

Flood Alleviation and Stopping Erosion in Lye Valley

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The Lye Brook, before the development of the land above and around the Lye Valley, was a shallow slow-flowing small stream. It was primarily fed by water emanating from springs on the valley sides above. The shallowness of the Brook and the good flow of water from the springs meant the whole of the width of the fen was wet all year round, with water at or close to the surface. The health of the fen relied on this good, all year-round supply of clean calcium-rich water emerging from the valley sides; the calcium being derived from its movement through the porous limestone that underlies the area.

The development of the surrounding landscape to residential and other uses (large areas of hard-standing, roofs and roads) created the need for surface drainage and the simplest way this could be dealt with was to send it via drains into and down the Lye Brook. During dry weather the normal flow (primarily groundwater flows from springs) are still low and create no problems BUT during rain the volume of water that flows down the valley is such that the banks of the brook (soft peat) can erode – deepening and widening the channel. During heavy rain even the modern expanded capacity of the brook is not sufficient to contain the volume of flow and water also spills onto the adjacent fen and where the banks are weak, washes away yet more peat. Thus, in places over time erosion, under-cutting and slumping have led to the width of the Brook (the distance between the undamaged fen on either side) now being 10 metres or more and the depth of the Brook channel two metres or more below its original level.

The interception of rainwater in the wider catchment and its diversion into drains also reduced the amount entering the ground by infiltration and therefore the amount of water entering the valley via the springs. Some springs may have dried completely or become more seasonal. Some springs are now polluted. The depth of the Brook has also led in places to the seasonal or permanent drop in water table of the adjacent fen, in places the zone that is too dry being as much as 10 metres wide.

Within the valley the historic management and other activities have also had unintended consequences and caused further damage to the rare fen habitats, for example before the construction of the current boardwalk made it unnecessary, there was further loss of water when under-path drainage pipes were installed to keep the valley bottom path dry for walkers.

To restore the fen to its pre-urban development “pristine” state is now impossible, too much irreversible damage has been caused and too much of the catchment built on. However, it is possible to reduce some of the problems caused by development and in part restore good fen habitats.

The first serious attempt to mitigate some of the problems was done in the 1980s when the two interception ponds were created in the brook at the top of the valley to hold up some of the water in a storm event. The design of these ponds is such that they did not (and still do not) do this job very well. They also have not been maintained anywhere near regularly enough, with the build-up of silt reducing their storage capacity. The most effective measure of this phase of work was the lining of the base of the Brook with a membrane and limestone rubble throughout the council-owned section, preventing any further deepening of the channel. However, the soft peat sides of the brook were left unprotected and continued to be damaged during heavy rain.

In more recent times a different approach has been adopted. This includes the following elements:

- The protection of the peat sides of the brook using woven hurdles (‘shuttering’ of hazel, willow or other species) or other material (e.g. log walls) to reduce and/or prevent further bank erosion
- Where high enough, these hurdles can prevent and/or slow water flows onto the adjacent fen during heavy rain, by keeping more water in the main channel.
- Rebuilding the banks lost to erosion by infilling the gap between the brook wall of the undamaged fen and hurdle with material previously treated as problem waste e.g. logs, brash reed and other cuttings created by ongoing habitat management. Waste peat created by pond digging (and dumped as banks) in the lower part of the site has also been used for this purpose.
- The installation of part leaky or wholly leaking dams in the lower part of the channel to slow the flow of water, reduce its power and therefore again reduce the risk of bank erosion. Slowing the flow during rain, even in the short top section of the valley, has also reduced flooding further downstream.
- The removal of the now unnecessary and damaging drainage pipes that kept the path dry, now that there is a boardwalk that is above the fen surface.
- Holding the spring-fed water on the fen in the valley bottom by retaining low bunds, rather than allowing it to flow directly into the Brook. This has allowed the recreation of a wet fen adjacent and parallel to the Brook. The work is still ongoing but the whole of the water that comes down the west side of the valley below the bridge is now contained, and only flows into the Brook at the end of the Council-owned land.

After a number of years, the structures and methods have been adapted, learning from where they have worked, and from where they have not been as successful as desirable. The modifications include the following:

- At regular intervals the addition of extra hurdles or walls of shuttering at an angle to the Brook and pointing downstream, such that they pull water back into the main channel should it be by sheer volume of flow or finding a weak point in the defences get behind the bank protection. This prevents the loss of long sections of material packing the bank – this material is vulnerable in the earlier phases of restoration as it will take

many years before it stabilises and consolidates into “solid” matter (hopefully if it can be kept wet, eventually form peat or something like peat).

- High sections of bankside hurdle/shuttering installed upstream from the dams to try and ensure even very high flows cannot get around the dams and either wash-out the material restoring the banks and/or cause further erosion of the original fen.
- One line of hurdles protecting the banks works, but in places a second or sometimes third line is necessary to slow and minimise the damage caused by and/or hopefully completely prevent storm water flooding on the fen at all.
- In the short-term concentrating on completing and improving the bankside protection to prevent storm water incursions onto the fen and damage to the banks. Once these defences have been improved it will be possible to do more work on the in-channel dams.
- By keeping the Brook channel clear of debris, damage to the dams and backing up of water during high flows can be prevented – again reducing the likelihood of water getting behind the bank defences.
- A task that has been carried out on a small scale, but which needs to be expanded, is the installation of solid shuttering, where the fen has suffered from bad erosion (in some areas by slumping) leaving a steep cliff face. This shuttering is either dug into the edge of the fen or erected as a standalone structure immediately adjacent to the exposed bank. When sealed it will maintain the water table at or close to the original fen ground level on the whole of the width of the surviving undamaged fen. This will be essential to maintain the fen in good condition as climate change brings increasingly unreliable weather including very hot and/or dry conditions.
- The above methods will, in some places, create a very defined three-tier structure to the fen – the original (undamaged) fen, the Brook channel itself (now in effect an **urban drain**) and between these a damaged section which depending on its width and level of historic damage can either be treated as part of the Brook (shallow stream and major urban drain during heavy rain) and/or an area which can be to some extent at least be restored to better fen or other wetland habitat (e.g. shallow pools).

In future once the bank side defences have been improved the strategy for the work will change again:

- In the long run to restore a higher water table on the whole of the remaining fen the bed of the Brook needs to be raised (reducing the height difference between the fen surface and lowest water table). This can be done by sealing the bottom section of the leaky dams and allowing the Brook to silt-up (this is actively happening already in places). Currently this strategy is especially important for the eastern side of the valley.
- However, without changes in the rainwater catchment, i.e. less road water being piped into the valley, it will be necessary to maintain the same (or bigger if climate change predictions are correct) capacity in the Brook. Therefore, the above will have to be done in parallel with continually improving (and where necessary) increasing the height and strength of the bankside protection structures. Work will be done in sections, working downstream.

- Of major importance in the long term will be improvements to the design and structure of the two interception/holding ponds at the head of the valley; such that they effectively hold water up during heavy rain but relatively quickly release water under controlled conditions after a storm event. The relatively fast emptying will be needed to allow for two heavy rain events in relatively quick succession. The FOLV have ideas for how the current structure could be adapted and for new structures that would improve the holding ponds such they are more effective.
- Even longer term, the future of the fen habitats in the valley will rely on wider policy. More water in the catchment should be percolating into the ground to ultimately feed the valley side springs. Less water needs to be fed directly into pipes and transported to the Lye Brook. There are several possible mechanisms to make these things happen including modifications of the existing drainage network (from pipes to infiltration) whenever ground work happens and new planning policies where water soakaways are the preferred option and adopted unless it is not possible. An initiative is being launched at the time of writing (Sponge Headington) to encourage people to interrupt down-pipes to install water butts on their houses and allow any overflow water to soak away – roof water otherwise ends up via the pipe system in the Lye Brook.
- A much more joined up system of public works and the planning system is needed before any major gains in this area will be achieved - with subsequent improvements to the ancient natural environment in the Lye Valley and more widely in other parts of Oxford.