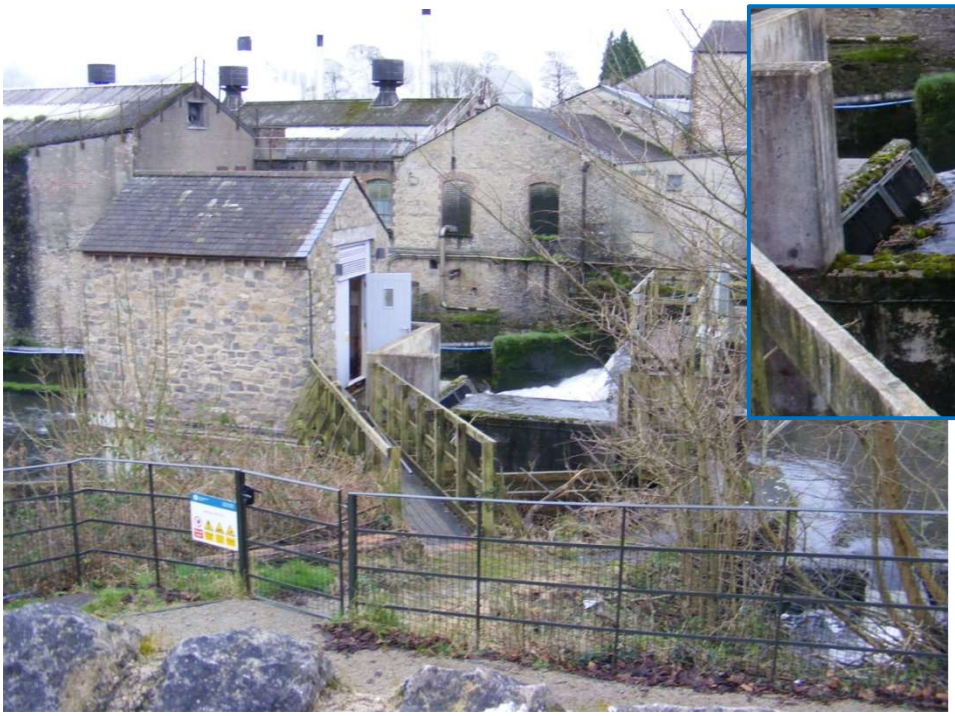
Heron Corn Mill

Heron Corn Mill is situated on the banks of the River Bela in Beetham, South Cumbria and is one of the few working 18th century mills in the area. Located on the weir adjacent to the Mill is a 100 kW Kaplan hydropower turbine, which was installed in 2010 and generates electricity for the Mill with any surplus sold to the paper mill opposite.



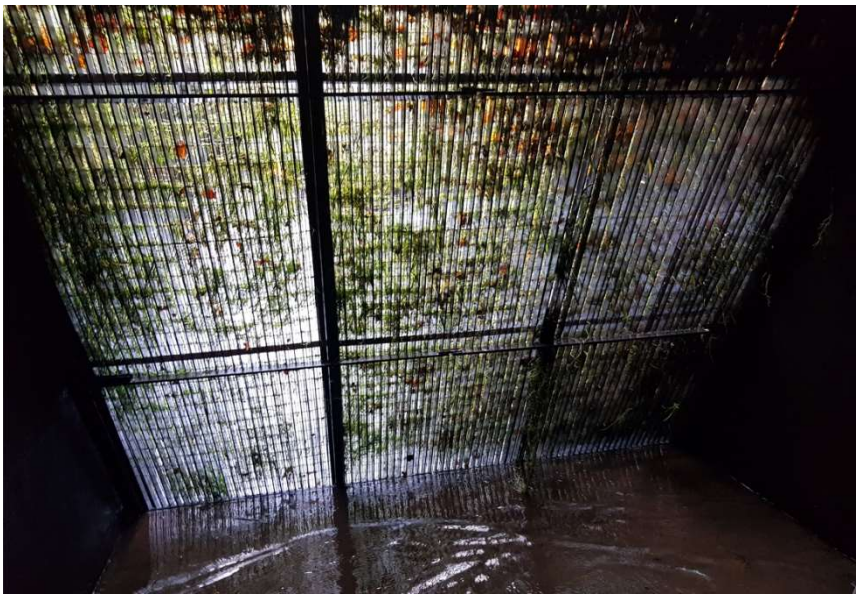
The inlet channel to the hydropower system originally incorporated a fixed bar screen to prevent larger debris entering the turbine. In addition to this, between 15th March to 15th June and 15th September to 30th November each year a finer 'smolt screen' with a bar-spacing of 10 mm had to be fitted on top of the screens to prevent young salmon smolts from entering the turbine.

As can be seen below, these static screens were prone to blocking and were very difficult to clean, which resulted in significant downtime for the hydropower system.

In 2019, GoFlo Screens were approached to provide self-cleaning screens which met the EA screening requirements, but also provided a self-cleaning system which would allow the hydropower system to operate at higher power outputs for longer periods of time.

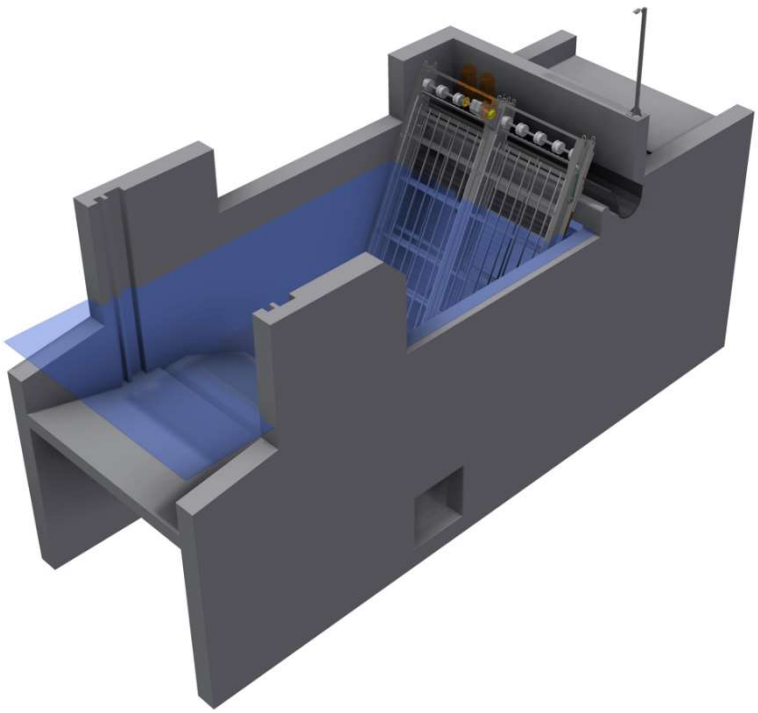
Smolt screens installed on top of the bar screen.

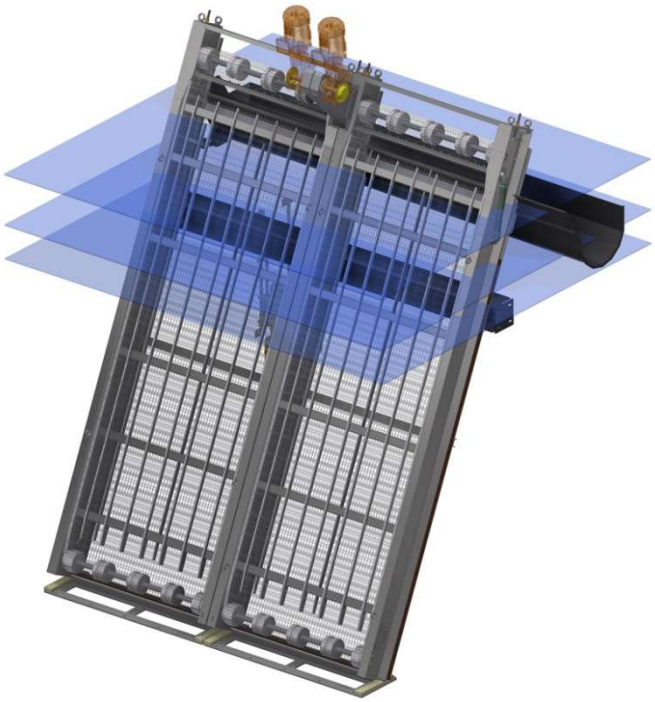
View from behind the bar screen, in the turbine inlet channel.



The Solution

A 10 mm bar-spaced mesh was specified to meet the EA requirements and would be in place year-round. Two GoFlo self-cleaning screens were needed, positioned next to each other. Each screen is 1.47 metres wide x 4.11 metres long, installed at an angle of 65° from horizontal.





The screens are powered by an IP56 1.1 kW electric motor/gearbox unit. The screens are made from 304 Stainless steel and are designed to handle the maximum flow to the turbine of 3.6 cubic meters per second.

The existing debris channel is level and slightly above normal operating water level. This did not lend itself to using bottom-fed submerged debris trough, so a stainless-steel trough liner was designed to introduce a 1 in 60 slope to carry the debris away, along with a pumped flushing flow to return it to the river.

A second identical pump provides flow to the spray booms, which spray high pressure water from inside the screen outwards, to wash any sticky debris off the back of the screen.

Rotaflush filter pump

Installation

Before work could commence the upstream sluice gates were closed and the intake area de-watered. Once this was complete, the old fixed screens could be removed from the inlet channel.

Several of the bolts holding the screen on the channel walls were rusted and had to be cut off, but overall, the screen panels were released from their fixings and lifted away relatively easily.

Intake chamber with the old static screens removed and waiting for the new GoFlo screen Baseplates to be fitted.

A 100-Tonne crane had to be employed to lift the new equipment into position; not because the equipment was particularly heavy, but because a long reach was required (30 m) to bridge the gap between the channel and the solid ground the crane could stand on.

Crane lifting the old bar screen clear of the channel.

The channel floor was relativity flat and level, so minimal shimming was required to level the GoFlo Baseplates.

View of the channel with closed sluice gate and screen pivoting frame being lowered onto the Baseplates.

Note blue tarpaulin used to seal leak under sluice gate!

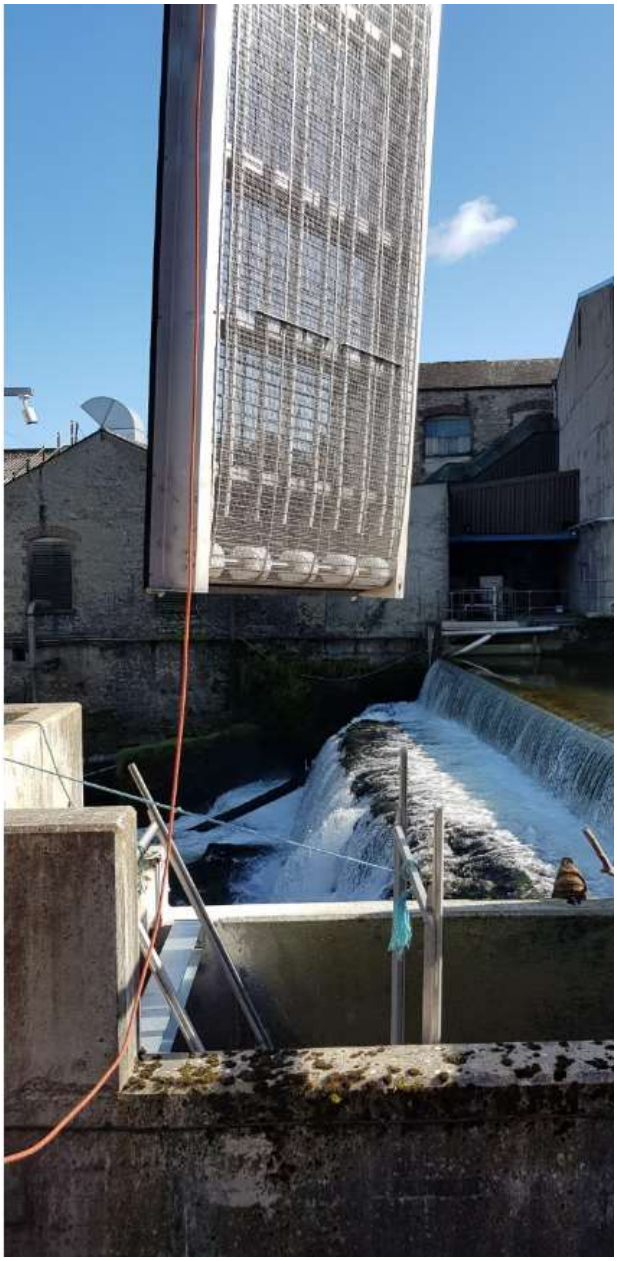
The screen Baseplate had to be positioned accurately so they would sit parallel to each other, but also with the channel walls and support beam.

The screen's Upper Support beam had to be installed precisely to make sure the screens rested on it squarely and with no twisting.

Baseplates in position and screen Pivoting Frames located on the pivot bearing blocks.

Aligning the frames parallel was relatively straightforward. The riverside wall, on the other hand, was not straight the whole way along to the turbine inlet; it tapered towards the turbine. This was not picked up on the survey due to the bar screen being installed at the same angle as the concrete fillet.

GoFlo screen no.1 being lifted over the trees to the intake.



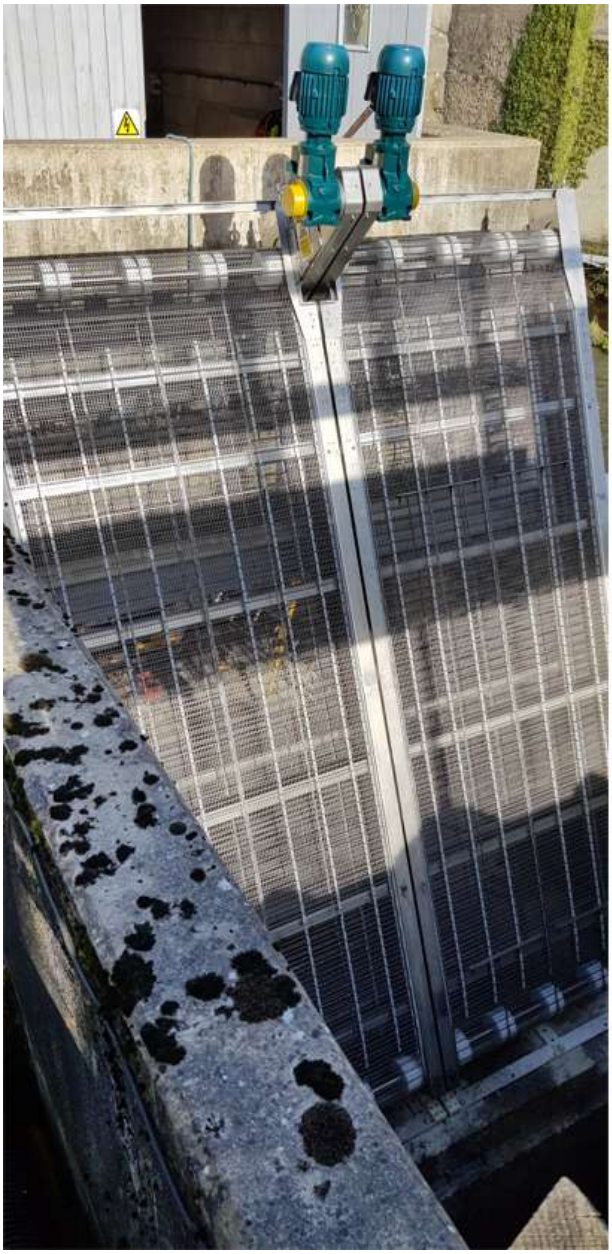
Main river weir can be seen in the background.

The pivoting frame was tethered so it could be moved to line up with the GoFlo screen as it was lowered onto its guide rails.

The pivoting frame only acts as the guide for the screen and does not form part of the screen's strength. This allows the pivoting frame to be relatively light and easy to move to align with the screen.

The second pivoting frame ready to accept the GoFlo screen. Note the pole in the centre of the frame to hold it upright and manoeuvre the screen onto the guide rails.

The screens rest on the galvanised 'I' beam which spans the channel. Plastic isolation strips are used between the dissimilar metals to avoid galvanic corrosion.



View of drive motors. Motors are located within easy reach of the walkway and debris trough. The debris trough can be stood in for accessing the wiring on the motors and pipework to the back of the screens.

Mounting rails for screen sprayboom and debris trough flushing flow pumps. Ladder rungs are for access into the turbine chamber and also used to access the GoFlo pumps.

Both GoFlo screens are controlled from one dedicated control panel mounted within the turbine house.

The panel enclosure contains the variable speed drives (VSD) for each screen motor, contactors for the spray bar and trough pumps, webcam and data connection to internet, and allows remote access and control to all aspects of the GoFlo system.

Cabling is absent from this photo, but all cables were routed through the wall (to the left) and under the walkway between the building and inlet channel. An AV (audio/visual) alarm and emergency stop button were also positioned adjacent to the screens to give warning before the screens start moving and a means to disable them instantly should the need arise.

A three-phase power supply was required for the screen drives; this was connected to the nearby supply from the hydro turbine controller. The blue actuator in foreground is part of the turbine inlet guide vane control mechanism.

Debris trough – discharge end spills into the river downstream of the weir.

Screen washing: Both screen's spray bars operate simultaneously for the duration the screens cleaning cycle.

Webcam view: Live feed from overhead camera gives a birds-eye view of the screen and debris trough. Access to the camera is via a secure webpage which can be viewed by the site operator from a desktop PC or smart phone.

With the addition of the GoFlo screens the turbine is now able generate for longer and at a higher power output due to the significantly cleaner intake screen.

GoFlo have similar installations at other locations around the UK. Have a look at our other case studies on the website.

Enquiry and contact info

If you have a specific screening project in mind, you may find it useful to complete the ‘measuring-up guide’ on our website here: **www.gofloscreens.co.uk /measuring-up-guide** Alternatively just call our office and speak with one of the GoFlo engineers who will be happy to help.

GoFlo Availability: GoFlo screens are available throughout the European Union. Availability outside of the EU is by special arrangement.

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