River Habitat Enhancement Case Studies

River Nene: Castor Back Channel

Version 1 (24.11.12)

Location: Downstream of Water Newton Weir (c3km west of Peterborough)

Upstream Grid Ref: TL103977

Length: c 1100m

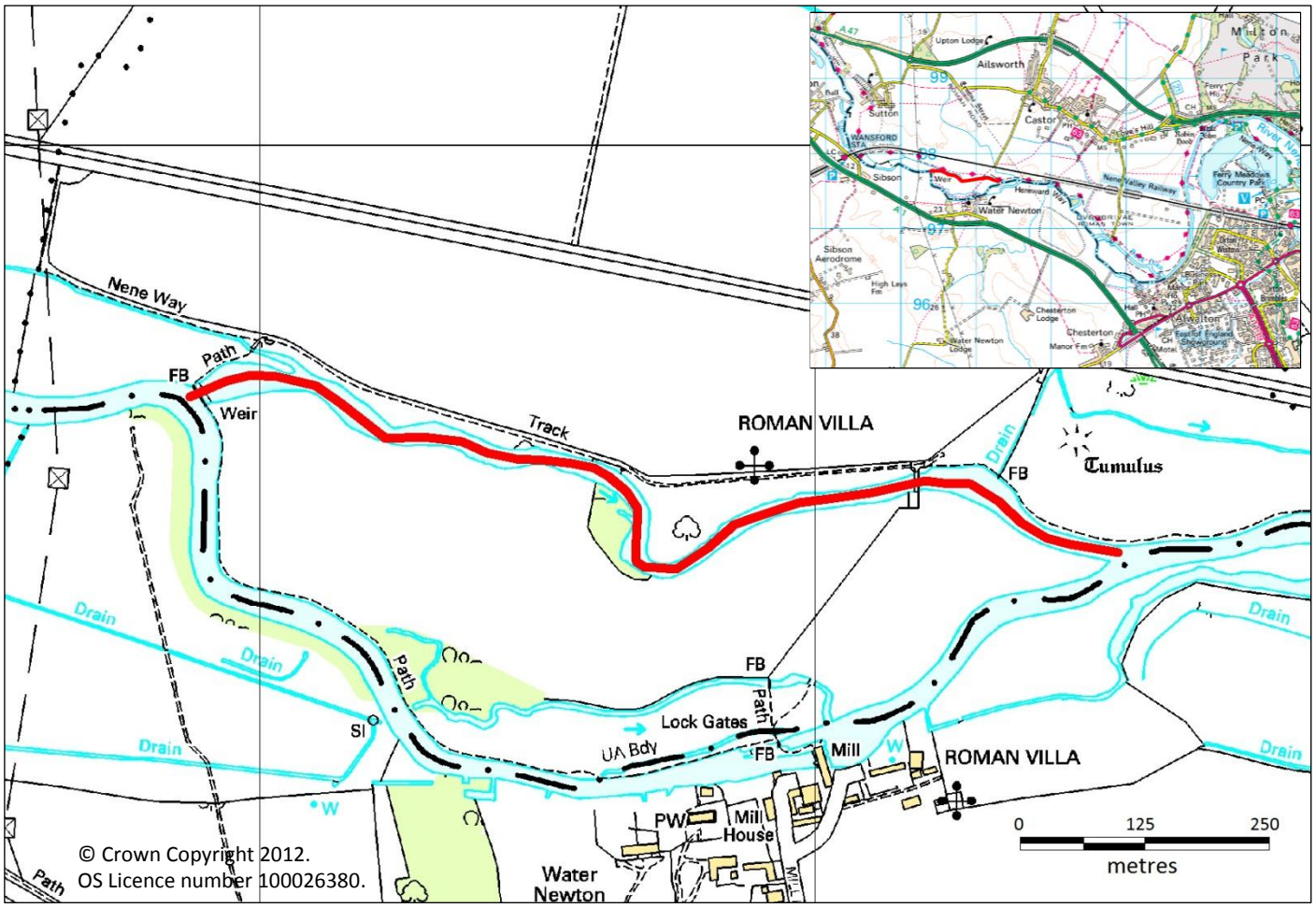
Completion Date: Spring 2012

Cost: £40,000

Partners: The scheme was implemented by the Environment Agency with the co-operation and agreement of the Nene Park Trust (landowner) and the support of Peterborough and District Angling Association (PDAA) and the Bedfordshire, Cambridgeshire and Northamptonshire Wildlife Trust.

Summary of Techniques: Bank reprofiling; bank revetment using ash faggots and spiling; installation of ash faggot flow deflectors; securing in-stream woody debris; gravel introduction to augment an existing run; excavation of new fish refuges; installation of new cattle drinkers and a “dog-dip”; riverside fencing; willow pollarding; riverside tree planting to create shade; and wildflower seeding. The bridge beams were also repainted with vandal resistant paint to address an existing graffiti issue.

Location Map



Background

The Wildlife Trust and the Environment Agency have collaborated on a number of projects along the River Nene in recent years, initially under the banner of the Trust's *Nene Vision* and now through the *Nene Valley Nature Improvement Area*. During the summer of 2010 one such project was a study of selected backwaters and back channels on the river between Northampton and Peterborough. A year earlier R. S. Brayshaw Ecological Consultancy, under contract to the EA, prepared *Recommendations to create and restore lowland coarse fish and eel habitat and improve access to the Nene Park Trust recreational fishery.* Both studies identified the potential for the enhancement of the Castor Back Channel.

The 1.1km long Castor Back Channel, sometimes referred to as Ailsworth Backwater, bypasses Water Newton Mill and lock. Prior to the implementation of the enhancement scheme the back channel comprised sections of 1.5 to 2m deep channel with some shallower sections. Two low lying areas within the banks remained dry except during spate conditions. Dense in-channel aquatic and emergent vegetation created variations in flow during the summer months, but when this vegetation died back in the winter the flow was more uniform. Occasional large collapsed willows provided some in-stream fish refuges. The southern bank had sections of heavy poaching and the only section that had been protected in the past, an area of wet woodland, was no longer cattle-proof. Cattle poaching (and dog access on the left bank downstream of the bridge) had led to significant bank erosion and there were also sections of steep, undercut bank as a result of water erosion during high flows. As a result of the bank erosion and the resulting siltation, areas of clean gravels, suitable for fish spawning, were minimal.

Fig 1. Severe erosion by cattle at drinking locations

Fig 2. Wide channel with uniform flows during the winter, few shade trees on south bank, cattle poached margins

Pre-project Surveys

The Wildlife Trust undertook an invertebrate survey of Castor Back channel in 2010. A total of 94 identifiable species were recorded, of which eight were defined as Local, two as Regionally Notable and one as Nationally Scarce – the riffle beetle *Oulimnius major*.

The Community Conservation Index (CCI) values for the back channel sample sites ranged from low to fairly high conservation value, with the watercourse representing a relatively natural, clean and unmodified habitat. The back channel achieved a fairly high CCI score throughout its length due to the overall community richness rather than the presence of uncommon species. The Biological Monitoring Working Party scores (BMWP) of >150, attained across the back channel, indicated “very high” water quality.

The survey report concluded with the following recommendations**:**

- *Look at de-silting the side ditch and clearing vegetation near its confluence with the back channel.*
- *Repair the fence to exclude cattle from the willow plantation.*
- *Consider options for new fencing to exclude cattle from some areas (for example the peninsula at the downstream end).*
- *Put in a gravel shoal to make one of the shallower sections even shallower.*

Following the identification of Castor Back Channel as a potential restoration site, several walkovers were undertaken throughout 2011 to observe it in different flow condition in order to shape the enhancement scheme. The key issues identified were: the severe bank erosion by cattle, people and dogs which was causing sedimentation issues; the uniformity of winter flows when the emergent vegetation had died back; and lack of fish refuges during higher flows.

Baseline Surveys

The Environment Agency undertook fish population and aquatic invertebrate surveys prior to the implementation of the scheme to provide baseline data for future monitoring. The fish survey resulted in a low catch of dace, roach, chub and pike. The aquatic invertebrate survey involved sampling in January as a pre-restoration control, and three further samples in March, May and July. For further information see the **Monitoring** section later in the case study.

Project Objectives

The findings of the initial walkover and other survey work were used to develop the objectives of the scheme, which were to:

- Reduce the impact of sediment inputs, in particular as a result of erosion caused by livestock and public access.
- Create a greater diversity of in-stream habitats through the manipulation of flows throughout the year.
- Consolidate woody debris to reduce flood risk whilst retaining the beneficial effects of natural flow deflection.
- Improve fish spawning habitat by introducing gravels. Target species include barbel, chub, dace and brown trout (and possibly brook lamprey).
- Provide holding and refuge areas for fish during high flows.
- Plant new trees to provide shade over the water to improve cover for fish and reduce water temperature.
- Improve access for anglers.

A scheme based on these objectives was prepared by the Environment Agency and R. S. Brayshaw Ecological Consultancy in consultation with the Nene Park Trust.

Consultation and Consents

The Environment Agency was of the opinion that it could undertake the proposed improvement as part of its statutory scope of works. The Planning Department at Peterborough City Council was consulted about the need for planning consent and it confirmed that this was not required. Natural England was consulted regarding the potential impact on Castor Flood Meadows SSSI and raised no issues.

Following consultation with the local planning authority, the Environment Agency National Environmental Assessment Service (NEAS) was asked to determine if the project required a formal Environmental Impact Assessment (EIA). NEAS assessed the proposals and classified the scheme as "low risk" consequently an EIA was not required. However, due to the proximity of the scheme to two Scheduled Ancient Monuments (a Roman villa site and a prehistoric bowl barrow), it was recommended that an Archaeological Assessment was undertaken.

Initially Peterborough City Council was consulted to determine the presence of undesignated archaeological features and then an archaeological site inspection was undertaken by the NEAS Regional Archaeologist. The inspection concluded that *"the proposal would have no serious effect on the historic environment beyond what is occurring through natural processes. If significant archaeology survives outside the scheduled areas it is likely that the result of the works will be to the long term benefit of such assets as the proposal reduces the erosive effects of cattle adjacent to the river."* The report recommended that (1) temporary fencing should be placed to identify the extent of the Scheduled bowl barrow area and avoid the risk of disturbance of the earthworks; and (2) excavation in the areas where limestone slates were found should be inspected by an archaeologist. (Note. Subsequent archaeological inspection during construction did not reveal any additional features).

Finally an internal Environment Agency application for Flood Defence Consent was made and approval was issued on 30 November 2011 (Internal Consent no. ANK/2011/00252).

The Enhancement Scheme

The main elements of the project were implemented in March 2012. The drawing in Annex 1 shows the locations of all the elements of the completed scheme. The techniques used are described below. It should be noted that the works started during a period of particularly low flows and concluded following a period of heavy spring rainfall which caused the river to overtop its banks.

In-channel Modification

Flow Deflectors

During the summer months extensive beds of in-stream vegetation (in particular grey club-rush *Schoenoplectus tabernaemontani)* created useful flow variation. However, in the winter, when the vegetation died back, flows were more uniform. Consequently, to create year round variations in flow, ash faggot and hurdle deflectors were installed. As well as increasing the flow velocity, the deflectors will encourage siltation at the margins of the channel and this will allow the extent of the marginal vegetation to increase, whilst maintaining an open, energetic central channel. All, apart from one, of the deflectors point upstream to reduce the potential for bank erosion. The downstream pointing deflector, located to protect and encourage the extension on an existing *Schoenoplectus* bed, deflects the flow towards a section of the bank that has been protected by spiling revetment. Note - initially a much larger number of flow deflectors were planned, however the number was reduced because the channel was too deep for them to be installed.

Figs 3 & 4. Faggot deflectors used to pinch the channel and to consolidate existing and encourage future siltation

Fig 5. Gravel placed to augment an existing run

Fig 6. Chub on the new gravel bed (May 2012)

Gravel Introduction

The bed gradient varies along the back channel, with steeper, faster-moving sections with relatively lightly silted gravels, interspersed with deeper, slower, siltier sections. A long section of gravel bed was located between the

sharp bends in the middle of the reach. The run was augmented by the addition of 40 tonnes of 20mm diameter gravel to improve opportunities for fish spawning and habitat for invertebrates. In addition, an ash faggot flow deflector was installed to concentrate the year round flow over/through the gravel to ensure that siltation was minimized. The gravels, which remained in place following the high spring flows, immediately attracted large chub and barbel.

Refuge pools

Two pools were excavated on the existing lower lying areas within the channel. These pools are designed to act as fish refuges during medium to high flows. The downstream pool is within an area of wet woodland and a line of new pollard willows on the southern side will provide additional shade.

Fig 7. Lower refuge pool under construction

Fig 8. Upper refuge pool during high flows in April 2012

Erosion Control

Bank reprofiling

Fig 9. Ash spiling used to protect bank toe

Fig 10. Eroded bank reprofiled behind spiling

The majority of the right bank and the upstream and downstream ends of the left bank suffered from very severe erosion, mainly from cattle, but also from people and dogs. The majority of the severely eroded banks were reprofiled behind ash spiling, backed with a geo-textile membrane, with faggots being used to consolidate the bank

toe where the bed was extremely hard. The bare earth on the reprofiled was seeded with a simple meadow grass seed mix augmented with the addition of some wild flower seed derived from the species list from Castor Flood Meadows SSSI just downstream of the back channel.

Cattle Drinkers

The river has traditionally been used to provide drinking water for livestock, but there was no specific provision of drinkers to limit the widespread impact of severe poaching. To reduce the impact cattle drinkers were installed at the (severely eroded) favoured drinking places in each of the fields. Excess earth, excavated during the construction of the drinkers, was used as supplementary fill behind the bank toe protection (see above). The cattle drinkers on the right bank comprised post and rail enclosures with a base of rammed limestone. However, because of the excessively hard bed adjacent to the left bank drinker the specification was modified to use angle-iron uprights instead of wooden posts on the front fencing to prevent stock from entering the river.

Figs 11. New "standard" cattle drinker

Fig 12. Cattle drinker front fencing showing angle iron uprights used to penetrate the hard river bed.

"Dog-dip"

In addition to the cattle-eroded areas, there was a section of eroded bank caused by recreational access. Rather than prevent access to the water here the bank was reprofiled and the bank and river bed were dressed with gravel to allow the use by people and dogs to continue but to limit the impact of soil erosion.

Fig 13. Before: the eroded recreational access

Fig 14. After: the repaired "dog- dip"

Fencing

At the start of the scheme all the redundant fencing around the wet woodland and the damp berm downstream of the bridge was removed. On completion of the in-stream works new fencing (wooden posts and 2 lines of barbed wire) was erected to protect the repaired banks; broad areas of damp riparian grassland that occur within the channel; the wet woodland area; the refuge pools; and a small group of trees at the confluence of the back channel and the main river channel. Simple pipe-stiles were provided along the fence-lines, which were set back from the bank crest, to allow access for anglers. Metal field gates were erected to allow access for stock to the in-channel grassland to enable light, controlled grazing to take place when conditions are suitable thus preventing the development of rank grassland and scrub.

Figs 15 & 16. New Stock fencing protecting in-channel grassland and wet woodland

Tree Management

A limited amount of tree work was undertaken. Several young willow trees were pollarded on the edge of the wet woodland to allow access for machinery to excavate the refuge pool. These will regenerate rapidly to provide shade, which will improve the quality of the refuge. Two live willow limbs were also dropped into the water and secured to narrow the channel and create a bankside fish refuge.

Fig 17. New pollard willows

Fig 18. Live willow limbs secured in channel

Future Management

In addition to periodic weed cutting by the Environment Agency, future management will be undertaken by the Nene Park Trust, their agricultural tenant and the Peterborough and District Angling Club. Effective management of the riverside grassland to prevent the development of extensive areas of coarse vegetation and scrub is a key outcome. Gates have been installed in the riverside fencing to allow controlled grazing. The timing and duration of grazing will be at the discretion of the tenant farmer, but the objective is to achieve a short, lightly poached sward by late autumn.

Future Projects

As the works were completed in the spring it was too late to undertake the proposed alder planting on the southern bank to provide additional shade. Tree cribs were constructed and Nene Park Trust will complete the planting in the winter of 2012/13. In addition a fish and eel pass is required at Water Newton Weir.

Fig 19. Water Newton Weir is currently a barrier to fish and eel passage

Fig 20. Cribs to protect alder planting in scheduled for winter 2012/13

Monitoring

Initial evaluation of the project was undertaken by Emma Forbes in a dissertation, "*how successful is an Environment Agency's river restoration project and can monitoring be improved with the use of biotic indices?",* submitted as part of her MSc degree in Global Environmental Change at Kings College London. It concluded that the scheme "*had considerable impacts on the macroinvertebrate community. The initial disturbance from the restoration led to substantial shifts in the community composition as well as declines in the macroinvertebrate abundance. However, the recovery of the invertebrates was rapid, but due to the short length of the study, only two sites showed signs of improvement with the abundance, taxon diversity and conservation value exceeding that of the pre-restoration control. Once the back channel stabilises following the 'ecological disturbance' and new species have had sufficient time to migrate into the reach, the morphological and biological effect of the restoration will become more apparent. Therefore, longer-term monitoring of the macroinvertebrate communities, particularly year-on-year comparisons, would provide a more accurate representation of the effects of this river restoration project*."

Longer term monitoring will be achieved by repeating the aquatic invertebrate and fish surveys which were undertaken prior to the implementation of the scheme. Visual inspections will also be undertaken, together with a photographic record, to monitor the integrity and performance of the in-stream enhancements and record any changes they are making to river morphology. PDDA will monitor the condition of the deflectors and provide catch returns.

Suppliers of Services and Materials

Supply of spiling and faggots and installation of revetment and deflectors
Woodland and Water Management Ltd: dom@woodland-water.co.uk or Tel. 01327 349073

Cattle drinkers, fencing, gravel introduction, refuge pool excavation, bank repairs and pollarding
P&R Plant Hire, Fleet, Spalding, Lincs. PE12 8NG. Tel 01406 422 669. www.pandrplanthire.co.uk

Further Information

For further information about the scheme, including arrangements for visiting, contact:

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Fig 21. Scarce Chaser

Fig 22. Otter tracks close to Water Newton Weir

Fig 23. Flowering rush

Fig 24. Mark Smith, PDAA bailiff, with a 14lb 3oz barbel, one of many large barbel to have moved in to Castor Back Channel since the enhancement work was completed.

The Water Framework Directive

The Water Framework Directive (WFD) is a major area of work for the Environment Agency. The WFD aims to get all water bodies - lakes and groundwater aquifers as well as rivers - into 'good ecological status' - or better - by 2027, with a series of 'landmarks' (2015 and 2021) to check progress.

The Water Framework Directive became UK law in December 2003. It provides an opportunity for the Environment Agency to plan and deliver a better water environment with the focus on ecology.

The Water Framework Directive will help to protect and enhance the quality of: surface freshwater (including lakes, streams and rivers); groundwater; groundwater-dependent ecosystems; estuaries and coastal waters out to one mile from low water.

The Environment Agency is the lead authority in England and Wales to carry out:

- Improvements on inland and coastal waters through better land management and protect them from diffuse pollution in urban and rural areas
- Drive wiser, sustainable use of water as a natural resource
- Create better habitats for wildlife in and around water
- Create a better quality of life for everyone

The Environment Agency is the leading organisation for protecting and improving the environment in England and Wales. We are responsible for making sure that air, land and water are looked after by today's society, so that tomorrow's generations inherit a cleaner, healthier world.

Glossary

Berm: A low, often wet, ledge or terrace at the edge of the stream that constricts the flow and allows a vegetated wetland margin to develop.

Brash: fine woody material including thin branches and twigs.

Coir: a natural fibre extracted from the husk of coconuts. It can be formed into mattresses and rolls for use in river bank erosion control and vegetation establishment.

Coppicing: cutting of a tree just above ground level resulting in the regrowth of a number of shoots. The shots are allowed grow to provide long straight poles which are re-coppiced on rotation.

Faggot: a bundle of brushwood (or brash) tied together into a cylindrical shape. Used as bank revetment; to form flow deflectors; and to promote the deposition of sediment in marginal areas.

Fish pass: Structure to enable fish to gain access past a weir, sluice or other structure that would otherwise be impassable.

Flood Defence Consent: consent issued by the Environment Agency to carry out works in, over, under or near a watercourse or flood defences. An application for Flood Defence Consent is needed to ensure that any works do not endanger life or property by increasing the risk of flooding or cause harm to the water environment.

Floodplain: Area of land bordering a river that is prone to flooding.

Flow deflector (groyne): a structure projecting in to the river which is designed to constrict water flow and promote scouring and deposition of sediment.

Glide: a section of stream characterised by moderately shallow water with an even flow that lacks pronounced turbulence. Although most frequently located immediately downstream of pools, glides are occasionally found in long, low gradient streams with stable banks and no major flow obstructions. The typical substrate is gravel and cobbles.

Large Woody Debris (LWD): pieces of naturally derived timber generally held to have dimensions greater than 10cm in diameter and 1m in length.

Left/right bank: the left/right hand bank of a watercourse as observed whilst facing downstream.

Meander: a meander is a bend in a watercourse formed as water erodes the outer bank and deposits the eroded sediments on the inside of the bank.

Poaching: river bank damage caused by the hooves of livestock resulting in the loss of vegetation and soil erosion.

Pollarding: similar to coppicing, except that the tree is cut at approximately head height to prevent damage by grazing animals. Trees managed in this way are known as **pollards**.

Pool: a deep section of stream bed with very little surface flow, typically located at the outside of a bend.

Revetment: works to protect the bed or banks of a channel against erosion.

Riffle: a length of stream with a steep gravel, pebble and/or cobble dominated bed, a fast flow and a broken water surface, where the water flows swiftly over the completely or partially submerged substrate.

Riparian: along the banks of a watercourse.

Run: differs from a riffle in that, although the water surface is broken, the water depth is typically greater and the slope of the bed is less.

Scour: Erosion of the bed or banks of a watercourse by the action of moving water.

Sediment: material ranging from clay to gravel (or even larger) that is transported in flowing water and that settles as the flow slows down.

Shoal: sedimentation within or extending into a stream or other waterbody, typically composed of sand, silt and/or gravels.

Spate (freshet): a period of fast river flow and raised water levels caused by heavy rain (or melting snow).

Spiling: the use of thin branches to create a woven ‘fence’ that protects the bank from erosion.

Toe (of the riverbank): where the river bed meets the bank.

ANNEX 1: The Completed Enhancement Scheme