



River Sid, School Weir Fish Passage meeting note

**Site visit and fish passage option discussions with Devon
Wildlife Trust, Sid Vale Association & Fishtek Consulting**

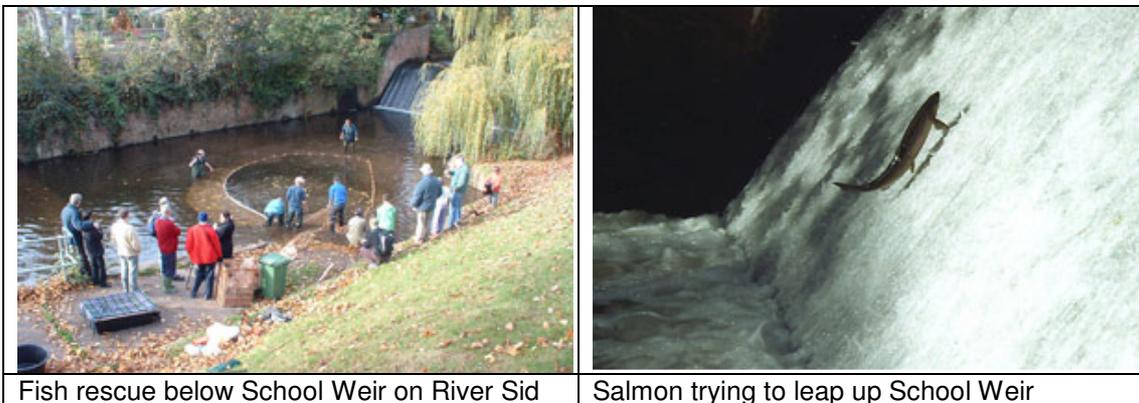
3rd March 2014



Background

The School Weir on the River Sid in Devon is considered to be impassable for a range of migratory fish species including salmon (*Salmo salar*) and sea trout (*Salmo trutta*). Most years fish rescues are undertaken by the Sid Vale Association and the Environment Agency to move sea trout and salmon upstream of the weir (see photos below). European eel (*Anguilla anguilla*) have also been recorded in small numbers upstream of the weir during electro-fishing surveys, however the weir is not considered easily passable for these species and eel passage could be readily improved.

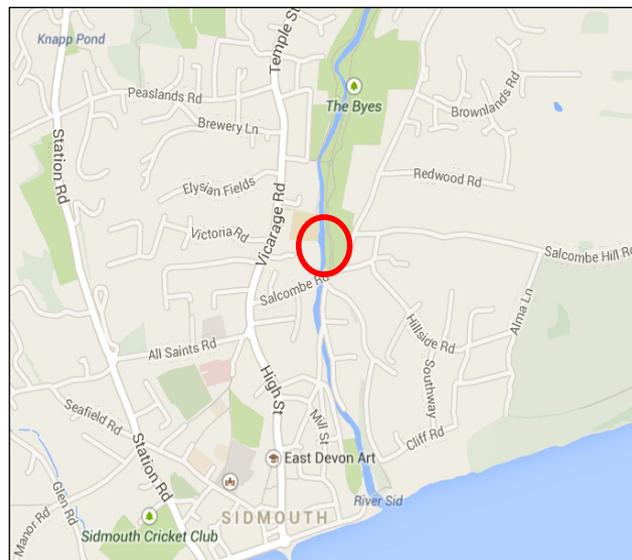
A site visit was undertaken on 3rd March 2014 organised by the Devon Wildlife Trust, with Fishtek Consulting Ltd and Side Vale Association to discuss the fish and eel passage options for School Weir. This meeting note outlines some of the options discussed onsite during the meeting and highlights the preferred options and recommendations.



Source: <http://www.sidvaleassociation.org.uk/index.php?page=river-patrol>

Location

The River Sid is a minor river in East Devon. It flows for 10.5 km southwards from a source in Crowpits Covert (OSGB36 Grid reference SY138963) at a height of 206 metres above sea level. The river flows through Sidbury and Sidford to Sidmouth and is fed by springs flowing from East Hill and water from the Roncombe Stream, the Snod Brook and the Woolbrook. In Sidmouth the river outflows at the Ham through a shingle bar.



Weir description

School Weir is an Ogee type weir which is approximately 2.5-3m in height. There are a series of other weir structures downstream of School Weir including a ford and two other crump weir structures (see photos below). The lowest of these structures may be drowned out on spring high tides. Migratory species such as salmon and sea trout are able to pass these downstream structures during high flow conditions although passage for these species and especially eels could be improved.



School Weir on the River Sid



Ford downstream of School Weir



Existing flow levels

No gauging weirs exist on the River Sid. Average flows are estimated to be approximately 1m³/second and summer flows are anticipated to be very low and probably only a few hundred litres.

Fish species

Main species include brown trout (*Salmo Trutta*) and eel (*Anguilla anguilla*).

Access considerations

School Weir is location at the bottom of the River Sid catchment in Sidmouth east Devon and approximately 0.6km from its confluence with the sea. The left hand bank of the weir is within The Byes Public Park with easy construction access via Byes Toll House, Salcombe Road. There is also a slip directly below downstream of the weir which would allow easy access into the river if required.

It is likely that any fish installation on the left hand bank may require the removal of two trees immediately downstream of the weir.



Options discussed

Fish passage

Three possible fish pass options were discussed during the site visit. These included a single unit Larinier with resting pool; a ducted or siphon pass and a single flight Alaskan A. The Alaskan A is the preferred fish pass solution for the site as the installation would minimise the extent of any ground works and the fish pass would be effective for the species under consideration namely sea trout and salmon. Some further brief details of the other fish passage options discussed are also provided below.

Super-active baffle (Larinier) pass

This type of pass, developed by Larinier and Miralles in the early 1980's (Larinier & Miralles, 1981) is coming to be widely used in Europe and Britain. There is increasing evidence that this type of pass is suitable not only for large migratory salmonids such as salmon and sea trout, but also for an extensive range of other species including brown trout, grayling, and coarse fish.

It is a relatively wide and shallow type of fish pass (by comparison with Denils), and only has baffles on the bed of the pass (see diagram below).



Single flights may be used to accommodate head differences up to a maximum of 1.5-1.8m for large migratory salmonids and a maximum of 1.2-1.5m for coarse fish species. The maximum gradient is 15%. Generally the gradient used is between 10% and 15%, although it can be less. The length of any one flight should be limited to 12m for migratory salmonids and 8-10m for other species.

Due to the head difference at School Weir if this option was considered it would require a single unit wide (due to the low flows) two flight pass with a resting pool. Because of the lower gradient of 10-15% compared with that of an Alaskan A and the need for a resting pool, significant ground excavation would be required if this option is to be considered at School Weir. Furthermore, one of the disadvantages of the Larinier pass is the sensitivity to change in head level which means that they will not generally remain effective if head rises more than about 200-300mm above normal

operating level in 100mm baffle passes, or 400 – 500mm above normal operating level in 150mm passes.

Pipe or siphon pass

The Sid Vale Association has also considered the possibility of an underground ducted type fish pass with baffles. The options for this were also discussed onsite.

The Siphon Fish Pass developed by Fish Flow Innovations is set in a tube that connects the head and tail waters of the river. A series of baffles inside the tube divides the head difference in small steps. A vacuum pump pumps air from the fishway and thus raises the water level in the tube. Once the headwater spills over the top baffle the fishway starts siphoning and the vacuum pump is switched off.

An air bubble in the fish ladder defines the flow rate over the fish ladder. The vacuum pump can also be used to regulate flow rate. The water consumption of the fish ladder can thus be adjusted to suit the water availability.

Examples and schematics of the fish siphon are show in below.



The length of the siphon is dependant on the number of baffles required to cover the head difference. One baffle is used for each 100 mm of head difference subsequent baffles are set at a distance of 800 to 1500 mm.

For salmonid passage the Environment Agency's Fish Pass Panel require that the pool sizes should be approximately 3x the fish's length. Based on the above specification the length of the fish pass required for the 2.5-3m head difference at School Weir may mean this is a less favoured option.

Alaskan A – denil pass

This type of fishpass with 3-dimensional baffles is a very specific type of pass originally developed for passing Pacific salmon in remote areas. The channel has fixed dimensions in terms of width and baffles and is narrow (0.56m) with a small free passage width (0.35m). It is used in depths from 0.7 to 1.4m. Modular units in 1m lengths and heights of 0.7m, 1.0m and 1.4m are available commercially in the UK.

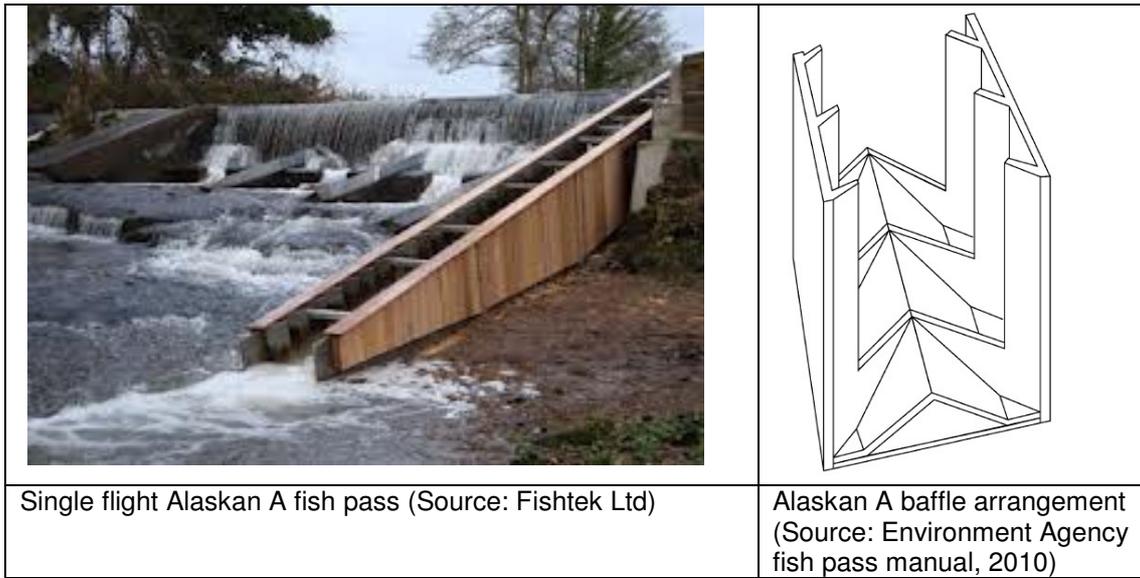
It is more effective hydraulically than a similarly sized plane baffle pass operating at a similar depth, passing less flow at a lower velocity. The baffles are closely spaced making the size of helical currents in the pass relatively small.

The key Alaskan A operational details are listed below:

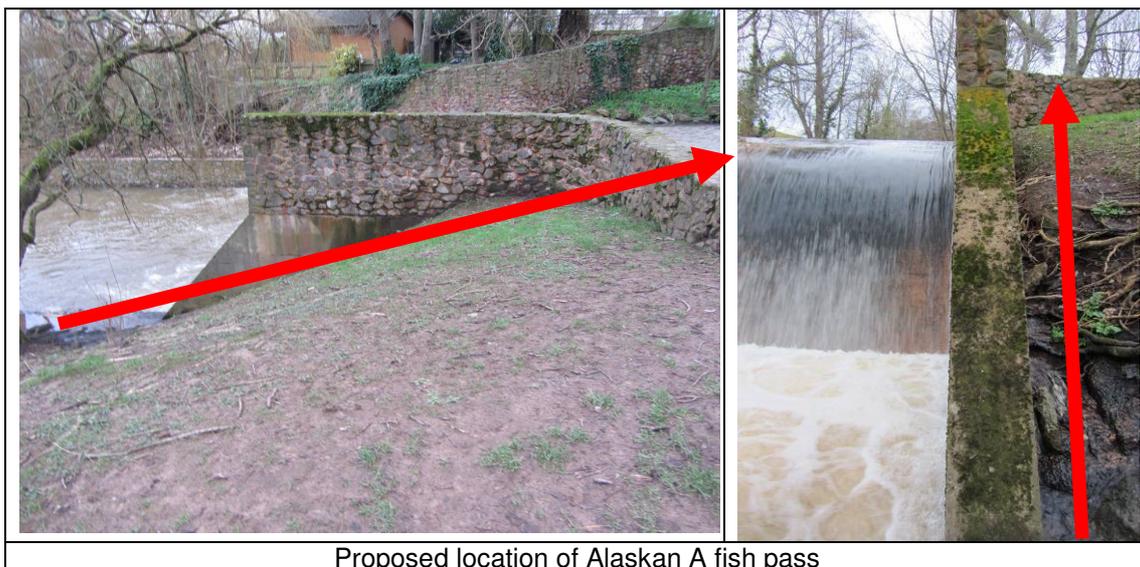
- **Suitable species:** They are very suitable for migratory salmonids and trout, probably suitable for sea lamprey, and for some larger coarse fish species. The relatively low velocities and small helical currents also makes these passes useful for larger coarse fish species, provided that gradients $\leq 20\%$ are used.
- **Head difference:** In exceptional circumstances single flights may be used to accommodate head differences up to 3.0m for migratory salmonids, and 1.6m for other species.
- **Length & Gradient:** Gradients used for this type of pass can be steep (hence it is often called a steeppass), and slopes up to 33% have been used. However, it is not recommended to use a gradient steeper than 25% for migratory salmonids and 20% for other species. A single flight should not exceed 12m for salmonids and 8m for other species.
- **Width:** The channel has fixed dimensions in terms of width and baffles, and is narrow (0.56m) with a small free passage width (0.35m).
- **Depth:** The lower operating limit of depth for large migratory salmonids is generally taken as about 0.325m for a pass at a 25% slope. The upper limit is not easily defined but should certainly not exceed 1.27m.
- **Discharge:** Can range between 0.1 and 0.81m³/second, most often being around 0.2 to 0.45m³/second.
- **Velocity:** Mean velocities are usually between 1.1-1.4m³/second (for slopes between 20-33% and depending on depth).
- **Strengths:** Well-tried and tested and commercially available as pre-fabricated modular units. Accommodates a modest increase in upstream head, provides passage at relatively low flows, and at slightly lower velocities than other Denils. May be considered for head differences up to 3m without a rest pool, and for gradients up to 25%.

- **Weaknesses:** The disadvantages of this type of pass are the likelihood of blocking, and the relatively limited discharge that reduces its attractiveness because of the low kinetic energy of the jet at the pass entrance. In many watercourses augmentation of attraction flow would frequently have to be considered.

Due to easy access at the site it is not anticipated that blocking of the fish pass will be a significant issue as regular maintenance could readily be undertaken to ensure the fish pass is functioning effectively during key periods of the migratory season.



The preferred location for the Alaskan A would be along side the left wing wall (see below). A prefabricated pass could be sat into a concrete channel which extends upstream of and is tied into the existing wingwall.



Eel passage

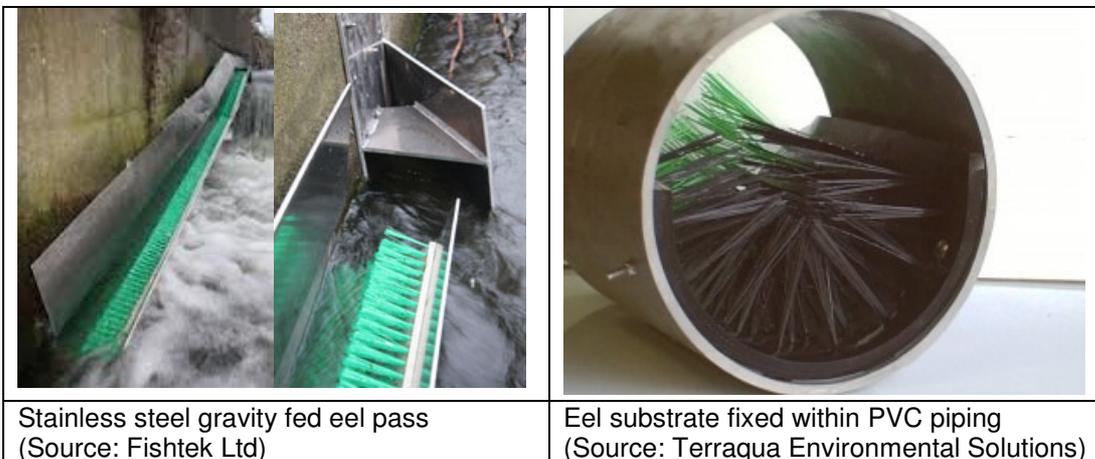
While some eels have been recorded in electro-fishing surveys upstream of School Weir the weir is considered to be a barrier to eel migration. Eel passage could be greatly improved through the installation of either a gravity fed or pumped eel pass on the weir depending on the low flow conditions. However any eel passage improvements at School Weir would be most effective if done in conjunction with improvements for eel passage on the downstream crump weirs as these are also considered to be obstructions to eel migration.

The preferred location for an eel pass would be the far bank to reduce the risk of vandalism or tampering etc. If fish passage were also to be considered at School Weir an eel pass could be fitted alongside the Alaskan A fish pass although the preference would be to keep them separate.



Preferred location of eel pass on right hand bank

It is anticipated that the flows over the weir are sufficient for a gravity fed eel pass. There are a range of gravity fed eel pass options available ranging from those fabricated from stainless steel to plastic piping (see photos below). Because of the public location of the site the preference would be for an eel substrate within a piped pass fixed to the wing wall with brackets which be less conspicuous and reduce the risk of theft or vandalism.



Eel passage on the two downstream crump weir can be easily improved by fixing eel tiles to the corners of the weir face (see photos below).



Eel tiles (Source: www.berryescott.co.uk)

Fixing eel tiles to weir (Source: www.wandletrust.org)

Recommendations and preferred options

Fish passage

The preferred option for increasing fish passage at School Weir would be the installation of a single flight Alaskan A fish pass which could be installed next to the wing wall on the left hand bank. The exact cost would be dependant on the outcome of further ground investigations but a rough estimate cost is considered to be £100,000 for the fabrication, construction and installation works.

Fish are known to be able to pass the downstream crump weirs during higher flow conditions. Fish passage while not as critical as at School Weir could be improved at these weirs through the installation of baulks. The estimate for this would be £50,000.

Eel passage

It is anticipated a gravity fed eel pass could be installed on the right hand bank at School Weir which would reduce maintenance compared to a pumped eel pass. Any eel pass options at School Weir would only be effective if eel passage were also facilitated at the two downstream crump weirs as the water velocities and height of the weirs do not make them readily passable for eels and especially elvers. The cost of a gravity fed eel pass is dependant on the materials used for construction. An inconspicuous PVC piped pass would be the preference. It is estimated this could be constructed and installed for less than £5,000. The installation of eel tiles up both sides of the two crump weirs is estimated at £3,000.

Cost estimate summary

Fish pass option	Cost estimate	Comments
<i>Fish passage</i>		
Single flight Alaskan A fish pass	£100,000	Required for fish passage at School Weir
Baulk fish passes on downstream crump weirs	£50,000	Migratory salmonids are already able to pass these weirs during high flow conditions but passage could be facilitated / improved.
<i>Eel passage</i>		
Gravity fed piped eel pass at School Weir	£5,000	If eel passage improvements are carried out they should be carried out on all three structures.
Eel tiles on two downstream crump weirs	£3,000	

Next steps

Some of the key next steps and requirements if fish passage options are to be pursued at School Weir are set out below along with rough cost estimates where appropriate.

- **Ground investigations (£1,000):** Ground investigations will be required to establish the current condition of the weir to inform the preferred option and detailed design.
- **Topographic survey (£1,000):** Required to inform the levels for the detailed fish pass design.
- **Water level monitoring (£800):** Monitoring of upstream and downstream water levels required to inform the detailed design, positioning of fish pass inverts etc.
- **Develop the outline design (£3,000):** Development of outline design for approvals.
- **NFPP approval, Flood Defence Consent, Planning, Ecology and Flood Risk (£5,000):** Fish pass designs will need to be submitted to the Environment Agency Fish Pass Panel for approval. Further consents, planning and ecological assessment will also be required.
- **Landowner agreements and consultation:** Landowner agreements, access requirements and consultation will need to be undertaken.
- **Detailed design (£4,000):** Development of construction ready drawings.