy White Paper 'Our Energy Future – Creating a Low Carbon Economy' published in 2003 set a national target for 10% of the UK energy to be provided from renewable sources by 2010, 20% by 2020 and 80% by 2050.

19.0 Other statutory duties

19.1 Section 4 Environment Act 1995 (pursuit of sustainable development)

We have considered whether additional requirements should be imposed in relation to our principal aim of contributing to attaining the objective of sustainable development under section 4 of the Environment Act 1995, the existing requirements are sufficient in this regard and no other appropriate requirements have been identified.

We have had regard to Government guidance issued under section 4(2) of the Act, namely 'The Environment Agency's Objectives and Contribution to Sustainable Development: Statutory Guidance (December 2002)'. Regarding the exercise of our water resources functions, we are required:

'To plan to secure the proper use of water resources by using strategic planning and effective resource management which takes into account environmental, social and economic considerations, and in particular:

'To ensure that the abstraction of water is sustainable, and provides the right amount of water for people, agriculture, commerce and industry and an improved water-related environment; and to develop and maintain a framework of integrated water resources planning for the Agency and water users.'

19.2 Section 6(1) Environment Act 1995 (conservation duties with regard to water)

We have considered our duty to promote the conservation and enhancement of the natural beauty and amenity of inland and coastal waters and the land associated with such waters, and the conservation of flora and fauna which are dependent on an aquatic environment. We have considered whether either scheme when it is operating will cause noise to be emitted and we are satisfied that any noise caused by the operation, over and above that already existing at the weir, can be mitigated to the

extent that any potential impact on the natural beauty and amenity of the River Avon and associated land will be minimal.

19.3 Section 6(2) Environment Act 1995

In reaching our decision we have taken all such action as we consider necessary or expedient for the purposes of conserving water resources, and securing their proper use (including the efficient use of those resources).

We support the use of sustainable energy, including hydropower, to help meet UK Government renewable energy and greenhouse targets.

With regard to proper use, we believe our decision to grant a licence for the Weavers Mill scheme will facilitate the generation of hydropower for the long term public interest.

19.4 Section 6(6) Environment Act 1995

It is our duty to maintain, improve and develop salmon fisheries, trout fisheries freshwater fisheries and eel fisheries.

The Weavers Mill applicant has incorporated eel and fish passage arrangements into his scheme. The licence we issue will include conditions ensuring the appropriate Hands Off Flow and the protection of flora and fauna.

19.5 Section 7 Environment Act 1995 (pursuit of conservation interests)

We have had regard to these factors as indicated (amongst others) in section 6.0 above.

Section 7(1)(a) of the Environment Act 1995 places a duty on us, when considering any proposal relating to our functions, to exercise our functions so as to further the conservation and enhancement of natural beauty.

Section 7(1)(c)(ii) of the Environment Act 1995 places a duty on us to take into account any effect which the proposals would have on the beauty or amenity of any rural or urban area or on any such flora, fauna, features, buildings, sites or objects.

Section 7(1)(c)(iii) of the Environment Act 1995 places a duty on us, when considering any proposal relating to our functions, to have regard, amongst others matters, to any effect which the proposals would have on the social well-being of local communities in rural areas and to take into account any effect which the proposals would have on the beauty or amenity of any rural area.

We have considered whether a scheme when it is operating will cause noise or vibration to be emitted and we are satisfied that any noise caused by the operation, over and above that already existing at the weir, can be mitigated to the extent that any potential impact on the natural beauty and amenity of the River Avon and associated land will be minimal. Whilst we would have regard to potential vibration we are refusing the North Mill application and have therefore not formed a view on whether locating a turbine on the weir would have such a negative impact on the Weavers Mill applicant (the issue of vibration was raised by the Weavers Mill applicant).

19.6 Section 8 Environment Acts 1995 and Sections 28G and 28I Wildlife and Countryside Act 1981

Under section 28G of the Wildlife and Countryside Act 1981 we have a duty to take reasonable steps to further the conservation and enhancement of the flora, fauna or geological or physiographical features by reason of which a site is of special scientific interest (SSSI).

There are no SSSIs within the vicinity of the weir which will be affected by the scheme.

19.7 Section 39 Environment Act 1995

We have a duty under section 39 of the Environment Act 1995 to take into account the likely costs and benefits of granting the applications ('costs' being defined as including costs to the environment as well as any person). We have taken these factors into account as indicated in section 17.0 above.

19.8 The Conservation of Habitats and Species Regulations 2010

Under regulation 61 of these Regulations, we must, before granting any abstraction or impoundment licence, assess whether it is likely to have a significant effect on a European site (Special Areas of Conservation or Special Protection Area), either alone or in combination with other projects; and if so assess the implications of the abstraction upon that site in light of its conservation objectives. In the light of the conclusions of the assessment (and subject to regulation 62) we will only grant a licence after having ascertained that it will not adversely affect the integrity of the European site.

There are no European sites within the vicinity of the weir which will be affected by the scheme.

19.9 Section 85 Countryside and Rights of Way Act 2000

Section 85 places a duty on us to have regard to the purpose of conserving and enhancing the natural beauty of the area of outstanding natural beauty (AONB) when exercising or performing any of our functions in relation to, or so as to affect, land in an such an area.

The scheme is within the Cotswold AONB. Matters relating to the AONB are discussed in section 6.0 above.

19.10 Section 40 Natural Environment and Rural Communities Act 2006

Section 40 of the Natural Environment and Rural Communities Act 2006 places a duty on us to have regard, so far as is consistent with the proper exercise of its functions, to conserving biodiversity. 'Conserving biodiversity includes, in relation to a living organism or type of habitat, restoring or enhancing a population or enhancing a population or habitat.

The licence we issue will not compromise biodiversity of the area.

19.11 Water Environment (Water Framework Directive) (England and Wales) Regulations 2003

As required by regulations 3 and 17 of these Regulations, in reaching our decision we have exercised our water resources functions so as to secure compliance with the Water Framework Directive and we have had regard to the Severn River Basin Management Plan for this river basin district which has been approved under

regulation 14 of these Regulations.

We are satisfied that in granting a licence to the Weavers Mill applicant it will not cause the current status of the water body to deteriorate.

19.12 WRA 1991 section 21(4) and (5)

We are satisfied that for in respect to the licence we issue the river flow will not be less than is necessary for meeting (in respect of both the quality and quantity of water) the requirements of public health, navigation and land drainage. The Hands Off Flow will ensure that there is adequate water available over the weir and so there are no further concerns regarding meeting the above requirements. All water used for hydropower generation will be returned to the river immediately downstream of the weir.

19.13 WRA 1991 section 38(3)(b)

We have had regard to the reasonable requirements of the applicant as shown in section 8.0 of this report.

19.14 Environmental Impact Assessment Directive 2011/92/EU

These Directives are implemented by the Town and Country Planning (Environmental Impact Assessment) Regulations 2011. These Regulations apply to applications for planning consent made to a local planning authority; they do not apply to applications for a licence made to us under the WRA 1991.

The application does not fall within the Water Resources (Environmental Impact Assessment) (England and Wales) Regulations 2003 as are not a “relevant project” for the purposes of those Regulations.