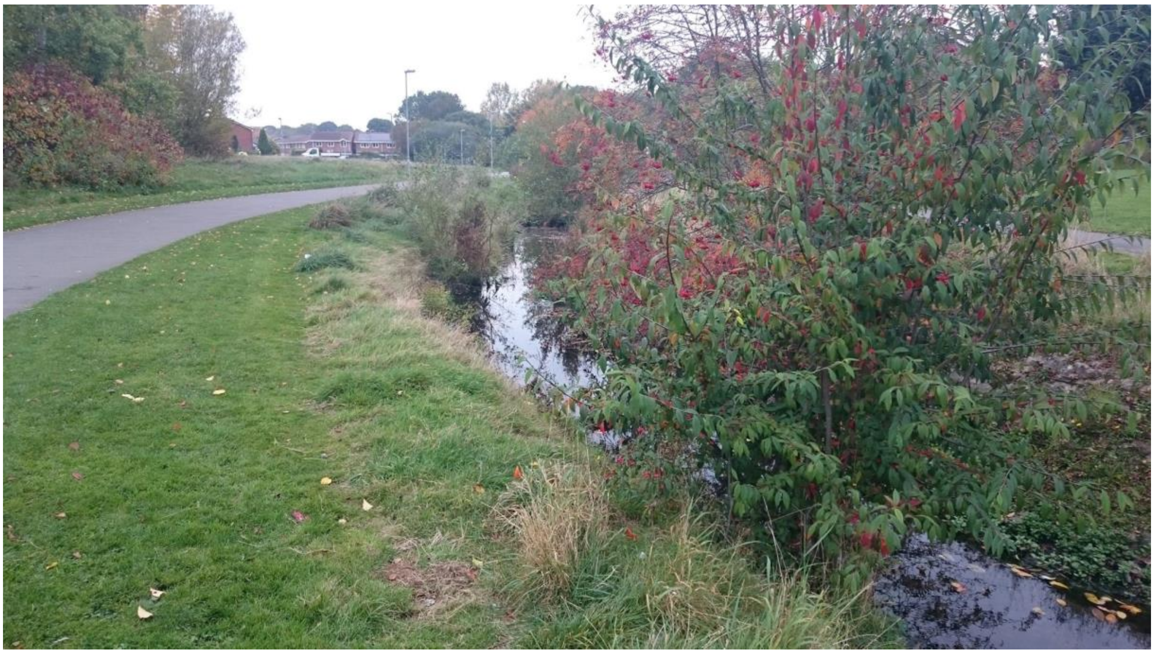
Upper Penk, Wolverhampton:
Advisory Visit & Small Project Proposal



Report and Proposal by the Wild Trout Trust – Following a Site Visit on 27/10/2015

1. Introduction

A site visit and habitat appraisal was carried out at the request of the Staffordshire Trent Valley Catchment Partnership (hereafter STV) to explore the potential for habitat improvement on headwater sections of the River Penk on the outskirts of Wolverhampton. The upper River Penk from source to the Saredon Brook constitutes the Water Framework Directive (WFD) waterbody identified by the reference GB104028046680. However, the visited sections appear to be upstream of the reaches mapped on the Environment Agency records for this waterbody (http://environment.data.gov.uk/catchment-planning/WaterBody/GB104028046680).

This report refers to a reach between an upstream limit at SO 87500 89661 and a downstream limit at SO 85985 00471. Observations at particular grid references are reported sequentially from upstream to downstream irrespective of the order in which they were visited.

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

2. Habitat Assessment notes

The upstream limit of visited locations was at SO 87500 89661. Here, a de-culverting project has reinstated the Penk as a surface watercourse. Encouraging signs of natural geomorphological processes (gravel exposed in the banks due to lateral erosion) were noted in the new, meandering channel that has been created (Figs. 1 and 2).

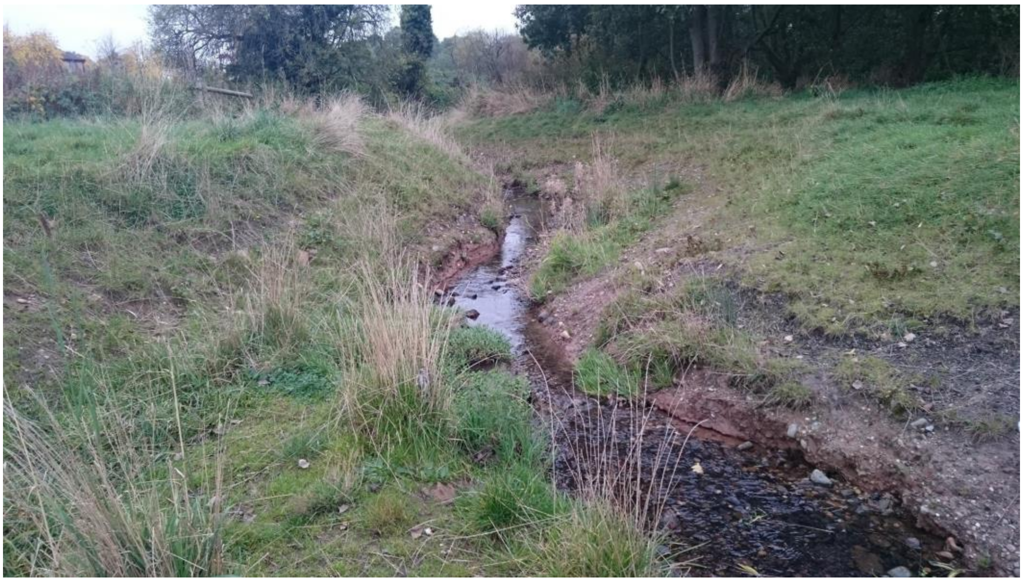


Figure 1: New channel created for a previously-culverted watercourse. A varied substrate with inputs of gravels and finer particulate material arising from natural erosion.

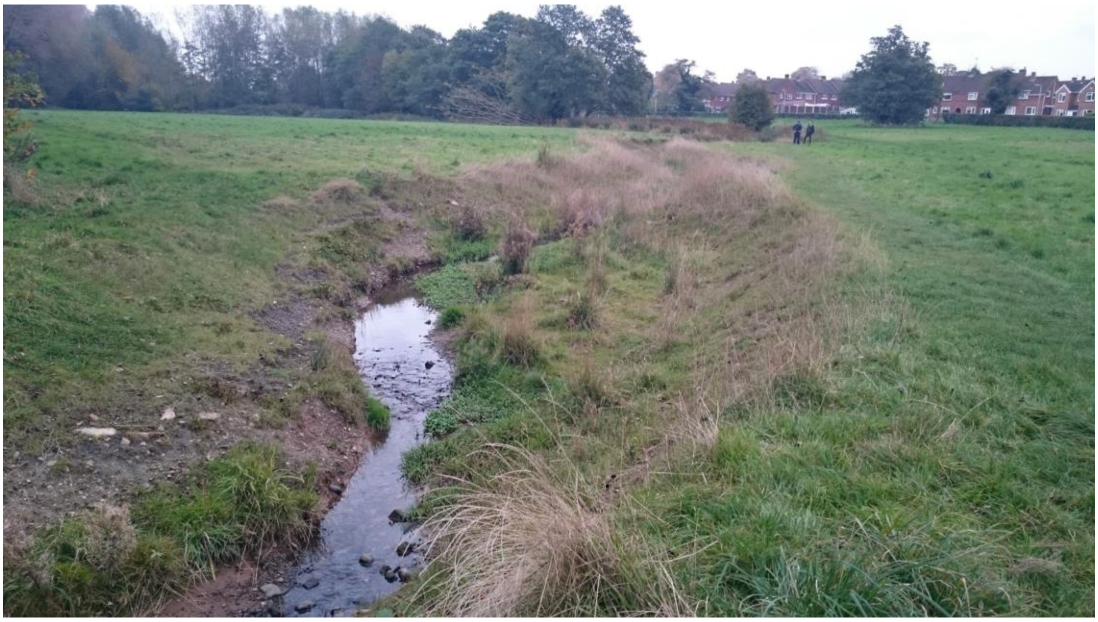


Figure 2: Deculverting project photographed from the same point as Fig. 1 (this view is facing upstream)

The new channel would benefit from a more structurally-diverse riparian vegetation (although apparently un-mown within the "bank-full" channel, the surrounding land management is unclear). It may be appropriate to consider some supportive planting and/or seeding of native river corridor species to increase floral and faunal diversity, using plants of local provenance.

This reach (visited under extreme low flows at the end of a particularly dry summer) is structurally quite diverse – with substrate particles ranging from fine silt, sand, plentiful gravel up to a few larger cobbles. It is a potentially valuable headwater stream – thanks to the deculverting project. However, there are extensive modifications just downstream of this reach that reduce its ecological status.

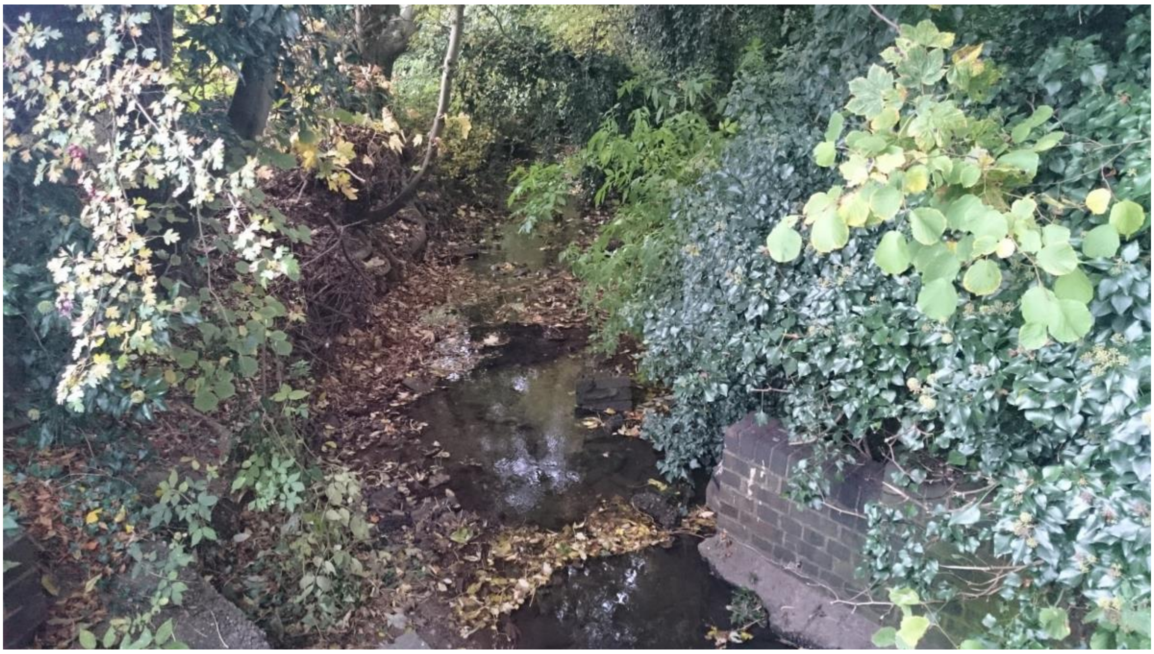


Figure 3: Area of dense shade (cool water refuge) with valuable leaf-litter inputs that support detritivorous invertebrates and attendant food-webs

Figure 3 is taken facing downstream off a bridge at SO87334 99651 and shows a valuable shaded/densely vegetated section. Cool-water refuge areas such as this are extremely valuable to small watercourses as long as other reaches with more varied tree canopy cover are also present.

An example of a lower-impact option for bridge culverting is shown at SO 87135 99727 (Fig. 4). This illustrates the benefits to fish passage and downstream river-bed substrate transport processes when square-section culverts are used in preference to circular pipes. Benefits are maximised when square culverting is sunk far enough into the riverbed to allow a natural riverbed (of the same character as directly up and downstream) to persist within the base of the culvert.

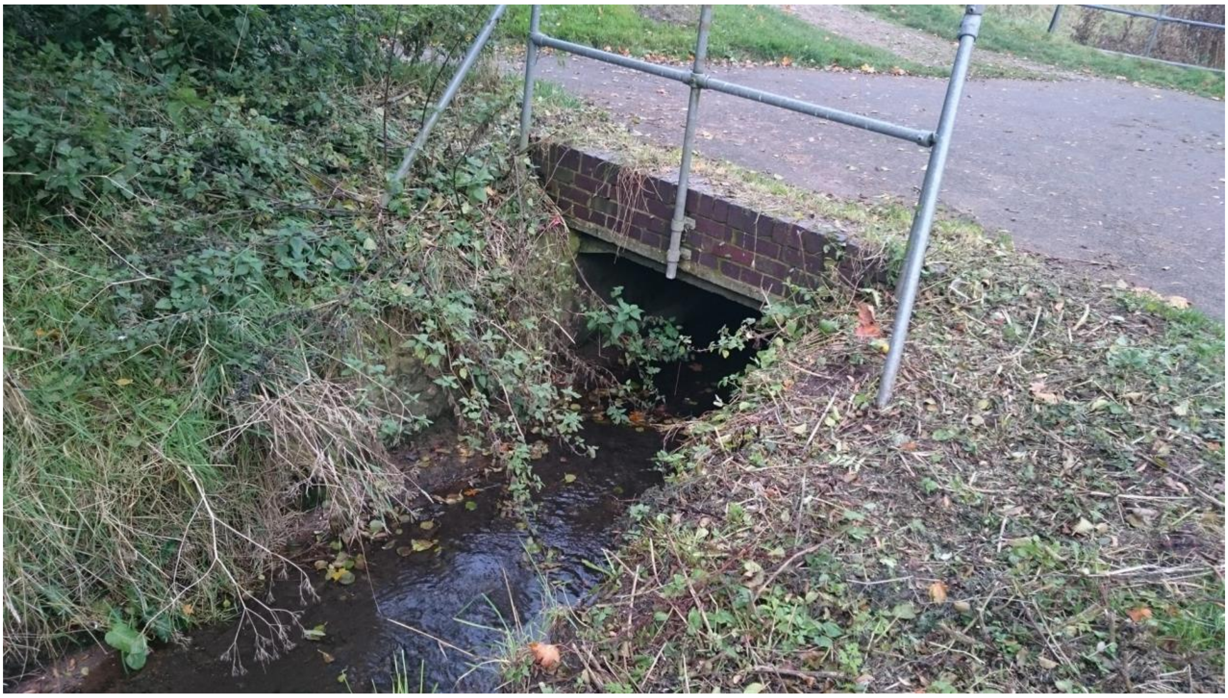


Figure 4: Square-section culvert - a good option to minimise impacts on habitat and biota.

Unfortunately, the straightening and extensive modification of the channel itself degrades the biological quality of this section. Figure 5 shows a heavily engineered section of channel that has an armoured riverbed and uniform, trapezoidal cross-section – essentially devoid of natural geomorphological processes. Compounding this poor channel habitat is the lack of any diversity in the riparian vegetation. The channel modifications and the way that the vegetation is managed as a lawn have severely degraded the ecological status/biological function of this section of stream. The shallow root system and compounding effect of road and pavement drainage will also make the runoff profile extremely "flashy". In other words, there is little or no opportunity for buffering of heavy rainfall via soak-away before it enters the stream. Instead, the flow in the stream channel will increase almost immediately in response to rainfall on the surrounding land – potentially elevating flood risk in the downstream catchment.

Depending on available funding and regional priorities, it may be possible to combine a flood-water storage scheme with greatly improved in-channel habitat and ecological status. As a minimum, there will be benefits in improving the riparian corridor vegetation (which would also increase its attractiveness and could potentially act as a valuable resource for pollinating insects away from intensive agriculture). Potential project work options are suggested in the "Recommendations" section.

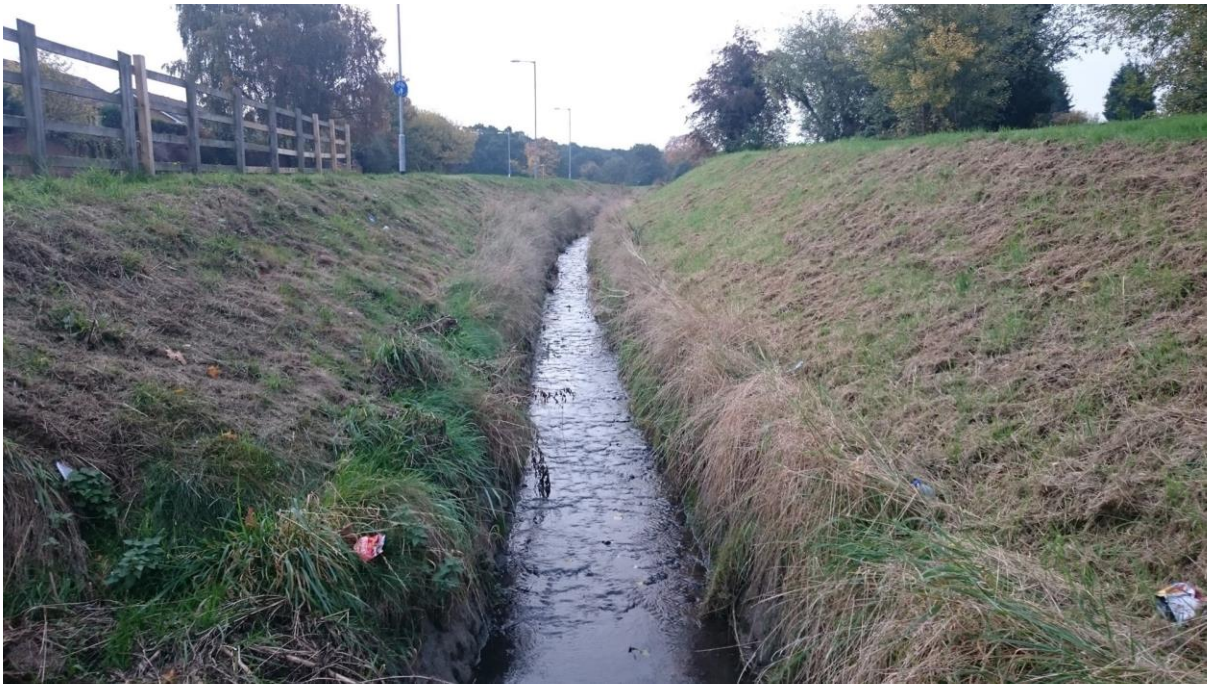


Figure 5: Trapezoidal channel at SO 8691799725 with armoured channel-bed. Very poor habitat in a channel that has little opportunity to buffer heavy rainfall on the surrounding land

A section of the Penk downstream of the location shown in Fig. 5 was also visited. Starting at SO86233 99732, it was apparent that the river runs through several on-stream lakes or ponds (e.g. Fig. 6).

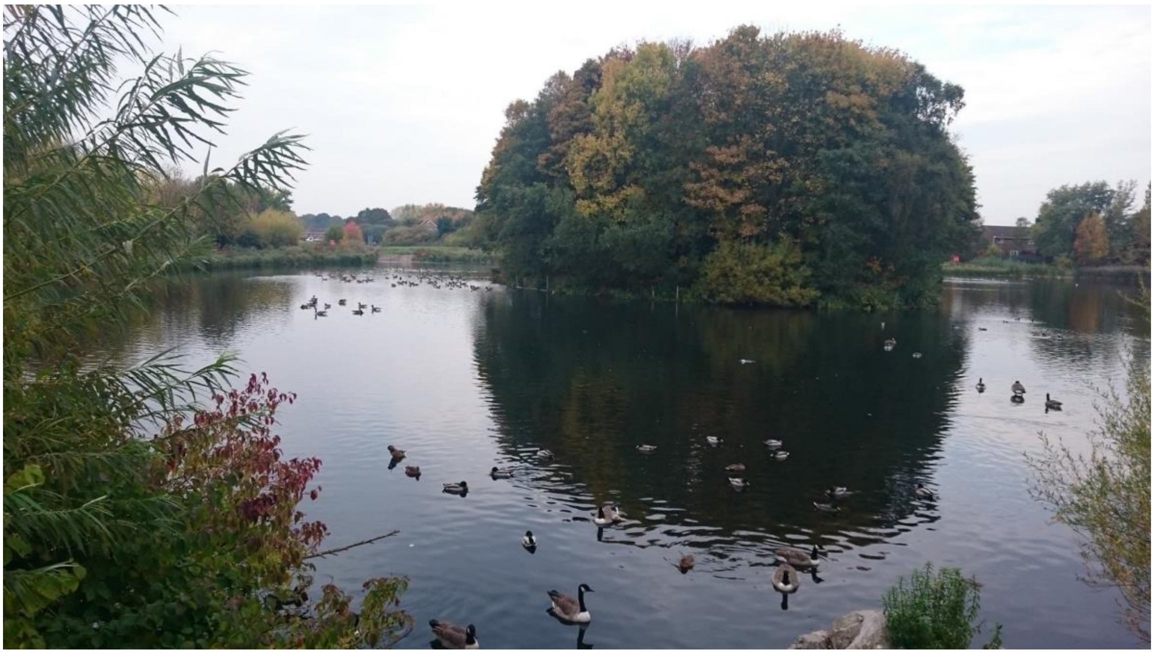


Figure 6: The Penk enters this on-stream lake at this point via a culvert at SO 86233 99732. The lake has had extensive planting for the benefit of wildlife both around the outer margins and also those of the island

These represent something of a trade-off as the one pictured in Fig. 6 provides good habitat for lentic (stillwater) species whilst also interrupting the transport of stream substrate and acting as a barrier to migration for rheophilic (flow-loving) fish. In order to produce these lake habitats (and to control water within a developed landscape), the stream channel is entirely artificial in significant proportions of the visited reaches (e.g. concrete channel at SO 86087 99852; Fig. 7). There are also multiple barriers to substrate transport and fish migration such as weirs (e.g. SO 86032 99915; Fig. 8) and culverts (e.g. SO 859939956: Fig.9).

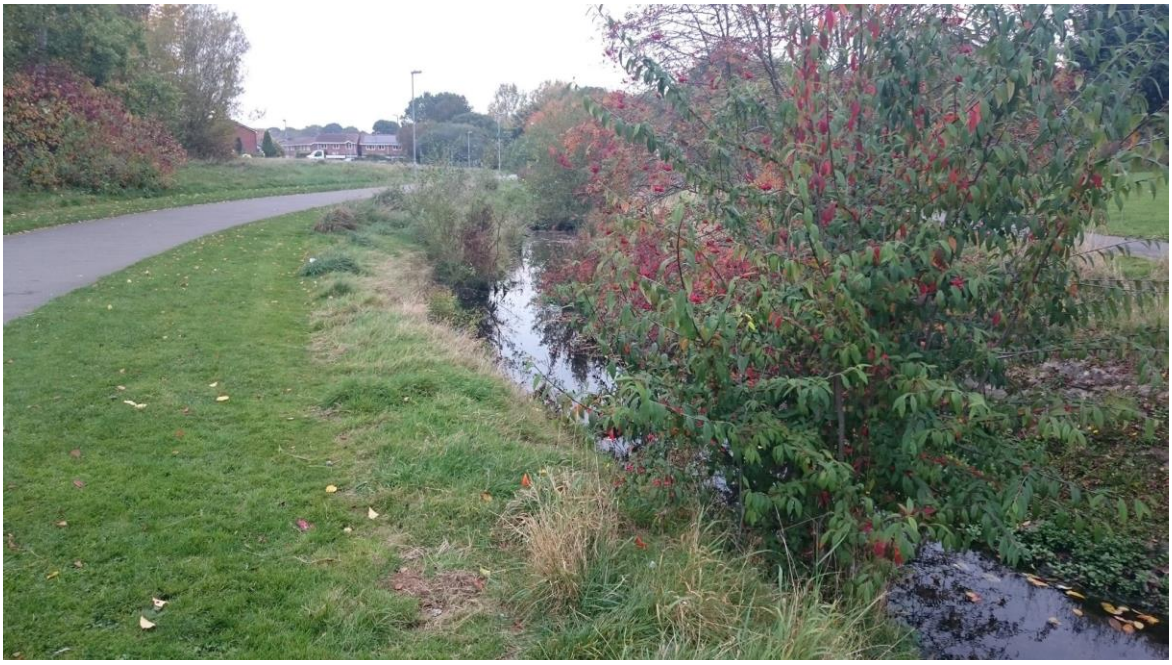


Figure 7: Artificial channel with water-level maintained by weirs

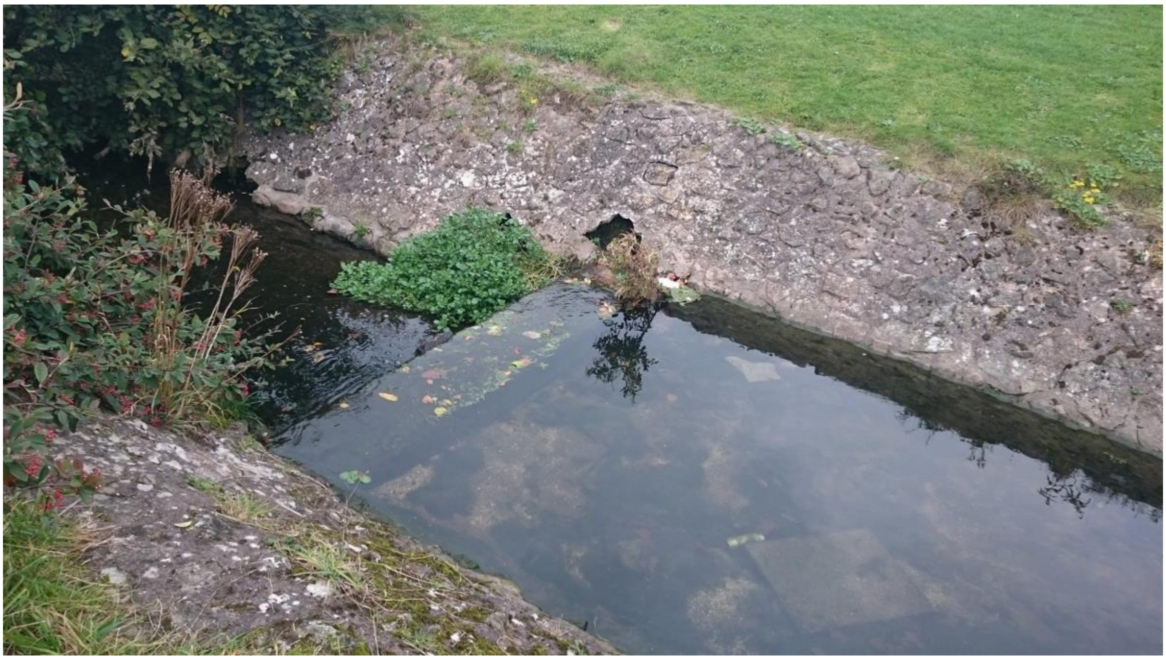


Figure 8: Example of weir impounding water to maintain a particular depth/width of water within the artificial channel (presumed to be for aesthetic reasons)

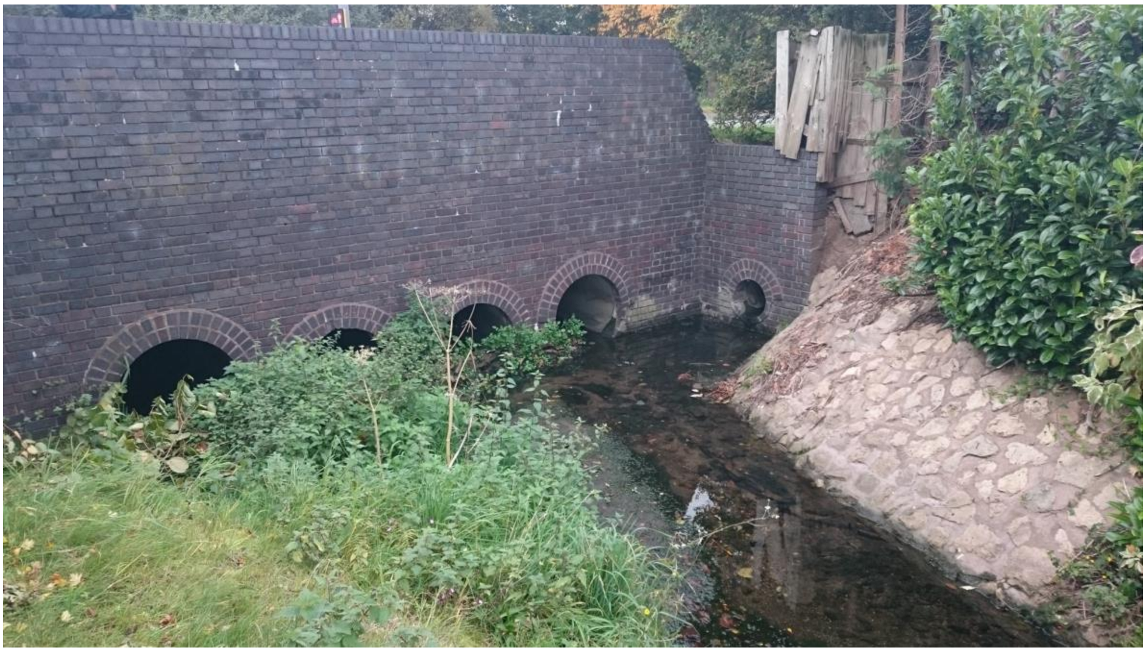


Figure 9: Circular-section culverting causing a barrier to fish migration as well as river-bed substrate

Below this relatively open section, the stream enters an area of woodland as it borders a housing development. It is thought that the channel was realigned and straightened in order to accommodate this housing. As a consequence, its depth/overall cross-section appears to have been designed to carry spate flows without presenting a flood risk to the adjacent properties.

The combination of its excessively straight plan-form and over-deep/over-wide channel has degraded the habitat quality under normal flow conditions (Fig. 10). A natural section of stream would have a much more meandering planform and also a significantly smaller wetted perimeter. In fact, other sections of the Penk that were visited (but not photographed) showed exactly those conditions in wet woodland habitat.

Figure 10: Straightened channel with an over-large cross section for normal flow levels. The smothering of the channel bed with sand and silt results in very uniform habitat with poor potential for diverse aquatic flora and fauna. The lack of gradient here would make any channel restoration very difficult

The over-large cross section and an exceptionally shallow gradient (possibly exacerbated by the realignment exercise) combine to reduce flow to imperceptible velocities. This, in turn, causes the substrate to be dominated by deep deposits of sand and silt from bank to bank.

Further barriers in the form of another on-stream lake and the culverts connecting that lake to the stream channel were noted around SJ 85941 00235 (Fig. 11). The bottom of the visited reach was defined by a trash screen on a culvert that takes the stream below ground at SO 85985 00471 (Fig. 12).

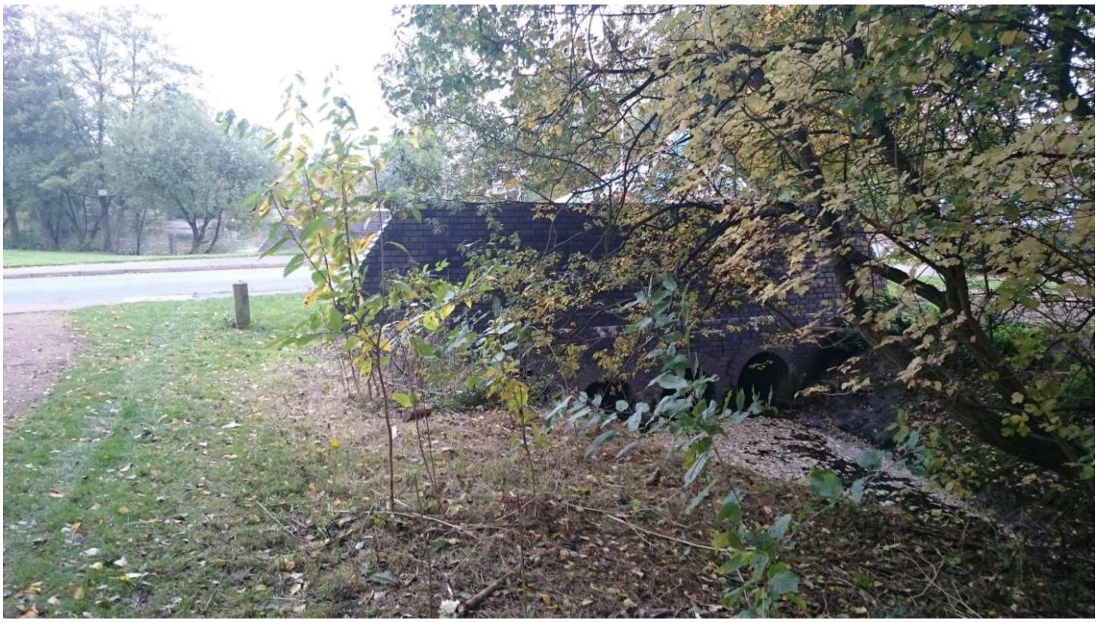


Figure 11: Bridge/culvert at the upstream end of another on-stream lake, thought to have been constructed at the same time as the adjacent housing development

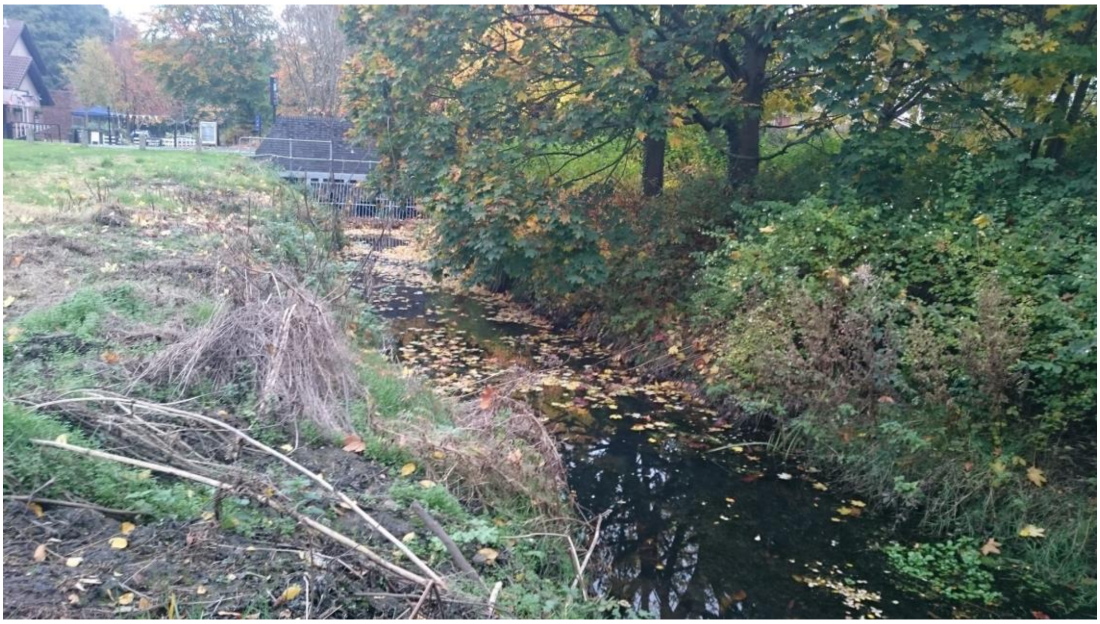


Figure 12: Downstream limit of visited sections marked by a trash screen over the entrance to a culvert (towards the left hand side of the upper/middle of frame)

Recommendations

The most achievable opportunity for improvements to the degraded habitat of the upper Penk probably lies in riparian vegetation enhancements at the de-culverted section around SO87500 89661 and also the trapezoidal section at SO86917 99725. This latter site could also be earmarked for a much larger project of radical re-profiling (perhaps as part of a flood-water storage creation scheme). Such a large-scale project would require its own, detailed and dedicated project proposal that incorporated relevant expertise in geomorphological channel design. Such a project would also provide an opportunity to break up the armoured channel-bed and restore processes of erosion and deposition within a more meandering planform.

For these riparian planting projects, volunteer-centred events run by Groundwork could be an ideal delivery mechanism. This could combine the introduction of "plugs" of mature riverside plants such as sedge grasses with the sowing of a suitable mix of native wild seed. Mixes of wild seed are readily available. Just by way of example (rather than a formal recommendation or endorsement) – a mix such as this http://wildseed.co.uk/mixtures/view/13/pond-edge-mixture would generate additional opportunities for more diverse fauna associated with an increased variety of wild flora.

Consultation with local Wildlife Trust personnel may be a good way to determine suitable species composition for planting and seeding activities (both in terms of regional appropriateness and in their suitability to the soil/moisture conditions found on site). Any riparian vegetation enhancement will need to be co-ordinated with the current mowing (or other land/vegetation management). Agreed boundaries for mowing of surrounding grass and comparable management are essential to agree in advance.

In contrast, in the remaining visited reaches, the lack of gradient and existing transport/housing infrastructure would make significant in-channel improvements (particularly for fish species) extremely expensive. The greatest gains for the upper Penk would be made by breaking up the artificial stream bed and straightened channel walls (as well as weir removals). This would allow a more natural, meandering planform channel at the inherent cross-sectional dimensions and shape associated with the volumetric discharge, available bed-slope and (re-introduced) natural substrate.

Additional gains could be made by re-establishing some riparian woodland habitat along the river corridor and also implementation of Sustainable Urban Drainage Systems (SUDS). However, the barriers to such a scheme would include:

- How to balance overall improvements with the amenity and biodiversity values of the on-stream lakes
- Physical constraints imposed by surrounding infrastructure
- High (financial) costs

- Gaining acceptance/support from local community
- Ensuring positive flood risk impacts
- Achieving meaningful connectivity with the rest of the river system

and specifically for rheophilic species such as trout:

- Lack of available gradient coupled with low volumetric discharge

There would need to be a comprehensive assessment of costs and benefits for all comparable projects within the catchment before undertaking such a large amount of effort and expenditure. Without ensuring that any improved headwater sections could be readily accessible to fauna migrating from lower reaches, there is a natural limit to the benefits that could be achieved by such expensive interventions. Certainly, in terms of the scope for local volunteers to contribute to improvements to the watercourse, riparian planting and seeding offer some of the most tractable opportunities. Consequently, this is where any initial efforts can be usefully directed.

Acknowledgement

The WTT would like to thank the Environment Agency for supporting the advisory and practical visit programmes (through which a proportion of this work has been funded) in part through rod-licence funding.

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