



River Enhancements on the Beverley Brook through Wimbledon Common

Project Proposal

Project Background

Introduction to the Beverley Brook

The Beverley Brook is 14.3 km in length with a catchment of 64 km². Approximately 66% of the catchment is urban/suburban. There are virtually no completely natural parts of the river and the whole length has at some point been altered. Only 3% of the banks are considered natural and unaltered. These modifications have dramatically reduced variation within the river and consequently biodiversity of both riverine fauna and flora is lacking. This in combination with other factors, both historic and present, are causing the Beverley Brook to fail its target of 'Good Ecological Potential' under the Water Framework Directive (2000/60/EC). Elements that the river is failing for are fish, macroinvertebrates, macrophytes, hydrogeomorphological elements and phosphate.

Approximately 55% of the Beverley Brook river channel is uniform. The channel throughout the waterbody tends to be over-wide with very little variation in width, depth or flow as a consequence of being heavily modified for either land reclamation reasons or perceived flood alleviation measures. The vast majority of the Beverley Brook has little or no sinuosity. In no part of the watercourse is pool and riffle development considered to be high or even moderate. In its present condition, little of the channel exhibits any geomorphological response to hydrological or catchment changes and few natural features can develop. Most of the river is still heavily constrained and due to the low energy of the river this means that full natural recovery is unlikely in most locations without intervention.

Due to the low stream power and the uniformity of the channel significant quantities of sediment, primarily sand, drops out and smothers the gravel bed. This reduces the habitat quality for plants and invertebrates, inhibits the successful reproduction of fish that lay eggs in gravels (which require water to flow freely through the gravels to oxygenate the eggs) and can directly damage fish.

It is suspected that fish passage through the river is restricted due to habitat deficient stretches which act as a barrier to their movement. Furthermore, the uniform nature of the river creates bottlenecks at various life stages of the fauna, therefore reducing the presence of species and increasing the vulnerability of those which are there.

The catchment is very flashy in nature with large peak flows experienced during/after rain events. This rapid response regime is due the natural geology and the extensive urbanisation in the catchment where there are significant amounts of hard impermeable surfaces. This in combination to the channelised nature of the river, the lack of habitat diversity, backwaters and refuges results in the downstream displacement of fish, in particular the juveniles. It is likely that some of these are permanently washed out of the waterbody.

There are very few active sources of sediment naturally eroding into the river from the banks or bed. Bank erosion along the river is rare (except where aggravated by poaching from deer, dogs and people), partly due to the extensive use of bank protection (70% of the total length) and partly due to the low stream power of the river. The geology under the Beverley Brook is mainly London Clay overlying chalk but at Wimbledon Common and Richmond Park the river passes over Thames terrace gravels, representing former courses of the Thames. These locations should act as the main source of gravels within the entire waterbody but the above modifications have effectively starved the river of gravels for decades.

The Beverley Brook in Wimbledon Common

The issues that impact the river as a whole, as detailed above are equally applicable through Wimbledon Common. The river here has historically been realigned, straightened, widened and deepened changing the course from its former meandering channel to that seen today. A brief reference informs us of it being deepened during the 1880s. A fuller account informs us that in 1936 “it was widened and straightened and the banks built up using the dredgings.” Walter Johnson, in an article written for the *Journal of the Wimbledon Natural History Society* in 1937, entitled Wimbledon Common – a Retrospect 1888-1937, stated, “The reconstructed Beverley no longer meanders, no eyots dot its course, no fish dart about its waters, no voles burrow in its banks”. These alterations have resulted in a homogenous environment with uniform channel widths, depths and flows.

Within the Common due to the presence of extensive sections of toeboarding along the majority of the banks, the channel’s uniformity is maintained, although there are sections where it is starting to fail.



A typical example of the Beverley Brook through Wimbledon Common. Note; the uniformity of the channel, extensive toeboarding and sand covered bed



Failing toeboarding in the background and in the foreground the large quantities of gravel found within the banks can be seen

The Project

At a holistic level, the proposed enhancements in Wimbledon Common will:

- Increase geomorphological diversity.
- Improve public awareness of river environments and their variability.
- Enhance the visual amenity and landscape character of the Common.
- Enhance habitat and species diversity.
- Increase the opportunity for more natural channel adjustment to varied flows and sediment loads through the restoration of natural functioning processes.
- Reduce the flashiness of the hydrological regime downstream. This promotes wildlife benefits and may help to alleviate flooding downstream.
- Increase the river's resilience to climate change.

The proposed project will focus on restoring natural processes which will enable the river to 'self-heal', enabling the Beverley Brook to become a functioning riverine ecosystem. This will primarily occur as a consequence of reinstating energy to the river. Doing so will allow a geomorphological response which will create new natural features. Areas of controlled scour and erosion, and consequently deposition will kick-start the recovery. The aim is to create a diverse mix of flow types, depths, velocities, widths, and cover. This will create the array of niches encouraging a more diverse and complex composition of both fauna and flora to colonise and establish.

This proposal will build on a previous small-scale project delivered by the South East Rivers Trust in Wimbledon Common which took place in 2014. Furthermore, it will build on a large-scale project delivered by SERT Richmond Park in 2015 which is on-going. This has been a collaborative project between the South East Rivers Trust, Environment Agency, The Royal Parks and the Friends of Richmond Park with Sir David Attenborough as Project Patron. This project has successfully enhanced over 600m of channel through the use of fencing to prevent deer access, erection of river gates, the introduction of significant quantities of Large Woody Material (LWM), channel narrowing, introduction of meanders, bank regrading, creation of fish refuges and an access point. Volunteers helped with planting of marginal plants and trees. A further component of the project addressed urban diffuse pollution entering into the Brook from a surface water fed tributary with the creation of a sediment trap and 850m² wetland.



A very uniform section of channel in Richmond Park before work. The channel characteristics are very similar to those in Wimbledon Common



The same location two years later. Note; the reduction in channel width, established vegetation and scoured gravel run



Another location in Richmond Park before work...



and two years later with a range of flows, depths and habitats

Baseline monitoring of a range of parameters was undertaken before the works commenced in Richmond Park. Follow up surveys are scheduled to take place in 2018. Initial scientific and anecdotal evidence demonstrate greater abundance and diversity of invertebrates and fish. The aesthetic value of the river has greatly improved and is recognised by all key stakeholders, interest groups and members of the public.

Wimbledon Common Project Details

Location of the Proposed Works

There is approximately 2km of the Beverley Brook that flows through Wimbledon Common. The landownership is shared between Merton Council and the Wimbledon & Putney Commons Conservators. Ideally permission will be granted by both landowners, therefore allowing for more extensive work, therefore maximising the benefits that can be realised.

It is believed that funding will be staged over a number of years. The Trust therefore suggests that a number of demonstration pieces could be delivered in a first phase. Following this, with landowner(s) and stakeholder satisfaction more extensive improvements can pursue through a second phase. For the time being, it is requested that agreement-in-principle can be issued from the landowners. With this the extent of the works will be known thus enabling a detailed design to be worked up and submitted for further approval from the landowners. Once agreed this will then be submitted to the Environment Agency as part of the consenting process.

Overview of Techniques

- Introduction of Large Wooded Material and Tree Management

The single best action that would benefit the river is the mass introduction of Large Wooded Material (LWM) to the channel. The presence of LWM in river channels is a completely natural occurrence which has in recent decades been limited through the largely unnecessary over-management of watercourses. Fallen trees and wood is routinely removed for either flood risk prevention (often only perceived) or to 'tidy' the river. The detrimental impacts of this routine removal of fallen trees are becoming understood. Increasingly the introduction of LWM is becoming a key tool to restoring rivers. The presence of LWM has been shown to help reduce the likelihood and/or severity of flooding downstream by attenuating the flow of water 'Slowing the Flow'. This action can safely be carried out in areas that are suitable for water storage such as Wimbledon Common.

Large Wooded Material serves a multitude of purposes. It provides habitat for all levels of the food chain. LWM creates flow and geomorphological variation which consequently scours pools which in turn sorts, cleans and replenishes gravel riffles. It creates in-channel features such as islands, bars and berms. It provides spawning, nursery and adult habitat for fish, therefore increasing the carrying capacity of the reach. The branches provide much needed cover and refuge. Generally speaking, LWM provides the foundation for the river to self-heal.



Naturally occurring LWM in the Beverley Brook at Wimbledon Common. Note the complexity of flows, scoured gravels and variation in the bed that have been created.



The same piece of LWM which has provided the natural gravels eroded from the bank and which has resulted in the formation of a berm which pinches the over-wide channel.

The LWM will consist of large, complex, multi-limbed tree structures and log flow deflectors. These will typically extend between half and two thirds the way across the channel and positioned to promote the formation of suitable channel characteristics which the Beverley Brook would resemble in its 'natural' state. Identified analogue reaches suggest that the appropriate wetted low flow channel should vary between 1.5 and 4 metres wide. This has been demonstrated to be suitable through the work delivered in Richmond Park. If rootwads/root balls can be sourced, these too will be used to kick the flow around and to provide great cover.



LWM collecting gravels, narrowing the channel and scouring out a pool



Large pieces of complex LWM narrowing the channel and providing a variety of habitat types

Some pieces of LWM will be orientated to promote scour centrally within the channel, encouraging the creation of deep pools which are currently scarce. Some LWM will be positioned to direct flows towards the bank in agreed locations. This will kick-start a meandering sequence whilst providing a sediment source, notably gravel which will form the in-channel features. As previously mentioned, the banks through Wimbledon Common are rich with gravel deposits. Releasing them through controlled localised bank erosion will not only help to significantly improve the river's morphology in the immediate vicinity but will also benefit the river downstream.

The LWM will be fixed using untreated chestnut posts and high tensile fencing wire. These fixings will be installed in a discrete manner, enabling the structures to appear natural. The number of fixings will be dependent on the size and shape of the LWM being secured. LWM will be positioned in a manner to reduce the likelihood of excessive debris collection. Any limbs or branches that will readily catch debris will be removed.

- **Tree Works**

Significant lengths of the Beverley Brook through Wimbledon Common are heavily shaded due to extensive oak and some sycamore coverage. Consequently, the channel is lacking in marginal and in-stream macrophytes and as a knock-on-effect the overall biodiversity is limited. 'Opening-up' sections through tree thinning and crown raising will allow more light. Undertaking the tree work will provide the LWM and the material required for channel narrowing.

Areas where extensive tree works are proposed will be assessed by an ecologist to identify any potential impacts that the work will have. The work can then be tailored to avoid/mitigate for these.

- **Toeboard Removal**

There is currently little or no interaction between the riverine and terrestrial habitats. This is partly due to the presence of wooden toe boarding along the entirety of Brook through the Common. Removal of the boarding would encourage natural adjustment of the channel and consequently will provide more transitional habitat. There are long sections that the toeboard could be safely removed without causing undesired bank instability. In areas where erosion could be problematic, the toeboarding could be removed and the toe of the bank stabilised (please see the '*Channel narrowing and re-meandering*' below for more details). All toeboards will be removed from site and disposed of by a reputable waste haulier.

- **Channel narrowing and re-meandering.**

In suitable sections where there is adequate light for the successful establishment of vegetation, the excessively over-wide channel should be reduced to between 1.5-4m. This width has been demonstrated as being suitable for the Brook through the work delivered immediately downstream in Richmond Park. Narrowing the channel will increase flow velocities and reduce the blanket deposition of sand/silt. Doing so will additionally provide a variety of flow types and habitats which are available. The narrowing would be achieved by creating low lying berms using either brash/tree tops or backfilled faggots (a description of each technique is below). Through this process a meandering sequence will be introduced by alternating the bank that the berms are installed.

- **Brash berms.** Brash/tree tops arising from the tree works are compacted and secured using untreated chestnut stakes and fencing wire. The brash will be positioned in a manner to minimise debris collection. As the water velocity slows through the dense network of branches, sediment in the water column will be deposited. Seeds will also become trapped and will establish with adequate light. Within a short period of time, the structure turns to a natural appearing bank, providing a wetland marginal habitat, a feature that is almost completely lacking in the Common.
- **Backfilled faggots.** This technique could be used if bank regrading is possible and agreed. A new bank edge is formed using hazel faggots (brash bundles). Again, these are secured using stakes and fencing wire or manila rope. A coir geotextile (biodegradable) lines the back of the faggots and the void behind is backfilled with a combination of brash and soil arising from the bank regrading.



Brash berms being used to narrow the channel in Richmond Park (October 2015)



The same brash berm two years later established with vegetation

- **Planting**

Once the brash has accumulated sediment the structures can be planted with a suitable mix of native aquatic species. This will kick-start the establishment which will be complemented by the natural upstream seed bank.

Timing of the Work

Due to the requirement for tree works, it is recommended that work will take place during the winter months to avoid bird nesting. The delivery will need to be relatively flexible in order to work around high winter flows.

Maintenance

All of the work will be stable and require minimal/no ongoing maintenance. The exception to this is that the introduced LWM will collect some litter, primarily due to the highly urban nature of the catchment upstream. This is likely to be more of an aesthetic issue as opposed to a flood risk concern. Volunteer litter picks maybe an easy way to remove accumulated litter whilst providing a way for the local community to become engaged with the river and help to instil a sense of pride for it.