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Removing or Passing Barriers

12.1 Restoring an on-line lake to a chalk stream

BABINGLEY RIVER

LOCATION - HILLINGTON, NORFOLK TF72532629

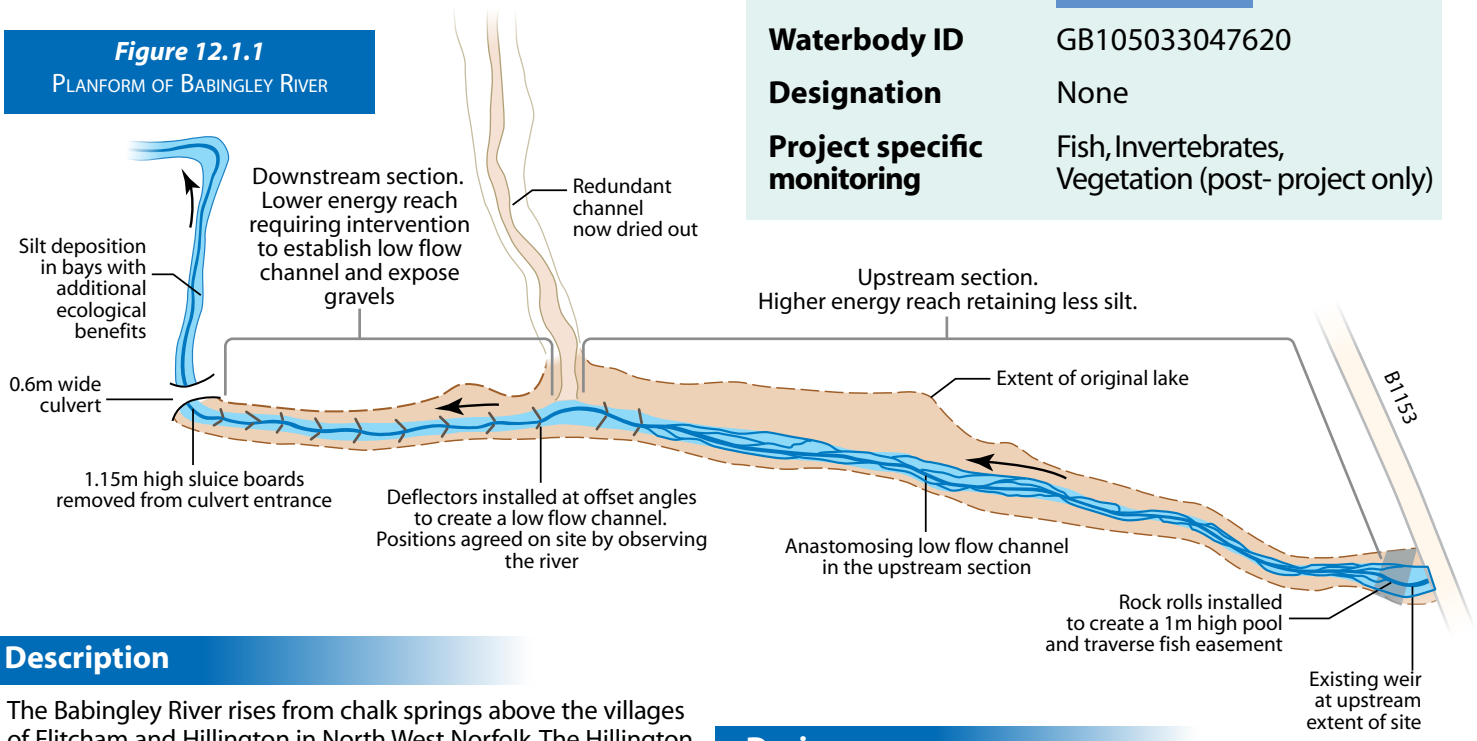
DATE OF CONSTRUCTION - 2006 – FEBRUARY 2007

LENGTH - 500M

COST - £600

Babingley River	Low energy, chalk
WFD Mitigation measure	**Click Here** to view details
Waterbody ID	GB105033047620
Designation	None
Project specific monitoring	Fish, Invertebrates, Vegetation (post- project only)

Figure 12.1.1
PLANFORM OF BABINGLEY RIVER



Description

The Babingley River rises from chalk springs above the villages of Flitcham and Hillington in North West Norfolk. The Hillington site is located close to the source and includes an impounded online lake known as the Broadwater. The aim of the project was to revert the lake back to 420m of river. This would resolve the water quality issues in the lake, remove barriers to fish passage, including eel (*Anguilla anguilla*), provide additional spawning habitat for wild brown trout (*Salmo trutta*). The sluice boards used to impound the lake were removed, lowering the water level. This concentrated the flow and enabled the river to cut a new channel. However, lowering the water level created a barrier at the upstream weir, which was addressed by a pool and traverse fish easement.

This low cost river restoration technique was possible at this site as the landowner owned both sides. The rural location of the site, and lack of infrastructure downstream, meant that flood risk modelling was not considered necessary.

Design

The work was designed to use the energy of the river to cut and form the new channel. The works were carried out in three distinct phases;

1. Controlled removal of downstream sluice boards

Six sluice boards, 1.15m high in total, were located at the downstream extent of the reach where the river flows through a 0.6m wide culvert. These maintained the water level in the impounded lake. The boards were removed using a staged approach enabling the lake level to be lowered in a controlled manner and allowing the amount of sediment released downstream to be regulated.

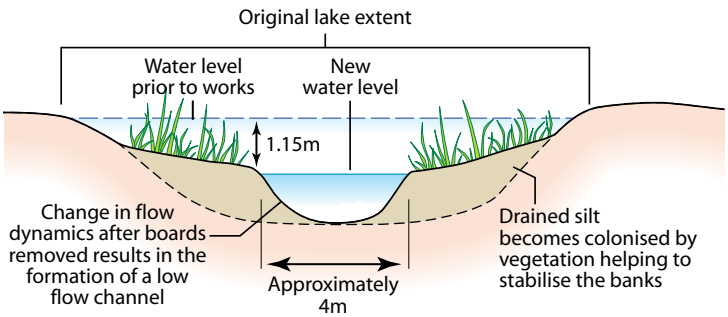


Figure 12.1.2
TYPICAL CROSS SECTION OF NEW CHANNEL IN DOWNSTREAM SECTION

The board removal started in mid-September 2006 and one board was removed every two to three weeks. When the last board was removed in November 2006, the flow in the lake had concentrated sufficiently to start cutting a new channel. This took longer than planned which presented a risk to the impending spawning season, but given the long term benefits this was deemed to be an acceptable short-term impact.

Sediment release was the biggest concern. Careful control of sediment mobilisation was observed to reduce impacts to the habitat downstream. Below the sluice boards the river was characterised by bays and riffles. It was predicted the silt would deposit in the bays and eventually colonise with vegetation. This approach was deemed significantly less disruptive than using an excavator to remove the silt.

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Downstream extent of the reach. The sluice boards have been completely removed – August 2007

2. *Pool and traverse fish easement using rock rolls*

The removal of downstream sluices and resultant 1.15m drop in water levels created a barrier at the upstream end of the site where an existing weir was located. To enable fish to negotiate the weir a 'pool and traverse' style fish easement was installed using rock rolls. This was trialled as a low cost technique.

The easement was constructed using twenty rock rolls to create jumps approximately 0.3m high, the height that brown trout are able to traverse. Two lines of rock rolls were laid across the downstream face of the weir creating three steps for migrating fish to negotiate the barrier. A gap of approximately one metre was built into each line of rock rolls to concentrate the flow. These gaps were offset to reduce flow velocities through the easement and to create fish resting areas.

It was recognised that initially water would probably percolate through the rock rolls. However it was envisaged that the sediment would deposit in the rock rolls and they would quickly vegetate.

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Pool and traverse fish easement after completion. Vegetation has already begun to establish on the rock rolls – August 2007

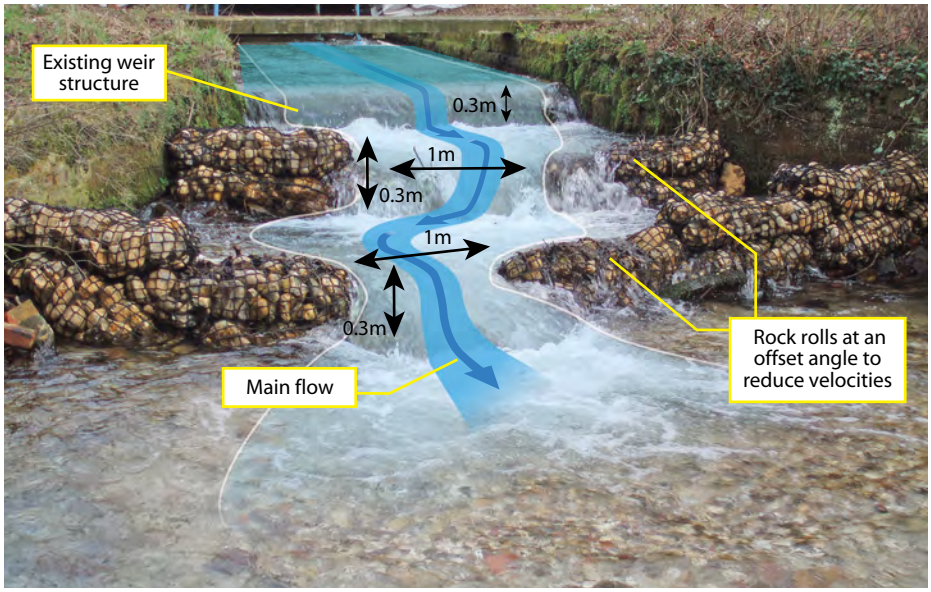

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Figure 12.1.3
POOL AND TRAVERSE FISH EASEMENT CREATED USING ROCK ROLLS

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Mitigation for Barriers

3. Installation of deflector boards

After the sluice boards were removed and the water level lowered, the river began to cut a new channel into the silt. In the upper reach, where the gradient was steeper, the river was left to naturally continue this process. In the downstream reach the gradient was less and lacked the energy necessary to continue cutting into the remaining silt. The installation of a series of deflectors created pinch points that have concentrated flows sufficiently to cut down to the hard bed and create pool and glide sections. Twenty deflector boards were installed facing in an upstream direction over a 200m stretch.

The deflectors were generally installed in pairs, some opposite each other and some offset. The locations were determined by working with the river. Hillington Fly Fishing Club was responsible for this work so the addition of the deflectors did not contribute to the Environment Agency project cost.

The newly installed deflectors face upstream and concentrate flow. The old silt bed has formed new banks and has since been colonised by vegetation – February 2007

One pair of deflector boards, installed at an offset angle, after six months. Marginal vegetation has rapidly colonised the silt helping to stabilise it further – August 2007

Subsequent performance

The upstream section of the restored river was quick to expose hard bed, and braided channels have formed here. The combination of newly exposed gravels and improved flows has increased the amount of available spawning habitat.

Downstream of the project site there were initial concerns that silt would smother the spawning gravels, but these have not been realised. As expected sediment has predominantly been deposited in wider slack water sections, forming bars and has assisted in natural channel narrowing. These have rapidly vegetated. Vegetation has also colonised the newly exposed silt helping to consolidate it and create juvenile habitat.

In the lower reaches of the project site the installation of deflectors has helped to concentrate the flow and create scour holes. These pools, up to a metre deep, provide refuge for fish and were occupied by brown trout soon after completion.

Some adaptive management of the pool and traverse fish pass has been required. The approach relied on the weight of the bags to keep them in situ. However, some movement did occur due to scouring of the soft bed and the rock rolls would have been better pinned in place. The rock rolls were repositioned manually and stabilised by ensuring that they were located on a hard bed.

Mitigation for Barriers

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Prior to restoration, expert judgement and angler records determined that there were little or no fish in the channel due to poor water quality and a lack of connectivity. A fish survey carried out one year after the completion of the project. Fish from several year classes were present in the channel. No further studies have been carried out to date (2013).

Post works vegetation monitoring was carried out in the form of a 'presence only' survey. This highlighted that a wide range of marginal and aquatic species had colonised the newly exposed silty margins. Species found included horned pondweed (*Zabbuchellia palustris*), water mint (*Mentha aquatica*) and lesser spearwort (*Ranunculus flammula*).

Invertebrate sampling has revealed that the site supports stonefly nymph (*Leuctra hippopus*), cased caddis larvae (*Goera pilosa*) and freshwater shrimp (*Gammarus pulex*). These species are indicative of fast flow and good water quality.

The work has created a self sustaining channel. No further management was planned, or has been necessary. The big advantage of this technique is that it works witht he natural processes of the river, producing a more stable environment.

Brown trout (*Salmo trutta*) present in the river four months after works were completed – February 2007

Prior to restoration works. The on-line lake was over deep due to the presence of sluice boards impounding water – August 2006

Post restoration works. The channel is narrower and shallower with diverse marginal vegetation and good spawning habitat – September 2007

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