Little Don, Stocksbridge (Steel Valley Project)

Advisory Visit

	The Porter River or the Little Don
River	Little Don
Waterbody Name	Little Don from Source to River Don
Waterbody ID	**GB104027057460**
Management Catchment	Don and Rother
River Basin District	Humber
Current Ecological Quality	Moderate
U/S Grid Ref inspected	SK 27869 98471
D/S Grid Ref inspected	SK 28756 98145
Length of river inspected	1.2 km

Wild Trout Trust Report – Following a Site Visit on 27/01/2020

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1. Introduction

A site visit and habitat appraisal of the Little Don was made at the request of The Steel Valley Project.

As part of their protection and improvement of the Little Don Valley in the Stocksbridge area, advice was sought on potential enhancements to the Little Don (also known as the Porter River – *not to be confused with another stream in the Sheffield area called the Porter Brook*).

To define the general process by which Wild Trout Trust (WTT) advice is derived, it is useful to understand that there are three key lifecycle stages of wild trout (spawning, juvenile and adult). By examining sections of watercourse, it is possible to identify if there are either absences – or a lack of access to – habitat that supports each key lifecycle stage.

To put this into context, *there are three types of habitat* that are needed for wild trout to complete each one of the *three key lifecycle stages* identified below (Fig. 1). Those varied requirements (Figs. 2-4) create a demand for varied habitat, which is (in turn) vital for supporting a wide variety of species.

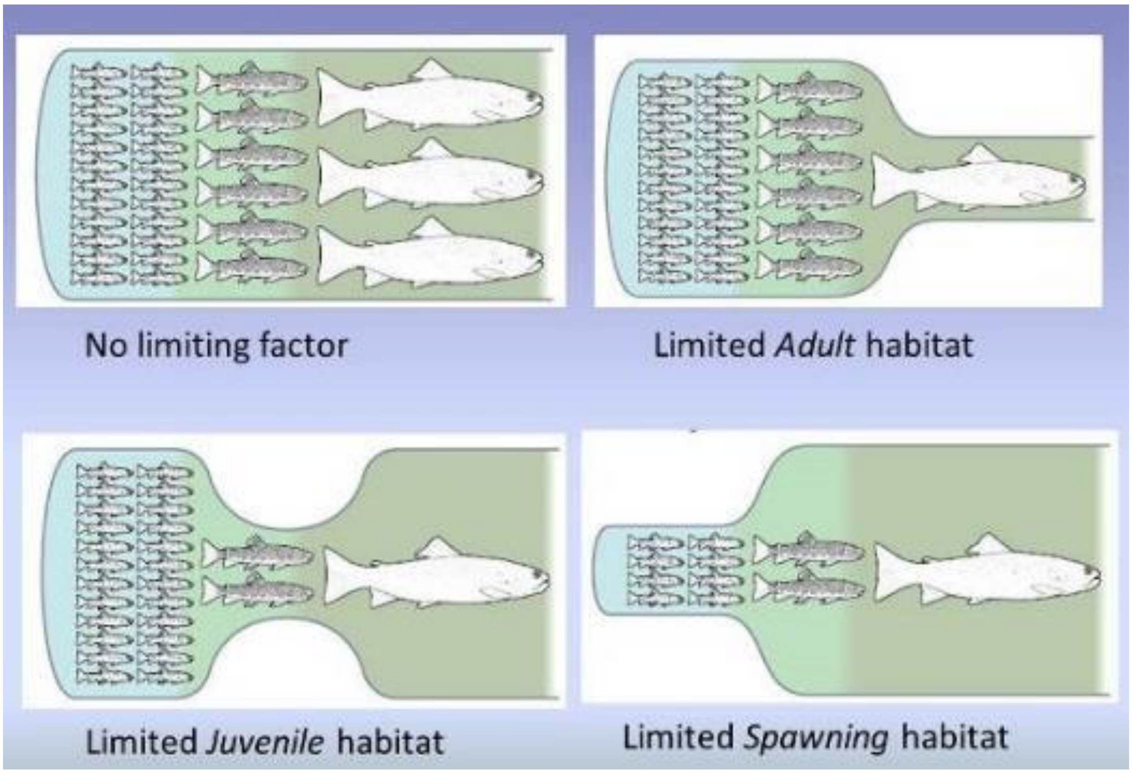

Figure 1: The impacts on trout populations lacking adequate habitat for key lifecycle stages. Spawning trout require loose mounds of gravel with a good flow of oxygenated water between gravel grains. Juvenile trout need shallow water with plenty of dense submerged/tangled structure for protection against 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.

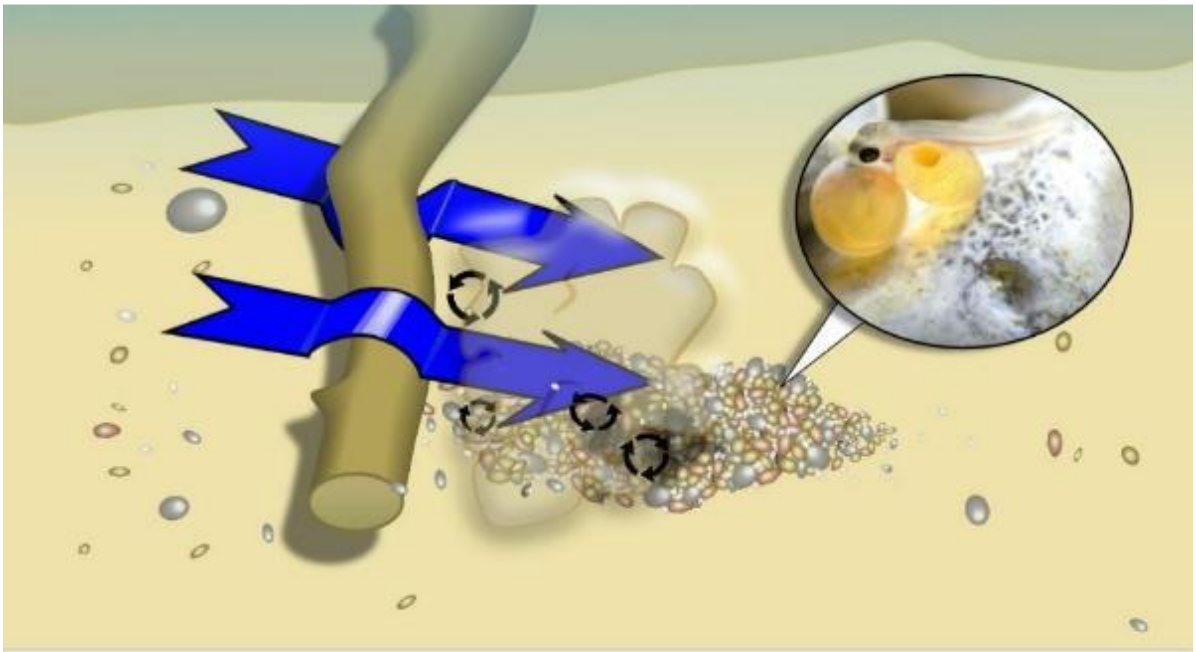

Figure 2: Features associated with successful trout spawning habitat include the presence of silt-free gravels. Here the action of a fallen tree limb is focusing the flows (both under and over the limb as indicated by the blue arrows) on a small area of river-bed that results in silt being mobilised from between gravel grains. A small mound of gravel is deposited just downstream of the hollow dug by focused flows. In these 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 3: 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, overhanging vegetation also provides a similar function and diverse bank-side vegetation has many benefits for invertebrate populations (some of which will provide a ready food supply for the juvenile fish).

Figure 4: 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.

With these broad descriptions of the elements of spawning, juvenile (nursery) and adult trout habitat in mind, both **habitat bottlenecks** and **examples of good habitat** are easier to highlight and define. 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.

2. Habitat Assessment

The upstream limit of this visit (Fig. 5) was the point at which the Little Don emerges from a large culvert at SK 27869 98471. The culvert has a large capacity and carries the river beneath the site of historic (and existing) steel works. At one time, almost the entire length of the Little Don valley below Underbank reservoir would have been dominated by steel works and their associated infrastructure/related services. Today, the remaining area occupied by active steel-production is much reduced. Some of the old sites have been redeveloped (including, for instance, the Fox Valley Shopping Park as well as new housing) and land has also been reclaimed for nature.

As well as proactive planting and management of woodland (e.g. through the Steel Valley Project), natural recolonisation of previously industrialised areas of the valley has taken place throughout the valley. Overall, there is a surprising richness of wildlife in what was previously an extremely industrialised valley. The processes of succession and recolonisation are currently at different stages in different areas – depending on how recently industrial activity retreated. Because of this staggering of the stages of natural succession throughout the valley, different cohorts of species that are associated with early, middle and later successional stages can occur. One notable example of early-stage succession in damp areas is the nationally threatened Willow Tit, which is locally abundant in the Little Don Valley.

This report focuses on the existing condition of the river – and seeks to identify opportunities to enhance and protect aquatic biodiversity; using trout as an indicator species. The importance of retaining what is already good is also a primary objective.

Figure 5: The Little Don emerging from a long, large-capacity culvert that carries it beneath Fox Valley Shopping Park at SK 27869 98471; the upstream limit of this visit.

While there is little realistic prospect of daylighting much of this culverted section, it may be possible to establish the presence or absence of any barriers to free movement of aquatic organisms. Connectivity between high-quality patches of habitat is extremely important for the resilience of self-sustaining populations. Often it is necessary for individuals to migrate between different habitat resources at different stages of their lifecycle. Alternatively, connectivity can simply provide a means of repopulation after a localised extinction. Therefore, any opportunities to identify and mitigate any barriers to free movement within the culverted sections would be potentially highly valuable.

Figure 6: Riverside vegetation, including Rhododendron.

The Little Don sits within a steep-sided valley. In the area immediately downstream of the culvert photographed in Fig.5 there are recent housing developments on the RB. Down at the level of the river, there is a variety of riparian vegetation lining the banks (e.g. Fig.6). In addition to native, mixed deciduous woodland species, patches of rhododendron were also noted – as can be seen in Fig. 6; photographed at SK28146 98356. That particular stand of rhododendron may offer some potentially beneficial shade and cover to aquatic species living in the margins of the river. However, overall it represents a negative impact on river corridor biodiversity. The tendency to dominate native understory species – as well as the potential to harbour a variety of fungal infections hazardous to native woodlands – mean it is beneficial to control the spread of rhododendron and remove/replace with native species.

A photograph taken from the same grid reference as Fig. 6 also shows the significant constraint created by the gas pipeline running along most of the length of the Little Don (Fig. 7).

Figure 7: Gas pipeline running along the LB - with housing at the level of the raised footpath on the RB visible in the background.

Clearly, having a housing development on one side of the river - with the pipeline on the other - will limit the degree to which a more meandering river channel can be achieved. Instead, introduction of stable woody material is advised (see subsequent details in report).

Figures 6 and 7 indicate the typical character of the river between the upstream limit of the reach visited for this report and the railway bridge at SK 28222 98308 (Fig. 8). Although not currently used for passenger services, this line is scheduled to begin carrying them in the future.

Downstream of the railway bridge (Figs. 8 and 9) is an area that the Steel Valley Project has earmarked for potential wetland creation. Comments were invited from the WTT on the idea as part of this Advisory Visit. The potential to increase lateral connectivity (particularly in the context of the severe constraints upstream of the railway bridge) is a valuable opportunity. Longitudinal connectivity has been mentioned earlier in this report in the context of migration up and downstream. Lateral connectivity refers to the ability of the river and its inhabitants to move between river channel and floodplain under differing conditions. The land adjacent to the river on the LB below the bridge is much lower-lying than the level of the footpath and housing above the bridge. There is also considerable, undeveloped, space available (Fig. 10).

Figure 8: Railway bridge, photographed facing downstream and gas pipeline (LB) at SK28222 98308

Figure 9: Railway bridge photographed facing upstream. The level of the bridge is approximately equivalent to the ground level of the housing on the RB above the bridge

Allowing the river to periodically inundate that section of floodplain would also create additional flood-storage in an area currently disconnected from the river. The broad plan to create scrapes in the ground and introduce locally-appropriate wetland plant species would be of ecological benefit. To maximise these benefits, the lateral connections between river and floodplain should be designed so as to avoid creating a "fish trap" effect as spate flows recede. Ideally, if the levels can be made to work, open channel(s) should be used in preference to buried pipes.

Channels to increase lateral connectivity should always avoid creating a raised lip at the point where water would discharge back into the main river channel as water levels recede after spate flows. This minimises the potential for fish to become trapped as the water levels drop.

Figure 10: Proposed wetland area to the left of the footpath - with the river channel hidden behind a raised bund along the single line of trees to the right of the frame.

Using footbridge(s) to preserve the footpath access would allow for open channels to connect river to floodplain. Such channels have greater ecological value than using sunken plastic pipes or round culverts (which would also necessitate disruption of the footpath and riverside bund during construction phases). The river channel at this location is shown in Fig. 11.

Figure 11: The Little Don at SK 28339 98177 as it skirts the area earmarked for wetland creation.

If tree works are deemed necessary in future (e.g. to protect the wall from collapse or as part of a very light rotational coppicing to create a more varied light/shade regime), there are opportunities to use the arising tree-crowns to create in-channel refuge habitat. The channel-straightening and stone walling have created uniform habitat with less roughness than is ideal for biodiverse aquatic communities. Therefore, securely anchoring tree crowns (Figs. 12 and 13) to remaining root-masses creates stable, complex, submerged cover that provides a wealth of benefits including:

- Maintaining healthy predator/prey balances that are made more fragile by simplified habitat (simple habitats are associated with "boom and bust" population crashes of both predators and prey
- Creating areas of slower flow during spate conditions that prevent weaker-swimming organisms from being washed away
- Offering overwintering habitat for dormant fish
- Mediating hot summer/low water conditions by creating cool-water refuge.

Braided steel cable and cable-crimps enable extremely robust anchoring of trees to stable root-masses (e.g. Fig. 12).

The crowns of the trees are only tethered at one end (the thicker, trunk-end) and so will be washed parallel to the riverbank. This arrangement also allows the free end to rise up and fall down according to the height of the river at any given time.

The size of these structures – known as tree kickers – can be tuned appropriately to the size and situation of the watercourse at hand. This is a quick and robust way to recreate a proportion of hydraulic roughness and habitat complexity that are both lost when river channels are straightened and simplified.

Figure 12: Example of tree crown cabled to stable anchor-point using braided steel cable and crimps

Figure 13: A small tree-crown installed as a stable tree kicker to mimic natural deadfall habitat.

The extensive weir at SK 28452 98147 (Fig. 14) presents a complex challenge. The length, gradient, shallow/laminar flow means that it is likely to be a complete barrier to upstream fish passage under all flow conditions. At the same time it is a structure that is likely to be valued in the local community for the heritage it represents.

Figure 14: Huge, sloping weir on such a small watercourse – a complete barrier to upstream migration for most fish species.

As well as explaining some of the lesser-known population genetics impacts of such barriers, the habitat-degradation caused by weirs is covered in detail in this online article: https://www.wildtrout.org/wttblog/why-presume-remove-weirs-river-dove-case-study

The insights provided on the above link are essential to inform public consultations on the options for dealing with structures that are designed to impound (hold-back) flows on our rivers. In ecological terms, the best outcome would be removal of the structure to allow the channel to re-grade naturally. The next best option would be the creation of a new channel with a bed of natural material and cross-sectional profile which bypassed the structure. Moving further down the list – purely from an ecological outcome perspective – removal down to bed-level of a significant portion of the structure would create a degree of upstream habitat improvement. Following that, there would be options which did not improve habitat quality – but could potentially reduce the barrier effect created by the weir.

Those fish passage easements/improvements would span the range from high-cost technical fish-pass construction through to less formal easements. Devoting a up to a third of the cross-section of this weir to some kind of fish passage easement that could include baulk installation, wooden baffles or a rock-ramp may allow a proportion of fish to ascend and descend this barrier. As is usually the case, in the absence of weir removal, a bespoke solution will need to be designed for this specific site. The unique challenges created by different weirs are not well addressed by generic solutions – so this would necessitate its own dedicated project.

Away from the constraints of bank-top development sites and a riverside gas pipeline, the Little Don shows that it can create habitat with high ecological value (e.g. Figs. 15 and 16).

Figure 15: Diverse, high-quality habitat at SK28756 98145. Do also note the presence of a small number of dead canes of the non-native, invasive Japanese knotweed towards the left of the frame.

Figure 16: Photographed from the same point as Fig. 15 but facing downstream. Note the natural deadfall of wood creating low/overhanging and submerged brashy cover habitat. Also note the diversity of flow depth and velocity – along with the variation in diameter of riverbed material.

When the river is allowed to transport, deposit and remobilise bed substrate (as in Figs. 15 and 16), habitat with high value to a wide range of river-corridor species results. One observation of note is the presence of a small number of Japanese knotweed canes on the RB of this reach (e.g. Fig. 15). The out-competing of UK native species by Japanese knotweed reduces both floral and faunal diversity in the absence of its natural control organisms/pest species from its own native range. While this infestation is still small, it is the ideal time to tackle it in a cost-effective manner. In ecological terms, achieving control (and not necessarily complete removal) of Japanese knotweed would be very valuable. This is in contrast to the absolute need for, extremely expensive, complete removal measures that would be required if the land was being built on.

Finally, an activity that could provide valuable cataloguing of Steel Valley aquatic biodiversity would be to undertake Riverfly Partnership monitoring (http://www.riverflies.org/). This would also act as a protective measure via the ability to detect and address pollution incidents.

3. Recommendations

A summary of the suggested actions given in the main body of this report follows (and is intend to help inform the more detailed planning already being undertaken by Steel Valley Project). Prior to listing those recommendations, please pay attention to the important information relating to permissions:

N.B. *Any and all works will be subject to a variety of legal permissions that include, but not limited to, landowners, regulatory authorities for the watercourse (which could be local council, Environment Agency or even drainage boards) and other stakeholders such as bodies responsible for infrastructure or services that may be affected by works.*

- Control/minimise rhododendron and Japanese knotweed growth using appropriately qualified personnel and approved methods for working adjacent to watercourses (e.g. considerations where herbicides may be involved: https://www.gov.uk/government/publications/application-to-use-herbicides-in-or-near-water)
- Introduce and anchor submerged cover in the form of "tree kickers". Alternating between LB and RB placements of kickers can create a degree of meandering flow within straightened channels. Additional guidance on this technique is available via video here: https://vimeo.com/72720550
- Hold consultations with the local community to help derive preferred options in both
    - Wetland creation (highlighting benefits as well as implications for modified access)
    - Ecological and/or longitudinal-connectivity improvements at the site of the large weir pictured in Fig. 14 (including explanation of the concepts highlighted in the article here: https://www.wildtrout.org/wttblog/why-presume-remove-weirs-river-dove-case-study). Detailed information on fish passage structures is available in this Environment Agency publication: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/298053/geho0910btbp-e-e.pdf
- On the basis of the above consultations, seek to establish dedicated projects and involve relevant experts in the design/delivery of preferred interventions (including appropriate measures to avoid the creation of "accidental fish-traps" within the channels created to enhance connectivity between river channel and floodplain)
- Explore the potential to investigate the presence/absence of barriers within the long culverted sections of the Little Don – and consider any potential solutions where such barriers may be discovered
- Consider enlisting and training volunteers to carry out Riverfly Partnership monitoring of the invertebrate life in the Little Don. This would create a valuable understanding of the baseline diversity of aquatic invertebrates – as well as provide a warning system for detecting and quantifying pollution incidents. More information is available by contacting Alex Domenge on this link: http://www.riverflies.org/diary-events

The WTT is willing to provide support (within its capacity) to help meet these recommendations. We'll also work to provide assistance in establishing contact with appropriate partners in instances where the required support is beyond our own capacity.

We are often able to provide demonstration and training in delivering the basic recommendations made in our Advisory Visit (AV) reports (like this one). This commonly takes the form of a "Practical Visit" (PV) where one or more of our Conservation Officers help you to carry out habitat improvement measures that we recommend in our AVs. A significant component of PVs is the training we provide that allows you and your partners to deliver similar works under your own steam.

Demand for PVs is high and are subject to the availability of our Conservation Officers (and our ability to identify supportive funding for staff time, mileage and materials).

For any clarifications on the observations and recommendations given in this report (or any other related questions/comments) please feel free to contact me on pgaskell@wildtrout.org.

4. Acknowledgement

The WTT thanks the Environment Agency for supporting the advisory and practical visit programmes, in part funded with rod licence income.

5. Disclaimer

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