River Glyme – Woodstock Meadows

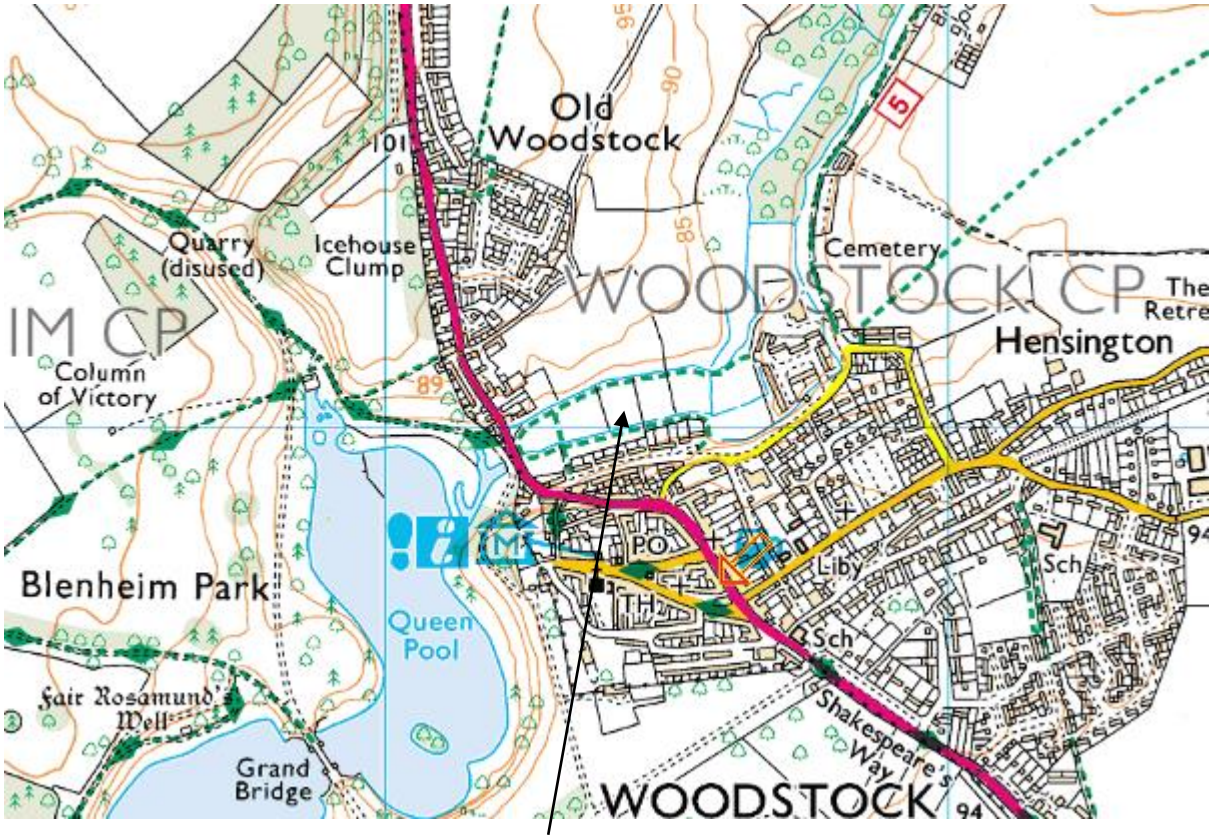
An Advisory Visit by the Wild Trout Trust December 2014

1. Introduction

This report is the output of a site meeting and walk-over survey of a section of the River Glyme and carrier adjacent to Woodstock Meadows in Oxfordshire.

The request for the visit came from Emma Jay representing Woodstock Council who own and manage the Woodstock Meadows site.

Comments in this report are based on observations on the day of the site visit and discussions with Ms. Jay.



Map 1: Woodstock Meadows

Throughout the report, normal convention is followed with respect to bank identification, i.e. banks are designated Left Bank (LB) or Right Bank (RB) whilst looking downstream.

The contents of this report cover the section of main river running from NGR SP 446 171 down to the inlet at Queens Pool, Blenheim Lake SP441169. The report also covers the carrier which skirts the southern boundary of the Meadows and enters the Queens Pool by a separate culvert.

The Glyme (Waterbody ID no. GB106039029940) is currently listed on the Environment Agency's website as being of poor ecological status under the Water Framework Directive but is predicted by the Environment Agency to meet 'moderate status' by this year.

2. Catchment and fishery overview

The River Glyme rises to the south east of Chipping Norton and flows in a generally southeasterly direction to join the River Evenlode at Bladon. Major tributaries include the Heythrop Stream and River Dorn. The catchment is predominantly Oolite limestone, with alluvium in the valley floor. The stream gradient is relatively steep for a Cotswold river, although there are long sections with a low gradient, particularly upstream of the many mills and on-line lakes within the catchment.

Groundwater and surface water abstractions within the Glyme catchment have a significant effect on flows. According to the Cotswold Catchment Abstraction Management Strategy (CAMS), the Glyme catchment is categorised as having no water available for future abstraction.

(http://cdn.environment-agency.gov.uk/geth1007bnmf-e-e.pdf)

Despite the regular low flows during the summer/autumn, there are significant overland flows during periods of heavy rain.

The water clarity in the Glyme is relatively turbid, even during periods of no rainfall compared to other groundwater fed systems. This may be attributed in part to the geology of the area, the mobilisation of diatoms and associated silt from on-line lakes and land-use may contribute locally.

Upstream of Cleveley (source to Enstone) is a groundwater safeguard zone and falls within the Nitrate Vulnerable Zone for surface waters. The river has experienced intermittent water quality problems, particularly with respect to blooms of diatoms floating to the surface, and excessive build-up of filamentous algae and silt on the river bed.

The geology of the surrounding hills consists of interbedded limestone and argillaceous rock (consisting of or containing clay), with the river valley comprising mudstone and ferruginous (iron-rich) limestone or 'ironstone'.

The limestone gives rise to thin, well-drained and easily cultivated, calcareous soils with a distinctive orange-brown colour where the ironstones prevail. These soils have favoured intensive arable farming across the gentle, upper slopes. Intensive arable agriculture on the hills in the headwater reaches may be contributing to the heavy sediment loads observed in the river.

Historically, the River Glyme supported a good quality brown trout fishery. However, a combination of in-channel dredging for land drainage purposes, land use changes and the creation of a number of floodplain lakes have detrimentally affected the river. As a consequence, the trout fishery has declined significantly. A number of fishery surveys undertaken by Thames Water, the National Rivers Authority and the Environment Agency, have highlighted the paucity of suitable spawning and juvenile habitat as a significant blockage on recruitment of brown trout. Fish migration is also impacted by the presence of a number of

obstructions, including lake dams and mills. Other factors including siltation, signal crayfish and predation could also be potentially affecting fish stocks.

The large ornamental lakes that intercept the Glyme at Blenheim, at the very downstream end of the reach inspected, have a huge impact on the quality of the lower Glyme and also impact on the reach at Woodstock Meadows.

3. Habitat assessment

3.1 Main Channel

The section of main channel through Woodstock Meadows is perched and raised above the valley floor. The river channel may have been diverted to create a head of water for agricultural irrigation for the meadows, or perhaps to provide a head of water for milling power near the top of the Queen Pool. A low weir (photo 1) still exists at the head of the Queen Pool, which may replaced an older structure. Although this weir will restrict upstream fish migration, it has not significantly drowned out the upstream reach, where the flow velocities are vigorous, generated by the significant slope in the river bed.

When river channels are artificially raised and impounded such as this, it is common for the flows to be sluggish and the river bed to be heavily infiltrated with fine sediments. In this particular case, the river still maintains a brisk flow generated by the significant gradient, promoting lively riffle habitat, particularly in the lower section just upstream of the road bridge (cover photo).

The bed of the channel here is dominated by coarse gravels, providing some spawning opportunities for brown trout *Salmo trutta*, as well as species such as grayling *Thymallus thymallus*, chub *Leuciscus cephalus* and dace *Leucisus leuciscus*. The firm river bed and vigorous flow conditions are ideal for submerged water crowfoot *Ranunculus* spp., an iconic aquatic plant which is synonymous with good quality habitat.

This section of main river channel has recently been the subject of extensive bank repairs (photo 2) where the river was in danger of breaching through the left bank. It is thought that the presence of burrowing signal crayfish *Pacifastacus leniusculus* is weakening the bank along this raised section of channel by burrowing into the bank and creating a pathway for leaks. Further repairs may be required to sections further upstream where the width of the raised bund/path is much narrower than in the lower sections. If leaks are detected, urgent action will be required to avoid a serious bank failure. Photo 3 depicts the perched nature of the stream.

Habitat quality within this main channel reach was considered to be very good given the constraints of a perched and impounded channel. In-channel cover was available via beds of submerged crowfoot and starwort *Callitriche* spp. with the upper section supporting soft, biologically-rich margins supporting a range of marginal emergent vegetation, particularly water sweet-grass, *Glyceria maxima.*

Photo 1 The weir at the inlet to Queen’s Pool (Blenheim Lake)

Photo 2. Hazel faggot revetment supports the recently repaired LB.

Photo 3 . View looking upstream adjacent to the repaired bank.

Photo 4. Good habitat provided by some low tree shading and soft, reed lined margins.

Some high level tree shading was provided by mature crack willows, *Salix fragilis*. As the name suggests, these trees are very brittle when mature and

some large willows along this section (photo 4) would benefit from pollarding to preserve the trees and to promote low level shading, which is considered to be much more ecologically valuable for river side trees. Any low branches that kiss the water surface, or hang low in marginal zones, provide ideal cover for a range of fish species and offer connectivity between aquatic and terrestrial ecosystems for a number of invertebrate species. Some local overhanging thorn bushes provide this type of habitat and should be retained where possible.

The upper section is dominated by soft reed beds encroaching from both banks. These reed beds not only provide superb habitat, both below and above the water surface, but also provide the best forms of bank defence. The soft reeded margins will not necessarily stop crayfish from bank burrowing, however the reed beds will tie in soft bank-side soils and absorb flow energy, providing the very best protection possible for a natural river bank. Reed sweet-grass is an ideal plant in these slightly deeper, slow flowing sections and it may well be worth considering planting more emergent reeds in front of vulnerable sections of bank at risk from erosion. Common sedge species such as *Carex* spp. have incredibly resilient root systems and are able to grow in shallow, fast flowing margins, making them an ideal plant for some of the margins in the lower reaches of the section. It might be necessary to create a shallow toe to the bank, using submerged log, or faggot revetment and backfilled with a gravel/soil mix to provide a protective medium for initial planting.

Some clearing of marginal reed has taken place adjacent to the LB near the very top of the reach. This is a particularly vulnerable section and it is recommended that a soft toe and planting is re-established along this section (photo 5).

Photo 5. Section of LB (right of photo) on the outside of the bend is vulnerable to erosion. Efforts to keep an established soft margin of energy absorbing plants is essential.

3.2 Carrier channel

An off-take structure (photo 6) in the north east corner of the site takes flow away from the main channel and diverts it through a carrier, which picks up additional flow via a small tributary that joins the carrier in the south east corner of the site. The carrier itself forms a dog-leg and skirts the southern boundary of the meadows.

The structure itself consists of a box-culverted hatch and a perched culvert tube set in a huge concrete block. The structure is poorly designed, both for river ecology and flood defence purposes and is in very poor condition. Any fish flushed down into the carrier will find migration back up into the main channel extremely difficult. It was not possible to view any water throttling control on the upstream side of the box but there might be opportunities to block the pipe culvert and ease out capacity in the main culvert to consolidate flow which might help to improve opportunities for fish migration. A complete redesign and rebuild of this structure would be expensive but is highly recommended to provide increased flood capacity and improved connectivity.

Photo 6. Off-take structure feeding water into the carrier.

Just downstream of the structure on the main river channel there is a submerged stone weir (photo 7) which presumably was installed to hold up water levels and divert more flow via the carrier. This bed impoundment is having an adverse impact on habitat quality in the reach of main river running upstream of the Woodstock Meadows and a modification to secure more flow by increasing capacity at the structure would be a much better method for securing flow into the carrier. Running the main channel at a slightly lower level by

removing the stone weir would also take the pressure off the vulnerable banks which have been defended with sheet steel piling in this location.

Photo 8. Line of in-channel stones forming a submerged weir. This was installed to either hold up water levels upstream, or secure more flow for the carrier. In-channel habitat upstream would benefit, as would vulnerable banks located immediately downstream of the steel piling, from its removal.

The carrier itself, has a very uniform morphology. The drop in bed level at the structure coupled with the right angled dog-leg route of the channel has in effect flattened out any gradient that might otherwise help to promote natural in-channel features such as pool and riffle. As a result the whole reach is made up of shallow glide habitat. Interestingly, the north–south section appears to have had very little maintenance work and is quite heavily over-grown and shaded, whereas the east-west section (photo 9) is relatively open, with only the odd clump of low overhanging shade. An ideal scenario would be a combination of both regimes where a dappled light and shade was maintained via sensitive bank and tree maintenance.

On long sections of straight, uniform glide, improved habitat quality could be achieved via the introduction of large sections of woody debris, firmly secured to the bank and bed. By pinching the channel width with woody debris, local bed scour could be encouraged to provide some much needed variety in the shape of the river bed.

Low scrubby material, such as trailing brambles provide valuable cover in bankside locations and should be retained whenever possible.

Photo 9. A straight and featureless section of carrier. Note the trailing bramble lying in the margins which provides some cover for resident fish populations.

Photo 10. Scruffy margins providing good cover and bank protection on a section further downstream.

Unlike the main channel, the carrier drops down into the Queen Pool via a screened culvert which flows under the road and joins the top end of the lake. There is no weir, or impoundment on the carrier and as a result, huge numbers of juvenile coarse fish fry, thought to be either roach *Rutilus rutilus* or bream *Abramis brama* have migrated up out of the lake to take residence in incredibly large, dense shoals within the carrier, particularly in sections where there is any overhanging tree cover (photo 11).

Photo 11. The black stream bed is in fact thousands of small coarse fish that have migrated up out of the lake, probably in response to bird predation pressures within the lake itself.

4. Conclusions

Riverine habitats within the Woodstock Meadows reach are diverse and valuable and complement the high value site which is primarily managed for nature conservation purposes. Habitat quality within the main river channel is particularly good for flow loving/gravel spawning fish species. The bank repair works undertaken on the lower section of channel have been undertaken sympathetically and provide a soft margin that could be further improved with some marginal planting.

Where the path is narrow between the main channel and the meadows, a close eye must be kept to ensure that no significant bank breach develops. The presence of burrowing crayfish will be of concern and a low thick fringe of marginally planted sedge may help to deter them, as would a shallow batter of imported gravels. Vertical clay or earth banks are sites where crayfish can inflict the most damage.

If there are certain locations where there is significant risk of bank breach, then it is possible to bury vertical piles longitudinally, possibly in the centre of the

path, which would restrict burrowing right through the earth bund separating the river from the low lying meadows. This would be expensive work and possibly a last resort but could be a solution to crayfish bank damage. Piling should not be contemplated as a measure to use on the interface between the bank and the river channel.

This section of channel would benefit from some sensitive tree work. Pollarding the leggy willows and trimming back some of the extensive thorn but still retaining some cover-hang would allow more light into the channel and promote improved submerged weed growth and channel productivity.

At the top end of the reach, the marginal emergent reeds should be left to protect the LB. If some work is needed to open up the channel during a low flow year, then reed should be peeled back from the RB and not the left. If clumps of emergent reeds become established in central channel locations then grub them out in favour of managing a pinched channel with a dense fringe protecting both margins.

There is scope for significant in-channel enhancement in the carrier. Getting the balance right between providing enough direct sunlight and leaving sufficient overhead cover is not always straight forward. Aim for a 50:50 dappled light to shade regime with tree work.

When undertaking tree work, consider using both large woody debris (LWD) and coarse woody debris (brushwood) to create enhanced in-channel habitat. The use of woody debris to create improved in-channel habitat is fully described in the WTT Chalkstream Habitat manual, which can be downloaded from our website at www.wildtrout.org or obtained as a CD from our office address, also found on our website.

The long, straight sections of carrier would benefit from pegging in LWD flow deflectors to promote bed scour and bundles of brushwood pegged in parallel to the banks would provide habitat and food for invertebrates and cover for small fish.

It is understood that the winter migration of vast numbers of juvenile coarse fish out of the lake and up and into the carrier is a concern for the local Environment Agency, who have undertaken fish rescue work at this site to try and minimise fish mortalities. One possible option worth discussing with the EA and Blenheim Estate is to create habitat in the margins of the Queen Pool area that might act as a refuge and deter fish from making the migration up into the stream searching for cover from fish-eating birds.

Laying in a matrix of brushwood into the shallow lake margins might at least intercept some of the fish destined for the stream.

Conversely, active migration for fish out of the Queen Pool and into the main river is made virtually impossible, due to the flat crested weir on the entrance to the lake. It is not known if fish in the lower Glyme are able to migrate from below and up and into Blenheim Lake. If they can, then it would seem sensible to create improved opportunities for migrating up and out of the lake via the main channel. Simply cutting a low level notch, or removing sections of block or

brick to create a low level gap of at least 300mm wide would significantly help with connectivity issues.

The large concrete structure which regulates flow into the carrier is a carbuncle. Replacing this structure with a controllable, fish friendly structure to determine flow splits should be planned for. Work of this nature will require a capital project, significant funding and a detailed consultation with the Environment Agency.

It is understood that improvements to sections of the Glyme just upstream of Woodstock Meadows are currently being planned by the Cotswold Rivers Trust and the host Catchment Partners. It would be advisable to engage in this process and explore options for partnership working which will be of benefit to all parties. Removing the bed impoundment near the offtake structure and modifying/replacing the offtake structure is a project that could benefit the whole river.

5. Recommendations

- Engage with the Cotswold Rivers Trust and WFD Catchment hosts to explore options for partnership projects.

- Monitor the condition of the LB of the main river on a regular basis. Finding the resources to protect this bank now, rather once it has failed could save money.

- In-channel and riparian work parties must be undertaken in a sensitive manner. Dense fringes of marginal emergent reeds offer fantastic bank protection and valuable habitat. Allow the channel to encroach slightly but keep central channel locations reed-free to promote vigorous central channel flow velocities which can keep the river bed gravels relatively silt free.

- Consider pegging in woody debris into some of the straight, flat sections of carrier. Details of how this can be achieved can be found in the WTT habitat management manuals which can be accessed via our web site www.wildtrout.org

- Discuss options with the Blenheim Estate Management for improving marginal cover in the Queen Pool to ensure that they don't lose all their valuable fish stocks to intense predation pressures.

- Discuss the need for improved fish migration opportunities from the lake into the main river and also from the carrier into the main river. These actions may well form part of actions highlighted in the local River Basin District Management Plans.

- The WTT is happy to help with any potential habitat management workshops/practical demonstrations to help train volunteers in many of the techniques discussed in this report.

Note: All work within 8m of the top of the bank will require a consultation with the EA and may require a formal written Flood Defence Consent prior to any work being carried out.

Acknowledgement

The WTT would like to thank the Environment Agency for supporting the advisory and practical visit programme.

Disclaimer