12

Removing or Passing Barriers

12.4 Weir lowering and rock ramp construction

RIVER CALDER

LOCATION - PADIHAM, EAST LANCASHIRE, SD78843308

DATE OF CONSTRUCTION - MARCH - MAY 2010

LENGTH – 548m

COST – £406,000

River Calder	Medium energy, gravel
WFD Mitigation measure	**Click Here** to view details
Waterbody ID	GB112071065490
Designation	None
Project specific monitoring	Fish

Description

Historically a degraded river due to its industrial heritage, water quality on the Calder has been significantly improved over the last 20 years allowing coarse fish populations to return. However, in-channel obstructions have prevented the migration of fish, including eels (*Anguilla anguilla*), to approximately 20km of spawning grounds and habitat further upstream.

The ambitious River Calder Fish Migration Improvement project was led by the Environment Agency and the Ribble Rivers Trust to link isolated sections of watercourse. The project aim was to restore fish passage on the River Calder. This was achieved by reducing the height of the existing weir structure as well as installing a rock ramp.

Padiham Weir was built in the 1950s to provide water to the now demolished power station. At 1.85m it was the largest weir on the Calder and created a total barrier to all fish migration. Since 2000 Padiham Weir had been the subject of a number of different fish passage proposals including a pool-and-traverse scheme, the installation of a technical Larinier fish pass, and even a white water canoe course.

At the location of Padiham Weir the River Calder has an average gradient of greater than 1 in 100, with a bankfull width of approximately 30m.

Padiham Weir prior to works creating a total barrier to upstream fish migration – October 2005

A 7lb Atlantic salmon attempting to jump the weir – November 2006

Design

Prior to the works a dive survey established that the weir was in poor condition and liable to failure. It indicated that there was extensive sediment deposition upstream of the structure. A topographic survey established the bed levels upstream and downstream of the weir which then informed the calculations to determine the level and spacing of the bed check weirs.

A hydromorphological assessment concluded that the impacts of the weir removal on sedimenttransport, water levels and the flow regime would be beneficial. It was established that there would be no increased flood risk and that there was likely to be a reduction in flood risk for at least one business due to the elimination of the weir's backwater effect. The banks were deemed stable enough to withstand the lowering of water levels. The left bank was already modified with stone blocks along the immediate upstream section and the right bank was gently shelving.

The end sections of the weir adjacent to the wing walls were left in place to assist with stability. The initial drop in water level following the weir removal was approximately 1m removing the impounding effect for approximately 500m upstream.

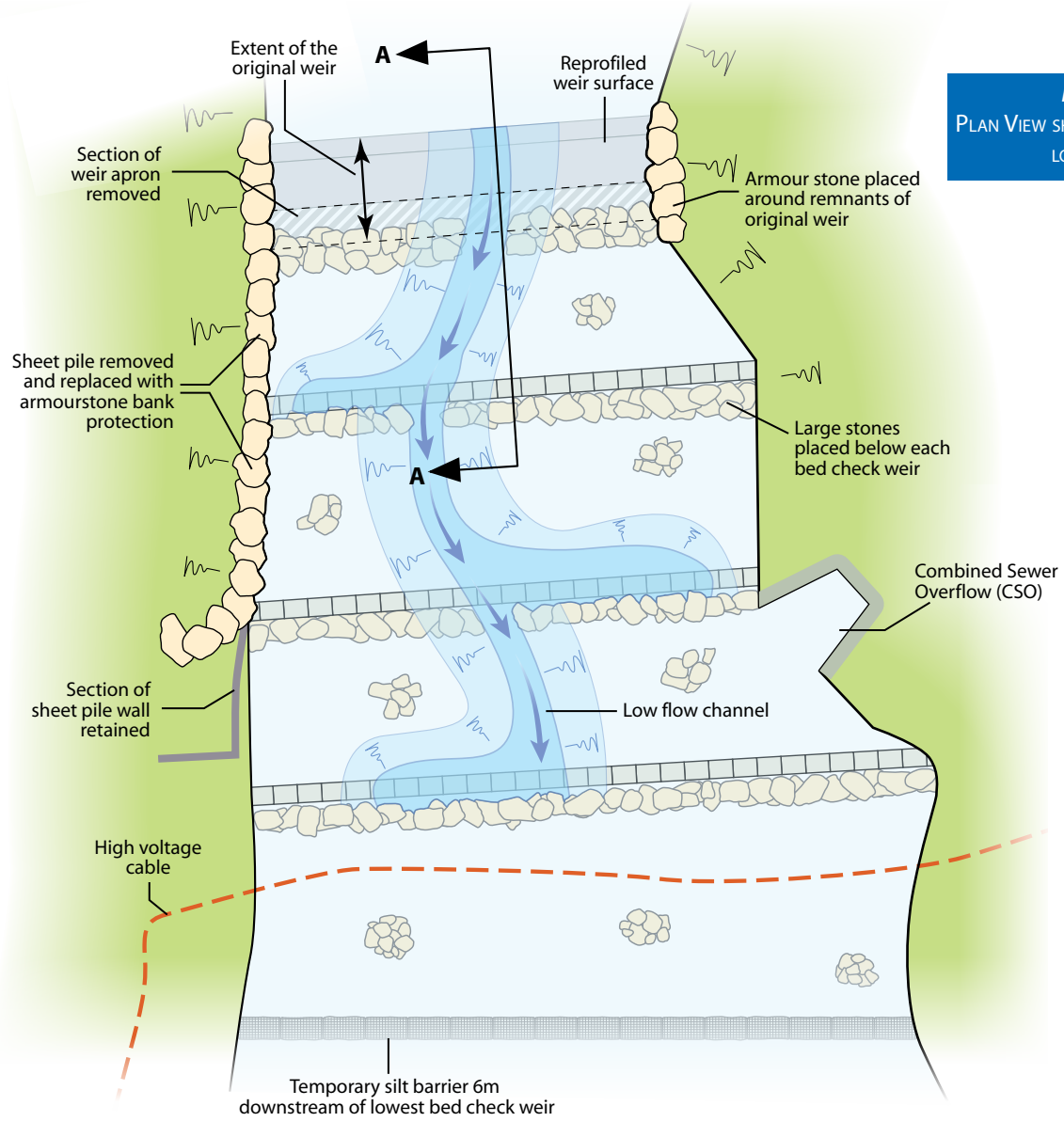

Figure 12.4.1
PLAN VIEW SHOWING BED CHECK WEIRS AND LOW FLOW CHANNEL

Additional site investigations were carried out prior to on the ground works commencing to address three main concerns;

1. A survey identified high voltage (HV) electric cables buried in the river bed. The project design was adapted to take these into account and location of the lowest bed check weir was chosen to ensure that the HV cable was protected.
2. Surveys confirmed that the sediment that had built up behind the weir was not contaminated. In order to reduce potential negative impacts downstream a temporary silt trap was constructed in-stream prior to works commencing. Located 6m downstream of the lowest proposed bed check weir, and downstream of the HV cable, the barrier was constructed from gabion baskets with an infill of straw bales and aimed at arresting the fine sediment fraction (silt) that had built up behind the weir over the last 50 years.
3. Liaison with United Utilities was necessary to ensure that the works, both during and after construction, would not interfere with the operation of the Combined Sewer Outflow (CSO) and that any impact could be mitigated. No further action was considered necessary.

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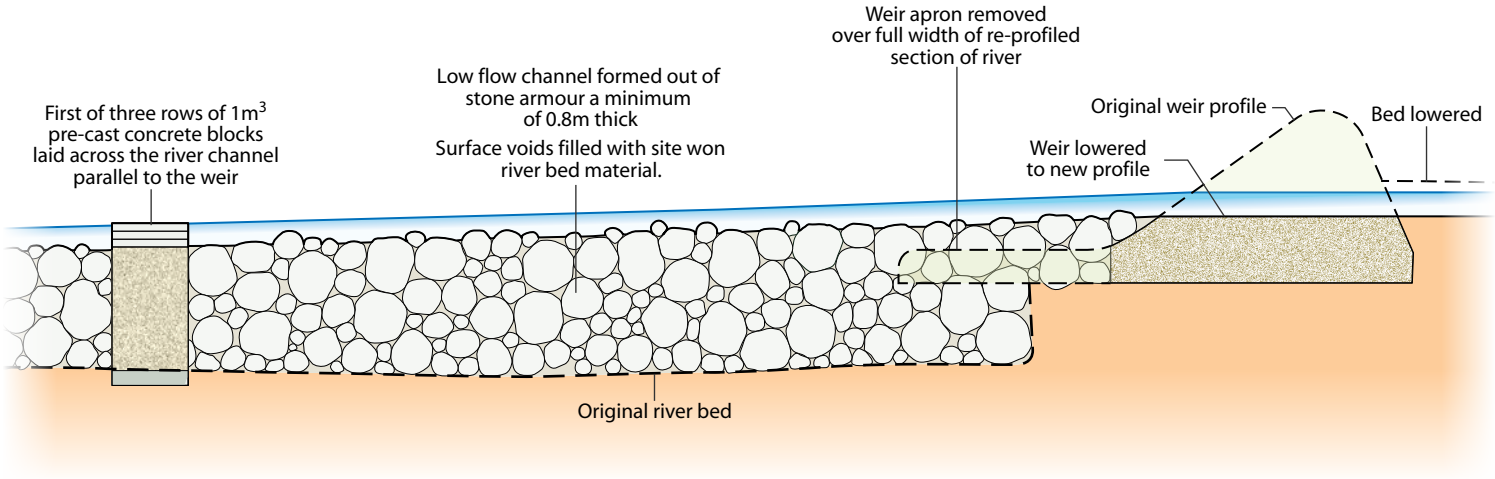
Three bed check weirs, all 0.3m high, were installed in phases using an excavator, working from downstream up towards the existing weir structure. This work was undertaken from within a sheet piled cofferdam. To install each bed check weir a trench of 1m deep was dug and interlocking 1m^3 pre-cast concrete blocks were set across the channel on aggregate bedding, parallel to the existing weir. The bed was lowered upstream of the existing weir. Stones (varying in size from large gravels to cobbles and boulders) were placed immediately downstream of each check weir to reduce the risk of scour causing instability of the structures. Stone armour was also placed at the toe of the existing weir structure, where scour had created a void, to help stabilise it. Once the installation of the bed check weirs was complete, the existing weir was partially deconstructed.

The weir crest was lowered through a combination of diamond wire cutting (wire saw impregnated with diamond dust that can be used for concrete cutting underwater) and hydraulic breaking. A central shallow (0.3m) v-shaped, low flow channel was created. The crest of the original weir was lowered by 1.45m and it now acts effectively as a fourth check weir.

Figure 12.4.2
LONGITUDINAL PROFILE **A–A**



The site on completion. The low flow channel is visible through the centre of the bed check weirs – October 2010

Subsequent performance

The design was developed such that continued maintenance of the structures should not be necessary. The site now operates as a full weir removal would have, with the bed check structures effectively buried and blending well into the natural river bed.

The material used in the rock ramp was selected to withstand the expected stream power at the site, however exceptionally high flows over a sustained period during 2012 appears to have caused significant scour and erosion both above and below the weir. Flow volumes experienced during 2012 resulted in velocities capable of entraining the material used for the rock ramp (the 1 in 50 year return period flood event in June had a peak flow of 220m^3/s compared to median annual flood flow of 173m^3/s).

Once a portion of the material had been scoured out, the uneven bed surface was vulnerable to further scour and turbulence and allowed more material to be scoured out during subsequent high flow events. The issues experienced at this site as a result of high flood flows highlight the importance of setting the size of stone used for the stone armouring according to bankfull flows.

Upstream migration of fish species has been achieved with adult Atlantic salmon (*Salmo salar*) and sea trout (*Salmo trutta*) observed upstream of the site. Juvenile population numbers are yet to be recorded upstream of the weir but have been identified immediately downstream.

Electrofishing surveys and redd counts were carried out following the completion of works, in the summer of 2010, to monitor migratory salmonid spawning for comparison with historic baseline data. However, bad weather and high flows in 2011 and 2012 have meant that the planned annual monitoring of fish has not been completed. Further electrofishing and redd counting is planned for summer 2013.

The site after three years. Some of the material entrained during high flood flows has been carried downstream but the majority has remained in the vicinity of the rock ramp and is visible near to the left hand bank – April 2013

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Reference material – Click here