WILD TROUT TRUST
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Advisory Visit
Chinn Brook, Druids Heath

Advisory Visit by Paul Gaskell (pgaskell@wildtrout.org)

13/04/2022

River	Chinn Brook
Waterbody Name	Cole from Source to Springfield
Waterbody ID	**GB104028042501**
Management Catchment	Tame Anker and Mease
River Basin District	Humber
Current Ecological Status	Poor
U/S Grid Ref inspected	SP0688278967
D/S Grid Ref inspected	SP0739079237
Length of river inspected	0.65 km

1 Summary

- *Recent (within local living memory) straightening of this tributary of the River Cole has degraded its ecological potential*
- *Sections of paleochannel carry flowing water on ephemeral basis following heavy rainfall*
- *A large weir may be redundant – judging from concrete blockage of previous connections – and currently imposes significant, negative ecological impacts*
- *Nutrient enrichment appears to be impacting this small, low-dilution stream*
    - *Some of this may derive from canal water inputs (via overspill towards the bottom of the inspected reach)*
    - *It is advisable to investigate main/obvious outfall inputs to check for misconnections and potential blockages*
- *Reconnecting the paleochannel would bypass the weir and support significant ecological improvements which would be of great benefit as a biodiverse green space for local communities*
- *Various tiers of pollution monitoring will allow any habitat improvements to reach their full biodiversity and societal benefit potentials*

2 Introduction

The Wild Trout Trust were invited by representatives of the community art project "People Make Places" to give advice on the management of the Chinn Brook. This tributary of the upper Cole runs through a valuable area of green-space, designated as common land adjacent to the Druids Heath area of Birmingham. Throughout the report, banks are designated as right (RB) and left (LB) while facing downstream and locations are specified using the National Grid Reference system.

2.1 Background

Local community members are keen to be involved with custodianship of the Chinn Brook. The People Make Places project is ideally placed to support and facilitate such initiatives. During the visit, community members were being canvassed for their opinions and experiences of the adjacent green space. Several people reported that aquatic life seemed to have declined and also remembered the Brook being straightened within recent decades. The reasons for the straightening were not known to the respondents encountered during the visit.

The Chinn Brook continues downstream from Druids Heath and joins the River Cole approximately 1.5km upstream of the Sareholes Mill Museum. Wild trout inhabit the River Cole in those reaches – and consequently, the Chinn Brook has the potential to act as an important resource for those populations of wild, urban trout and all associated river corridor flora and fauna.

While the Chinn Brook is not considered as an individual watercourse under the Environment Agency (EA) Water Framework Directive classification, it forms part of the "Cole from Source to Springfield" waterbody. The current rating for that waterbody is "Poor ecological status", despite often being rated as "High" for fish in previous cycles of assessment.

3 Habitat Assessment

The reach was walked from downstream to upstream, with observations recorded sequentially. At the downstream limit of the reach, natural processes of erosion and deposition had created varied habitat features of high ecological value (Fig.1). Meanders – along with gravel-bed deposition and scour-pool formation – were promoted by the naturally-arising large woody material in the channel (Fig. 2).

In this area, stone-turning revealed a few freshwater shrimp (*Gammarus* sp.), hoglouse (*Asellus aquaticus*) and very tiny olive mayfly nymphs (*Baetis* sp.). Stones and rocks showed some filamentous algae growth here. As a preliminary interpretation, these features suggest a degree of nutrient enrichment which may be limiting the diversity of aquatic species. Further investigation into potential sources of pollution is, consequently, advised.

Figure 1: Natural erosion providing valuable inputs of gravel. Note the reinforcing influence of tree roots which helps to keep erosion within manageable limits - while also promoting a meandering channel planform.

Figure 2: Natural and stable input of large woody material. The fallen tree (circled) is promoting additional structural diversity - while also helping to retain leaf litter (a vital food-source for a significant component of aquatic food-webs, particularly in rain-fed rivers).

One potential source of nutrient enrichment (due to effects of boat-traffic, resuspension of nutrient-rich sediment and associated algal-growth) is the canal overspill at SP0735679242 (Fig. 3). However, while some larger olive nymphs were found in the Chinn Brook upstream of this overspill, it appears that there are other sources of elevated nutrients as well as the canal.

Figure 3: Canal overspill entering the Chinn Brook on the LB. The fallen tree shown in Fig.2 is a few metres downstream, outside the right hand side of the frame.

Upstream of the canal overspill, there is an offshoot to what was previously the natural channel – now heavily overgrown but also providing some good, wetted, habitat. The confluence between the original channel and the new, straightened channel is shown in Figure 4.

Figure 4: Confluence between old channel (lower left corner) and new channel (mid-to right of frame). Neither channel is fed by the canal overspill at this point.

Discarded shopping trolleys and other litter was evident in this area (e.g. Fig. 5). Probably the most pragmatic approach to this is to remove the most visible items – while leaving others that are being reclaimed by the fauna and flora of the brook. As long as the materials are relatively inert and visually difficult to notice, it may do more harm than good to rip out dumped items. However, very prominent items tend to act as "permission" to continue or accelerate the frequency of littering. For this reason, they are best removed.

Figure 5: Discarded trolley in plain view of anyone walking along the brook. This item is worth removing as part of regular custodianship duties. Other items – such as extensively-colonised carpet off-cuts – are very difficult to spot and are also supporting a variety of flora and fauna. These are best left in place.

The main Brook channel upstream of this point is characterized by an artificially straightened planform, with a degree of incision below the adjacent floodplain (Figs. 6 and 7).

Figure 6: Straight, incised channel with vertical banks, uniform slow flow and trash trapped in debris dam.

Figure 7: Incision below the flood-plain and steep, near-vertical banks on both sides of the channel. Note how it is far easier for vegetation to encroach and choke the channel than in natural sections.

This is a typical effect of straightening a channel. Whether simply a result of how it was dug – or whether the straightening initially made the channel steeper and caused it to erode downwards – the banks are now close to vertical. There is a marked “step” between the surrounding bank-top and the water’s surface under normal flow conditions. While trailing vegetation is providing some cover, the overall effect of slowing and straightening the brook has reduced habitat structural diversity. Biological diversity tends to map onto structural diversity due to a greater variety of opportunities for different species to exploit.

Figure 8: Facing upstream into the impounded reach above the weir.

Relative to the width of the brook, a very tall weir has been built at SP0729779204 (Figs.8 and 9). This creates a long reach of straightened, impounded flow upstream and creates a huge barrier for both upstream and downstream fish passage.

Figure 9: View from the side of the weir at SP0729779204

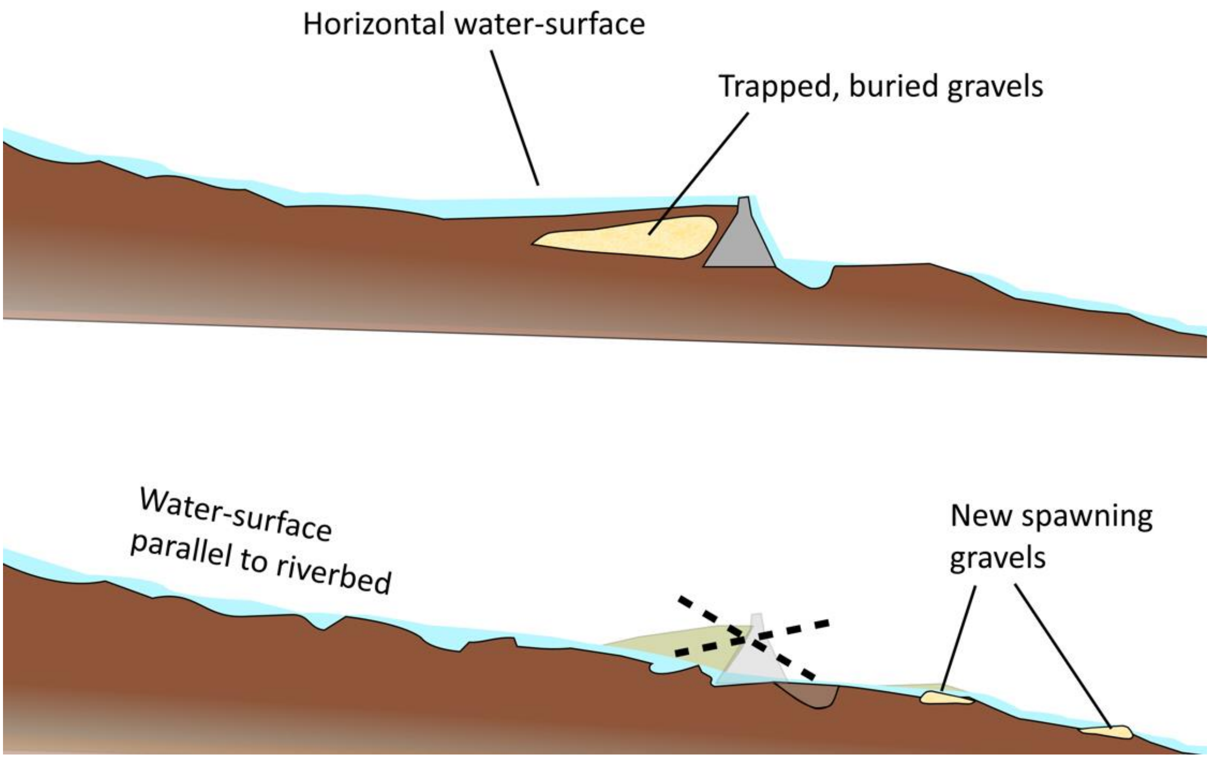

Figure 10: Impounded sections of river create unnatural "steps" in the longitudinal gradient. The interception of valuable substrate behind weirs interrupts its supply to downstream reaches. Under natural conditions the water surface should be parallel to that longitudinal slope – whereas large impoundments create a horizontal water surface with greatly reduced flow velocity.

While the basic barrier-effect of weirs is relatively widely appreciated, weirs also create a range of more subtle impacts. Figure 10 gives an indication of generalised impacts of weirs (or series of weirs) on the capacity of rivers to generate varied, high-quality habitat.

That interception of bed material - and the reduction in a river's potential to redistribute bed material during spate conditions – are equally significant compared to "barrier-to-migration" impacts of weirs on a river system. Highlighting that (lesser-known, yet significant) impact does not diminish the serious problems caused by fragmenting breeding populations of fish and/or reducing the access to key habitat features utilised by trout to complete their lifecycles (see Appendix 1).

The value of a naturally meandering planform in terms of diversifying habitat structure is easier to appreciate with some explanatory diagrams (Figs. 11 & 12).

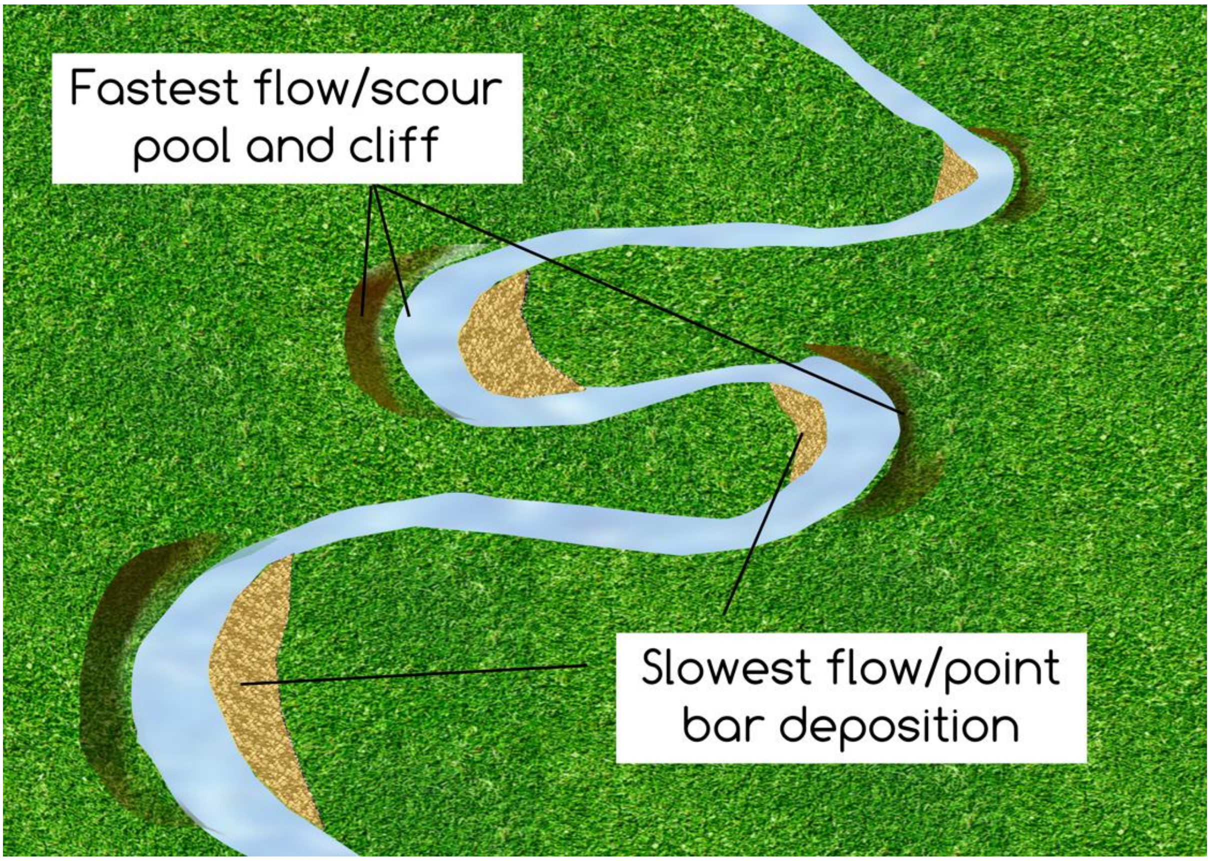

Figure 11: When meanders form naturally, the faster flow on the outside of the bend scours deeper pool habitat. The arising material is subsequently deposited downstream as point bars (and riffles) in the slower flows caused by friction between water and the riverbed.

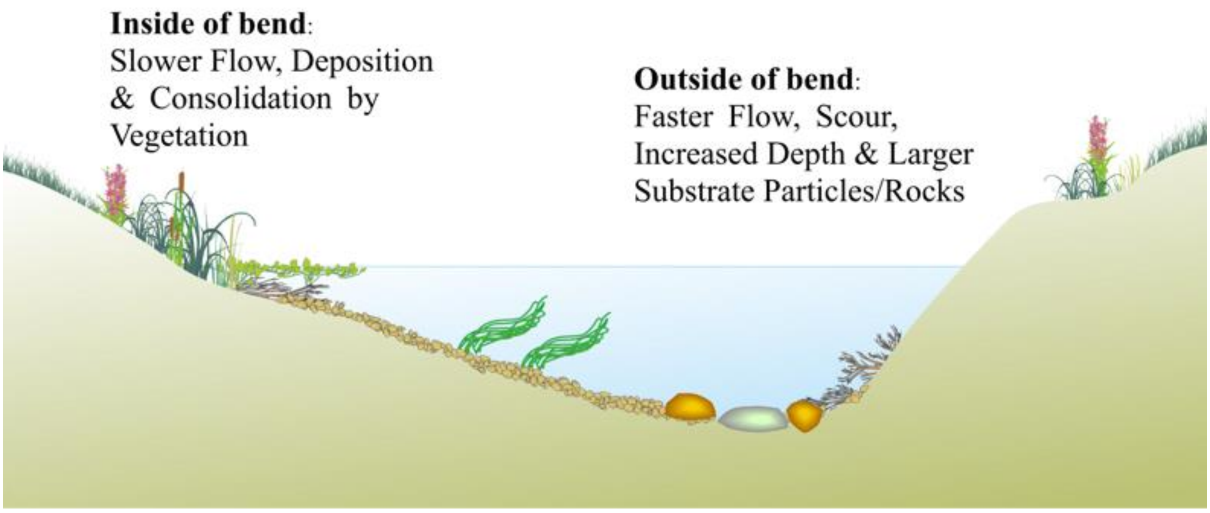

Figure 12: The benefits of natural river process can be seen in a typical cross-section through a bend. Each depth and velocity band over that cross-section will have its own characteristic flora and fauna. In contrast to pools formed by impounding water (which fill in with deposited material over time), sediment is continually scoured out of bend-pools.

Contrast the cross section shown in Fig. 12 with the trapezoidal cross-section shown in Fig. 13. Hopefully it is easier to see which has the greater diversity of micro-habitat niches to support more aquatic life (including fish populations which depend on the full food-web of a river). Natural cross-sections also have greater resilience to low-flow conditions by allowing flowing water to be focused into narrow channels. In over-capacity box-shaped channels, low flows often form separate ponds of stagnant water.

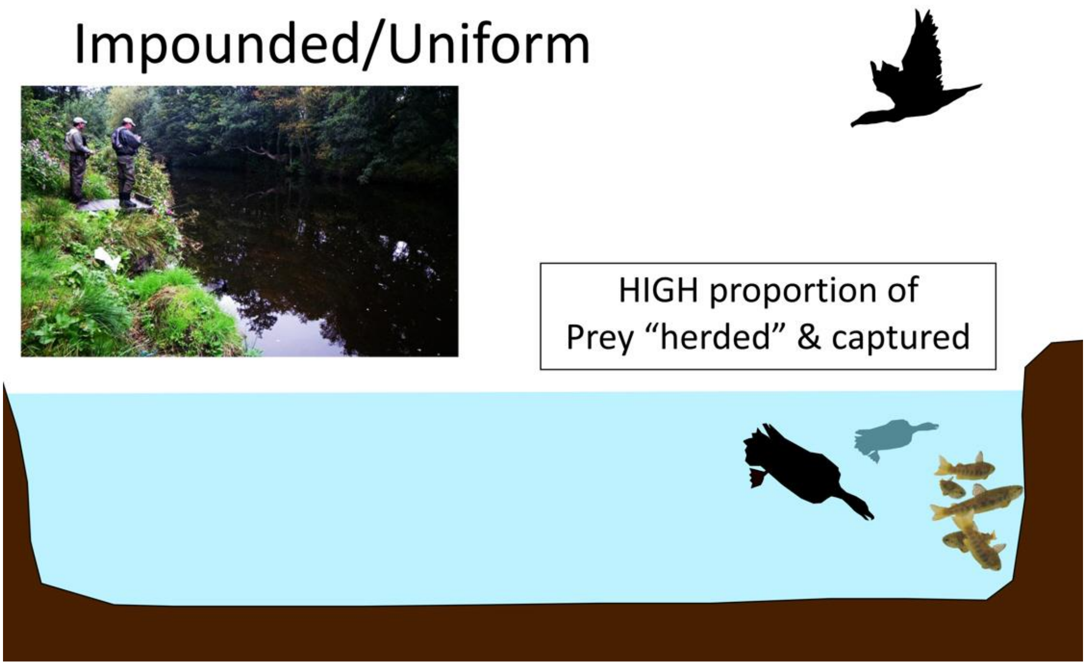

Figure 13: Trapezoidal, uniform cross-section. Simple habitat provides fewer niche opportunities and also disproportionately favours predator-efficiency.

This is one reason that the instinct to simplify, straighten and lock a river in place is important to resist. Another, more subtle, reason is that the greatest ecological diversity – and hence greatest resilience – is maintained when habitat is allowed to change over time. Locking a river in place stifles biodiversity by favouring a smaller subset of species that are particularly adapted to those stabilised conditions. In a more natural scenario, Periodic shifts and disturbances help to reset competitive interactions and allow more species to co-exist. However, if large magnitude disturbances occur too frequently, then this will also stifle biodiversity by only favouring species adapted to extreme disturbance. The ideal situation – which tends to occur in nature - is somewhere between these two limits.

Looking down into the structure of the weir, it seemed as if a previous connecting duct/goyt has been blocked off (Fig. 14); though formal confirmation of that would be required.

Figure 14: Looking down into chamber fed by the weir – with an apparently sealed connecting goyt – suggesting the weir may be redundant in terms of water diversion.

Both directly adjacent to the bridge at SP0725379197 (Fig. 15) and also around seven to ten metres away from the watercourse on the LB (Fig. 16), dead canes from a stand of Japanese knotweed (*Fallopia japonica*) were noted. This invasive, non-native plant tends to spend quite a long time as a relatively small patch – while it establishes an extensive underground rhizome (root) mass. After reaching a certain tipping point, the increase in coverage quickly overwhelms native plant species and has a strongly negative impact on biodiversity.

Consequently, treating stands of knotweed while in that initial, relatively controllable, lag-phase of growth can significantly reduce both the costs of dealing with it and the damage associated with exponential growth. Unlike Himalayan balsam (*Impatiens glandulifera*), Japanese knotweed cannot be easily controlled via hand-pulling, strimming or other mechanical methods. In fact, attempting that will accelerate the spread of an infestation – and would constitute an offence under the Wildlife and Countryside Act 1981. Instead, it requires specialist herbicide treatment by accredited personnel.

Figure 15: Dried Japanese knotweed canes left behind following winter die-back. The rhizometous mass remains alive underground and will produce vigorous re-growth of new canes through the warmer months of the year.

Figure 16: Stand of Japanese knotweed several metres away from the watercourse. It is possible that the rhizome network from this stand is connected to the smaller stand adjacent to the bridge shown in Fig. 15.

Since control, would be an acceptable ecological outcome (compared to construction sites where total elimination is the only option), stem injection with glyphosate-based herbicide is likely to provide the most cost-effective control. This also carries the lowest risk of impacting surrounding, native flora. For dedicated groups of local custodians, it may be possible to undertake appropriate training and accreditation (City and Guilds/NPTC PA1 and PA6 including PA6 stem injection) in the use of herbicides adjacent to watercourses (and also purchase the appropriate stem-injection, pesticide storage and personal protection equipment). However, the simplest approach may be to employ suitable contractors to inject any stands of knotweed identified.

The combined effects of impoundment and straightening of the channel are very obvious for considerable distances upstream. For instance, the brook at SP0718979176 (Fig. 17) shows extremely uniform characteristics of flow velocity and cross-sectional depth profile.

Figure 17: Uniform depth and flow-velocities over the full cross-section in a box-shaped artificial channel. Marginal vegetation provides some structural variation and shelter from predators but cannot mitigate the overall severe habitat degradation.

Extensive stands of Himalayan balsam grow on the RB here (Fig. 18).

Figure 18: A significant area of the ground vegetation coverage in the background is made up of Himalayan balsam seedlings in this area.

Fortunately, it is at least possible to control stands of Himalayan balsam by hand-pulling before the plants set seed (and composting the resultant stems on-site, but well away from any watercourse, to avoid spreading the infestation). With repeated efforts to account for early and late flowering individual plants, it is possible to gain good control over Himalayan balsam within two to three years. Their seeds tend to only remain viable for less than three years in the seedbank. When viewed in the context that many native plant species lay down seed that can remain viable for centuries, then prospects for recovery are good.

While it is always ideal to find the furthest upstream infestation of balsam in a catchment and then work systematically downstream, it is important not to underestimate the value of creating localised “fire-breaks”. Controlling balsam infestation over a period of time in manageable patches allows good regeneration of native species. When these smaller, localised actions are added up over a landscape scale, the summed positive impact on biodiversity is highly significant. Some headline impacts of balsam are summarised here in this Centre for Agriculture and Bioscience International (CABI) infographic:

https://himalayanbalsamdotcabidotorg1.files.wordpress.com/2013/06/himalayan-balsam-infographic.pdf

Although the brook shows some very limited signs of recovering a more natural, meandering planform (e.g. Fig.19), the rate of such recovery will be limited by the impounding effect of the weir.

Figure 19: An obvious gradient-break has locally-increased water velocities and a small amount of lateral erosion and deposition has resulted. However, the impounding effect of the weir strongly limits the potential extent of those processes to create significant re-naturalisation of the channel form.

While examining this section, it was possible to back-track and visit part of the flood-plain on the RB-side of the artificial channel. Here, there were clear signs of the paleochannel of the brook (e.g. Fig. 20).

Figure 20: A view along the centre of a section of paleochannel. A small meander winds around the coppice-regrowth towards the centre/left of the frame.

On the EA Catchment Data Explorer map of the waterbody, part of the paleochannel is clearly marked (presumably because it acts as an ephemeral watercourse during heavy rainfall; Fig. 21).

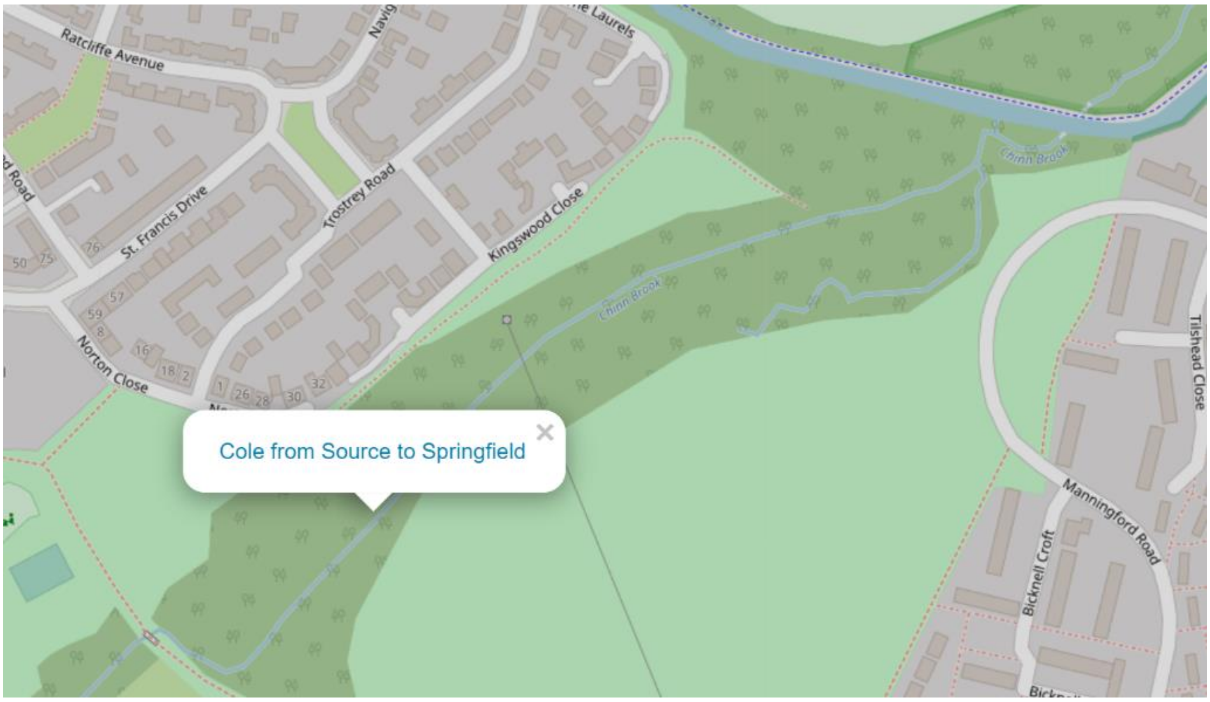

Figure 21: Catchment Data Explorer map with the Chinn Brook annotated as "Cole from Source to Springfield" waterbody. The meandering, cut-off paleochannel can be seen joining the new, straightened, channel just upstream of the canal overspill (upper right corner).

Re-connecting this paleochannel (if necessary, via a designed, nature-like connecting channel) to the current course of the brook would provide a suite of benefits. As well as increasing the potential to incorporate natural flood-risk management to downstream infrastructure and properties, both ecological quality and the associated community wellbeing benefits would be improved. With interpretive signage, those wellbeing benefits can be maximised by providing visitors to the site with the ability to recognise and appreciate the wildlife associated with a naturalised channel. The common land status of the surrounding floodplain creates an unusually large area around the watercourse in a heavily urbanised setting.

As an indication of what the Chinn brook can (and should) look like, there is a short section of more natural channel towards the upstream limit of the visited reach (Fig. 22).

Figure 22: The brook's characteristics change significantly when allowed to occupy its natural cross-sectional width and depth – providing a far greater range of micro-niche habitat structures.

Consequently, the connection to any re-meandered nature-like channel should aim to join the brook as close to this point as possible (thus minimising any artificially-straightened/deepened channel). Once disconnected from the flow, the current, straightened channel can be retained as wet woodland areas.

Given the extent of the obvious paleochannel, any connection to it should also – easily – bypass the problematic weir towards the lower end of the visited reach. It may also be possible to use further investigative tools (e.g. LIDAR survey data) to identify the complete paleochannel and simplify any channel design work.

Just upstream from the features shown in Fig. 22, an outfall was noted as a potential source of pollution (Fig. 23).

Figure 23: Simple visual monitoring of this outfall could be augmented by invertebrate monitoring upstream and downstream of the discharge point – and even relatively low-tech tests for misconnections are possible to carry out.

Identifying whether this outfall is creating water quality issues within the brook would be extremely valuable. It should be possible to deploy a suite of investigative techniques to give the best chance of flagging up any problems. Simple visual monitoring to check for the formation of grey "sewage fungus" bacterial biofilm in the area of the discharge is a vital first step. Secondly, the presence of any "optical brighteners" in the discharge itself should indicate whether there are misconnections of residential drains to this outfall point. More details about an unconventional, but cheap, assessment method for testing for optical brighteners (used in many household products, including laundry detergent) can be found here:

https://www.theguardian.com/environment/2015/mar/31/tampon-tests-could-be-used-to-track-sewage-in-rivers

Finally, depending on the frequency and severity of any upstream impacts on water quality, the response of aquatic invertebrates living in the brook could be assessed. Sampling and recording particular groups of aquatic invertebrates at points with similar habitat upstream and downstream of the outfall can indicate when problems occur. Training and connections with a data-recording/reporting network for monitoring stream invertebrates is available via the Riverfly Partnership's "ARMI" programme:

https://www.riverflies.org/ARMI

Local participants in the community events being held during the visit reported that wetland treatment of runoff had been installed to the north of the Brook (i.e. within the drainage pathway on the LB). Therefore, there appears to be a precedent for identifying and tackling polluting runoff sources. Continuing and extending such practices will be an essential part of safeguarding and improving biodiversity within the brook. Similarly, to make it as safe as possible for families accessing the river corridor, polluting inputs that are hazardous to human health need to be tackled.

The visit covered in the current report had an upstream limit at SP0688278967 where the brook entered a culvert beneath a road (Fig. 24). The existence of a continuous streambed within that culvert has significant benefits for the general habitat value and also the physical "passability" of that culvert.

Figure 24: Culvert beneath a road at the upstream limit of this visit. Note the continuous streambed consisting of natural substrate.

To support communities in their custodianship of urban watercourses, the WTT has instigated the Trout in the Town Accreditation scheme. With tiers for all stages of project development, there is reciprocal support via other urban groups who are facing (or have overcome) the same challenges you encounter. Please feel free to request more details and a short application form if you would like to benefit from this free-to-join support network.

Recommendations

- Identify the reasoning behind the original straightening of the brook (and the party/parties responsible)
- Identify what the purpose of the weir is/was and whether bypassing is (or can be made) feasible
- Seek funding to support the connection of a nature-like, meandering channel to the obvious paleochannel (and transform the blocked-off, straightened channel into areas of wet woodland)

    - Appropriate hydrological modelling capabilities should be built into any such funding bid (and the WTT may be able to assist in identifying and appointing a contractor)
    - An initial design and feasibility stage is necessary to identify the scope and scale of works (and identify whether all substrate can be won on site or if there is a need for imported substrate – including quantities)
    - Interpretive signage will increase the chances of realising community wellbeing benefits that can be associated with environmental improvements
- Seek funding to support the training of groups of volunteers to undertake regular aquatic invertebrate monitoring (e.g. via the ARMI protocols)
- Instigate visual (and if possible optical-brightener) monitoring of the main outfall at the upstream end of the visited reach (Fig. 23)
- Fund and carry out control of Japanese knotweed on the site by accredited personnel via stem injection (repeated as and when necessary)
- Undertake selective trash removal working parties to improve the visual amenity value of the brook
    - Leave or re-position dumped materials that have been extensively colonised by flora and/or fauna
- Undertake regular "balsam bashing" to hand-pull and compost Himalayan balsam on-site prior to plants setting seed
- Retain large woody material and naturally-arising debris-dams within the watercourse (over time these will encourage natural meandering and also help to retain essential leaf-litter to support aquatic and terrestrial foodwebs)

Legal permissions must be sought before commencing work on site. These are not limited to landowner permissions but will also involve regulatory authorities such as the Environment Agency – and any other relevant bodies or stakeholders. Alongside permissions, risk assessment and adhering to health and safety legislation and guidance is also an essential component of any interventions or activities in and around your fishery.

Further information

The WTT may be able to offer further assistance such as:

- WTT presentation/Q&A session
    - Where recipients are unsure about the issues raised in the AV report, it is possible that your local conservation officer may be able to attend a meeting to explain the concepts in more detail.

In these examples, the recipient would be asked to contribute to the reasonable travel and subsistence costs of the WTT Officer.

The WTT website library has a wide range of free materials in video and PDF format on habitat management and improvement:

www.wildtrout.org/content/wtt-publications

We have also produced a 70-minute DVD called 'Rivers: Working for Wild Trout' which graphically illustrates the challenges of managing river habitat for wild trout, with examples of good and poor habitat and practical demonstrations of habitat improvement. Additional sections of film cover key topics in greater depth, such as woody material, enhancing fish populations and managing invasive species.

The DVD is available to buy for £10.00 from our website shop www.wildtrout.org/shop/products/rivers-working-for-wild-trout-dvd or by calling the WTT office on 02392 570985.

4 Acknowledgements

Wild Trout Trust would like to thank the Environment Agency for their continued support of the advisory visit service, in part funded through rod licence sales. The advice and recommendations in this report are based solely on the expert and impartial view of WTT's conservation team.

5 Disclaimer

This report is produced for guidance; no liability or responsibility for any loss or damage can be accepted by the Wild Trout Trust as a result of any other person, company or organisation acting, or refraining from acting upon guidance made in this report.

N.B. See Appendix 1, over.

Appendix 1: Key trout lifecycle stages and associated habitat

There are three main types of habitat that are needed in order for wild trout to complete each one of three key lifecycle stages (spawning, juvenile and adult; Fig. A1). The consequences to trout populations of a lack of each specific habitat-type are also illustrated in Fig. A1.

The basic process by which the Wild Trout Trust's advice is derived is to examine whether each of the key habitats are represented within a visited reach. Where those habitats do exist, there is then an assessment of whether trout can access those habitats to make use of them and successfully complete self-sustaining lifecycles. In this way, both habitat quality and habitat connectivity are assessed in order to judge whether wild trout populations could survive and thrive.

Because the habitats which support complete trout lifecycles meet a wide range of varied requirements, they are physically diverse (Figs. A2-A4). That structural variety is, in turn, vital for supporting a wide variety of species.

In this way, assessing habitat for a trout provides a means of identifying how to improve and/or protect wider river-corridor biodiversity.

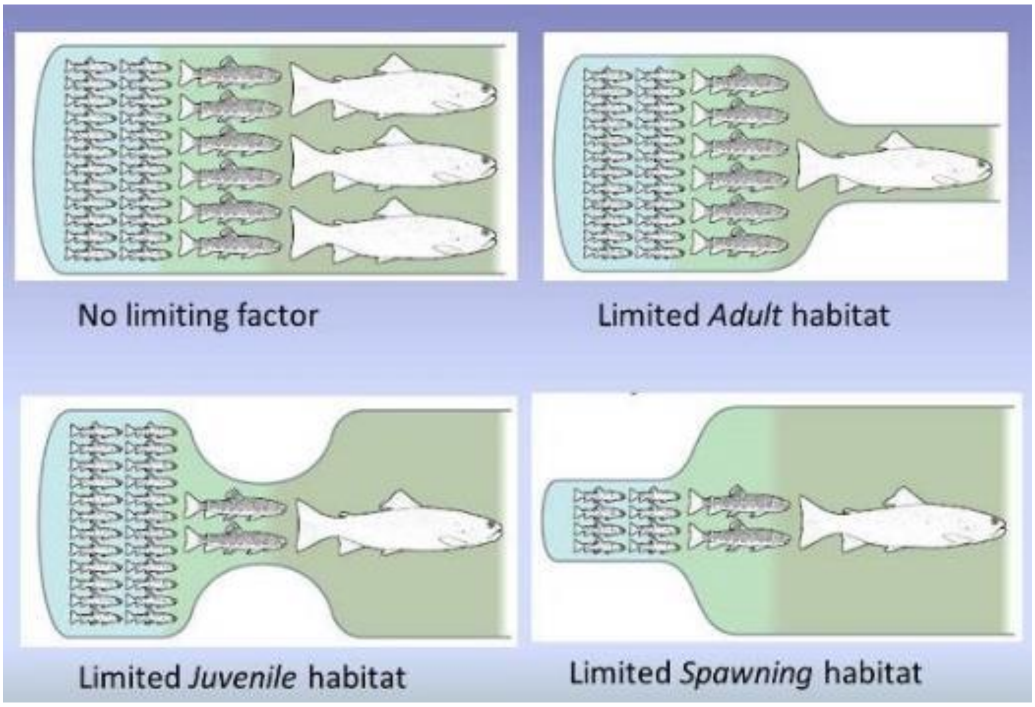

Figure A1: The impacts on trout populations lacking adequate habitat for key lifecycle stages. Spawning trout require loose mounds of gravel with a good flow of oxygenated water between gravel grains. Juvenile trout need shallow water with plenty of dense submerged/tangled structure for protection against predators and wash-out during spates. Adult trout need deeper pools (usually > 30cm depth) with nearby structural cover such as undercut boulders, sunken trees/tree limbs and/or low overhanging cover (ideally trailing on, or at least within 30cm of, the water's surface). Excellent quality in one or two out of the three crucial habitats cannot make up for a "weak link" in the remaining critical habitat.

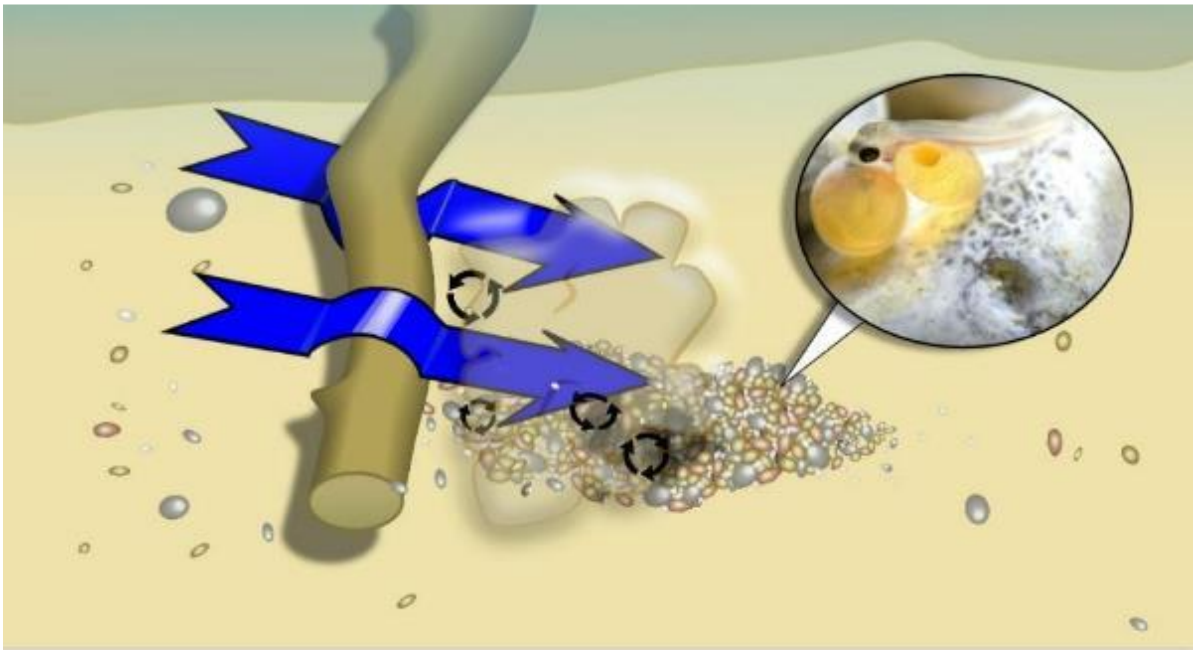

Figure A2: Features associated with successful trout spawning habitat include the presence of silt-free gravels. Here the action of fallen tree limb is focusing the flows (both under and over the limb as indicated by the blue arrows) on a small area of river-bed that results in silt being mobilised from between gravel grains. A small mound of gravel is deposited just downstream of the hollow dug by focused flows. In the resulting silt-free gaps between the grains of gravel it is possible for sufficient oxygen-rich water to flow over the developing eggs and newly-hatched "alevins" to keep them alive within the gravel mound (inset) until emerging in spring.

Figure A3: Larger cobbles and submerged "brashy" cover and/or exposed fronds of tree roots provide vital cover from predation and spate flows to tiny juvenile fish in shallower water (<30cm deep). Trailing and overhanging bank-side vegetation also provides a similar function and has many benefits for invertebrate populations (some of which will provide a ready food supply for the juvenile fish).

Figure A4: The availability of deeper water bolt holes (>30cm to several metres), low overhanging cover and/or larger submerged structures such as boulders, fallen trees, large root-wads etc. close to a good food supply (e.g. below a riffle and with prey likely to fall from overhanging tree canopy in this case) are all strong components of adult trout habitat requirements.