



River Lod – Lurgashall Mill Pond



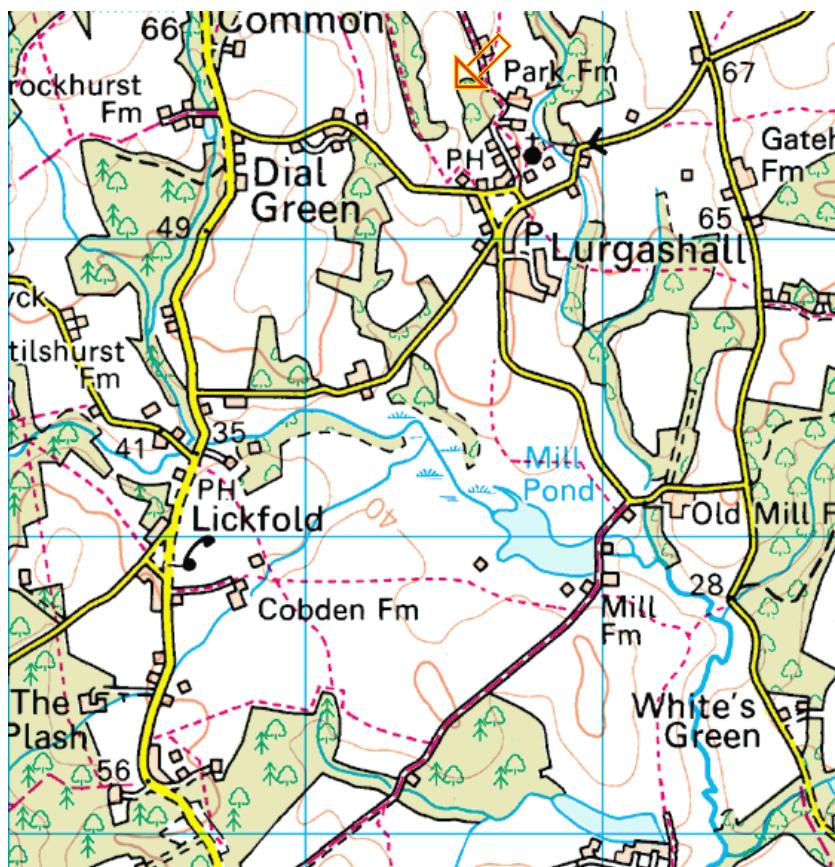
A Project Proposal by the Wild Trout Trust – May 2014

1. Introduction

This report is the output of a Wild Trout Trust visit to the River Lod at Lurgashall Mill Pond in West Sussex (National Grid Ref. SU 939 259). The site meeting was convened to explore options for finding a sustainable and affordable solution following a failure of the dam structure. Present at the site meeting were Charles Bacchus, Perikles Karageorgopoulos and Damon Block from the EA and Charles Grandlund from Smiths-Gore, who are the managing agents for the Leconfield Estate.

The river Lod is an important tributary of the Western Rother and this unfortunate incident potentially provides an opportunity to find a solution which will improve the ecological value of the river and provide a sustainable use for the old Mill Pond, which has accumulated huge quantities of settled sediment as a direct result of impounding the river over many decades.

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.



Map 1 Lurgashall Mill Pond

2. Catchment overview

The River Lod is an important tributary of the Western Rother. The Lod (Water Body GB107041012830) has been classified by the Environment Agency as being of “moderate ecological status” under the Water Framework Directive (WFD). The Western Rother is failing to meet objectives for good ecological status under the WFD with a poorly performing fish community. Sedimentation and poor connectivity is highlighted as a major issue for the Western Rother and tributaries.

The Western Rother is the main tributary of the River Arun, rising from the chalk hanger near Hawkley and Empshott. Much of the Rother is characterised by a soft sand substrate, a function of the greensand geology. River bed gravels are relatively scarce. Those that are present tend to be derived from two principle sources, either from broken outcrops of sandstone or ironstone, or from the small quantities of flint that have washed down from the streams that drain the chalk slopes to the south. Although strong populations of wild brown trout are to be found upstream of Petersfield, generally low densities of both trout and coarse fish are found through the middle reaches, where the substrate is quite soft and habitat relatively uniform. Sections that possess a firmer substrate and more varied habitat, however, can support healthy fish populations which include both resident and migratory trout *Salmo trutta* as well as protected species such as brook lamprey *Lampetra planeri* and bullhead *Cottus gobio* and a range of native coarse fish species.

3. Habitat assessment and options appraisal.

The dam at Lurgashall Mill Pond has been impounding the River Lod for several hundred years. During severe storms in December 2013, it was not possible to fully draw the existing hatches on the outlet structure and the Lod cascaded over the top of the dam structure causing a huge amount of damage to the dam and the footings of a an old building which sits on the downstream side. The dam structure and access road are damaged and in danger and in need of repair. The hatches on the main outlet have been fully drawn and the Mill Pond is drained.

Habitat quality both upstream and downstream of the Lurgashall Mill Pond will have been massively impacted by the existence of the on-line impoundment. The legacy of hundreds of years of impoundment are an impoverished channel running upstream for a considerable distance above the old Mill Pond boundary and a downstream section starved of gravels in the size usually associated with successful fish spawning. The adverse ecological impacts of on-line lakes and ponds are well documented and are a major factor in why many rivers and streams are failing WFD objectives. The partial collapse of the impoundment at Lurgashall Mill Pond does represent an opportunity for restoring a natural form and function to the Lod, which in turn will bring direct benefits for the main River Rother.

There are potentially four options for the Leconfield Estate to consider:

1. Repair the dam as it once was and de-silt the old Mill Pond.
2. Repair the dam and access road and create a much smaller off-line pond and partially restore the river with a bypass channel
3. Break out the old spillway, install a free spanning access bridge and facilitate a managed recovery of the river channel and adjacent area land.
4. Do nothing.

3.1. Repair the dam and de-silt the Mill pond.

Advantage: Modest income from the development of a restored stillwater fishery. "Aesthetic" restored to what local people might be used to seeing.

Disadvantage: Very expensive and unsustainable. Cost could be reduced if the size of any restored mill pond was considerably less than the original. A major disadvantage is that a restored smaller pond will require regular de-silting to remain viability which will be hugely expensive and technically difficult.

This option provides no long-term solution to sedimentation issues and has no prospect for meeting any ecological objectives for an improved local environment. The issues associated with managing flood flows will not be resolved.

3.2. Create an off-line pond and partially restore the river.

Advantage: Potentially provides an opportunity to create a still water above the existing dam structure within the confines of the old Mill Pond. Improvements to river connectivity could be achieved via this option.

Disadvantages: The dam will need to be repaired and an access bridge constructed. The flashy nature of the Lodd will mean that any off-line pond created within the confines of the existing Mill Pond area will be subject to inundation from the river. This potentially negates any benefit in trying to establish a viable still water fishery where the stock can be managed and separated from the river. Regular flood inundation will also result in the settlement of sediments in the newly created off-line pond but maintenance intervals will be greatly reduced if the lake only takes a small percentage of the flow. A rough indicative sketch is included in drawing 1.

3.3. Facilitate a managed recovery of the river channel and adjacent area

Advantages: The dam infrastructure can be repaired to retain the heritage aspect of the structure without the need for it to retain a head of water. A simple clear span bridge could be installed where the damaged spillway is currently located. A sustainable option and potentially the most beneficial for the river would be to slowly remove the central spillway by cutting away the central part of the dam and associated concrete below. Allow the river cut a new channel from both below and up into the old Mill Pond bed. The main cost associated with this option will be the cost of building a new wide span bridge to facilitate road access.

Ideally the core of the dam should taken down to the original bed level of the old Mill Pond. There may well be sound engineering reasons why some of the residual dam core has to remain. In this scenario there will be a requirement to build a technical fish pass on the downstream side of the bridge invert which would significantly increase the cost.

A possible option might be to manage the existing head differential between the downstream channel and the reach above by creating a series of low, naturalistic steps in the channel running below the centre of the dam and up into the existing pond bed. Some lowering of the existing Mill Pond bed will be required and the banks stabilized using green engineering techniques. The river channel in the upper half of the existing Mill Pond and beyond can be left to naturally recover over time. This option provides an acceptable environmental solution and will not require expensive long-term maintenance.

Disadvantages: Abandons the concept of any still water pond at the site.

3.4 Do nothing

Advantages: Cheapest option

Disadvantages: The river cannot fully recover without lowering the impoundment. The site will look derelict and the long-term solution for improving connectivity in the river channel and flood capacity will not be addressed.

3.5 Existing structures

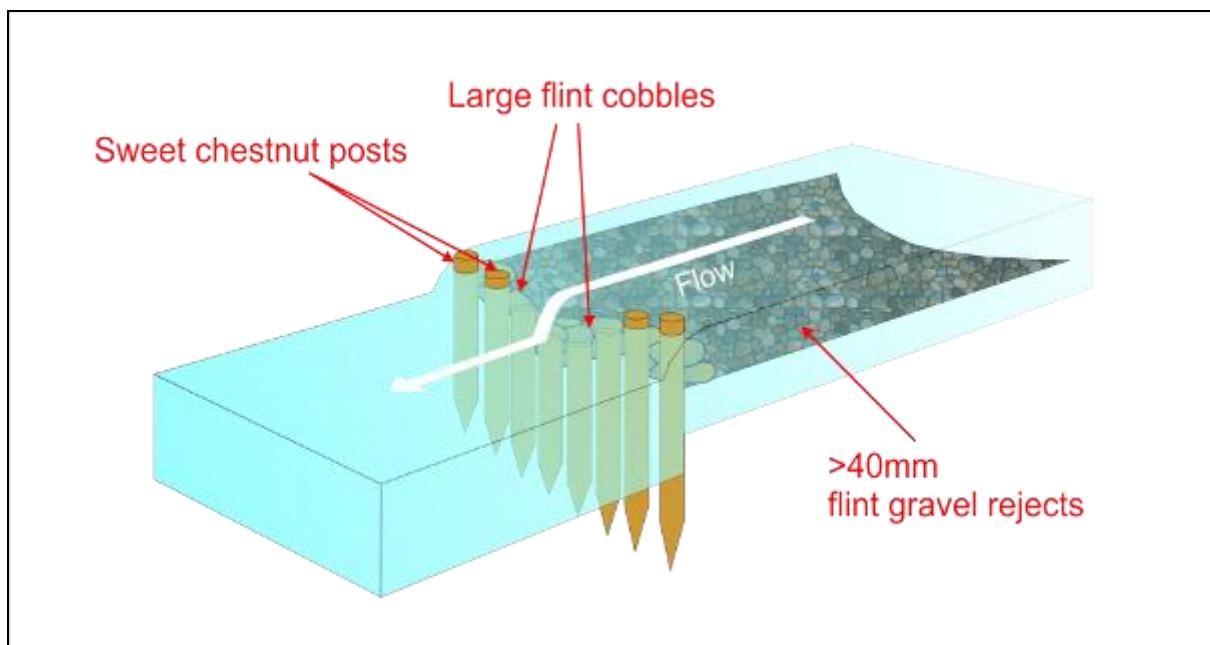
The main outfall (Photo 1) from the Mill Pond is intact but finding an effective solution for reducing the head differential at this particular location, as well as improving fish connectivity would be expensive and difficult, especially given the need to repair the centre of the dam and provide a sustainable solution for the site as a whole.

This main exit route could be utilised as a channel for emergency flood capacity, or possibly used to accommodate a smaller proportion of the flow via a restored but smaller off-line pond (option 3.2) created in the northeast corner of the existing Mill Pond (See sketch 1 on pg 13). This could be the best option if a pond at the site is considered as an essential component of a restoration plan. An inlet taking a small sweetening flow into any newly constructed pond could be taken off from a constructed main channel near to the top end of the existing Mill Pond. The pond carrier would feed into the new small pond with the current hatches forming the outlet structure. The new main channel should meander down through the existing pond bed to exit through the site where the current spillway is located.

If no pond is required then the hatch gates and winding gear on the existing outlet should be removed, as should the vertical piles (photo 2). If the gates were completely removed there may well be sufficient capacity without the need to accommodate additional flow on the old spillway.

The central part of the dam and associated spillway are in poor condition and of a flawed design (photos 6-10). Breaking out the existing culverts, concrete and block work spillway could provide a route for a modified main channel with a clear span bridge for access.

The current head-loss difference between downstream and upstream water levels could be gradually reduced, facilitating a natural channel recovery. If this were not possible because some of the dam structure is required for access, the head differential could be managed by creating a series of low steps in the new river bed using either blockstone or vertical wooden piles backfilled with imported cobbles and gravel (drawing 1).



Drawing 1. Small level check weirs can be created with imported stone or vertically driven posts backfilled with cobble and gravels.

These low "check-weirs" could be located both below and above the existing dam to reconnect the two levels. Each step should be sufficiently spaced to ensure stability and would need to be at least 30m apart longitudinally. The banks and margins of any newly created naturalistic channel lying within the confines of the old lake bed will initially need to be formed with an excavator and the soft banks defended with biodegradable soil saver and then planted.

The height of the banks immediately downstream of the existing dam may also need to be raised slightly to accommodate the increase in water levels and to protect the footings of the old mill building. Material taken out of the centre of the dam could be potentially used for this purpose. A clear span bridge would be required to facilitate access.



Photo 1. Existing pond outlet. If the river channel were to be restored, the hatches could be removed and this channel left as an emergency spillway with no operational requirement or maintenance liabilities.



Photo 2. The trash screen/walkway should be removed, as should the temporary bank repairs. This area of bank will naturally recover.



Photo 3 View of the drained down Mill Pond with huge quantities of settled sand. This area could be either a "green swale" or alternatively a small "off-line" pond but would still provide additional capacity during a large flood.



Photo 4. Existing outlet structure. No options for fish passage at this location.



Photo 5. Downstream end of existing outlet – a high velocity chute.



Photo 6. Damage to the downstream face of the dam.

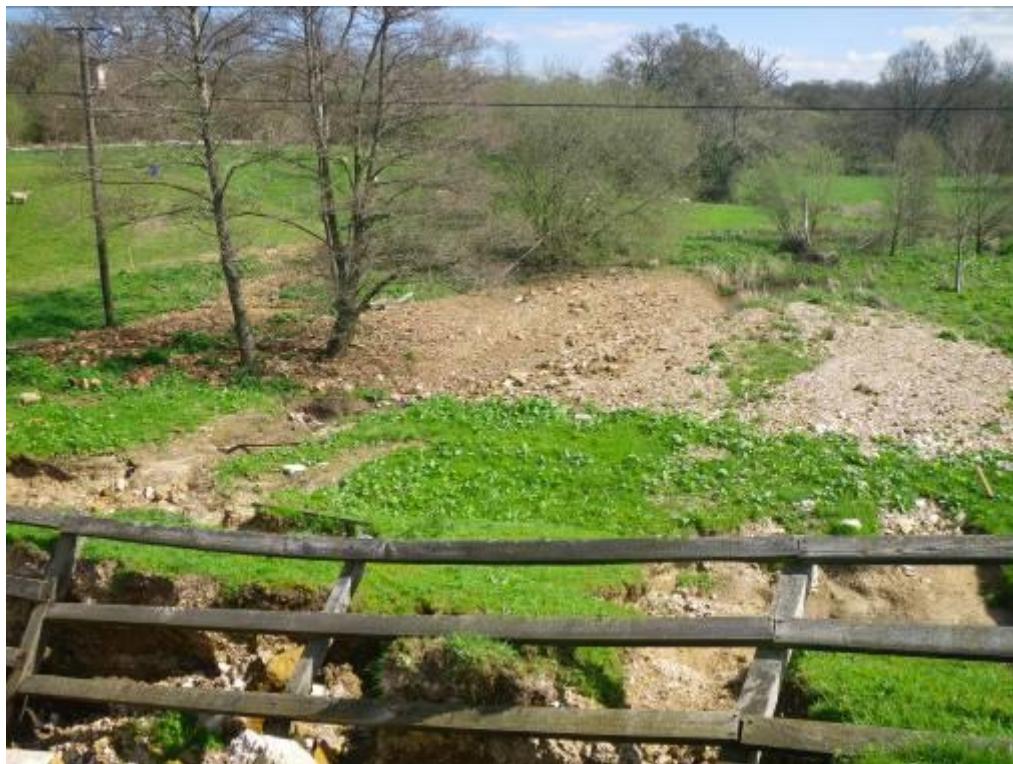


Photo 7. Spoil blown out from the dam structure.



Photo 8 High level spillway outlet. This could be broken out to create the new route for a naturalistic river channel.



Photo 9. Spillway channel. Potentially the route for a new main channel.



Photo 10. The inlet side of the spillway.



Photo 12. View upstream from the spillway. A new river channel with small managed "steps" in the bed to overcome the existing head differential could be created both downstream and within the bed of the old mill pond. Soft river margins would have to be defended with biodegradable geotextile and planted. The area to the right above could be raised to separate the channel from an excavated off-line pond if this is deemed an essential element of the project.

4. Conclusion and recommendations.

A full restoration to an on-line pond would be hugely expensive and be unsustainable as well as providing no environmental gain. If unlimited resources were to be thrown at this project then it is technically possible to create an off-line pond and resolve both flood risk and river connectivity issues but is likely to be a very expensive option. Other than aesthetics, a pond at this location will have very limited fishery value due to the constant risk of flooding.

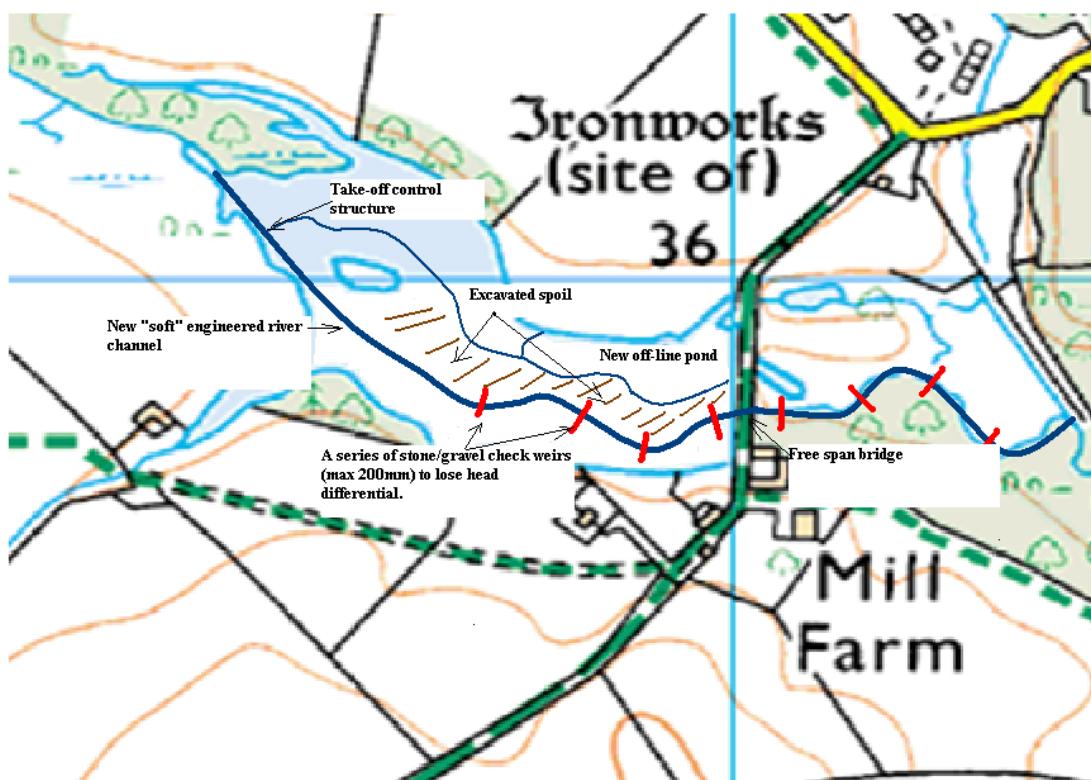
Cutting a large whole out of the centre of the dam, where the current spillway is located and facilitating a natural recovery in the river channel would be the most desirable environmental outcome. Installing a clear span bridge will be the most expensive aspect of this option. A full 'levels' survey is required to ascertain if a removal of a section of the dam down to the old Mill pond bed level is feasible without additional engineering measures. With this option there might be a requirement to either retain a low structure in the core of the existing dam, or build a series of smaller structures downstream to maintain stability in the remaining dam walls located either side of any new bridge abutments.

This option removes long-term implications for expensive maintenance and ensures that the ecological value of the stream is restored and flood risk issues resolved. It is recommended to commission an engineers report to ensure that

the buildings located on the dam can be adequately protected if this option is to be pursued.

A slow, managed reduction in dam height will allow the stream to carve a natural channel both up and downstream from the dam wall. No intervention should be carried out until as much of the head differential as possible has been removed. The bed level in the channel running up from the dam will cut down and the soft banks will slump and then become naturally vegetated and stable over time. This natural process will take at least one full year and it is recommended to leave the upstream site for at least two years before considering any intervention.

This option would provide a major enhancement to the river channel and will simply cost time rather than money.



Sketch 1. Indicative Sketch of how option 3.2 might look.

Acknowledgement

The WTT would like to thank the Environment Agency for supporting the advisory and practical visit programme.

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