**Advisory Visit**

**Colne Brook, Iver, Buckinghamshire**

**August 2018**

**Undertaken by Rob Mungovan**

## Key findings

- Juvenile brown trout (parr) habitat is limited. The shallow riffles have become degraded in the low summer flows and could be enhanced.
- Many areas are over-deep due to past dredging. Restoration of the former bed level could be undertaken through the importation of suitable stone and gravel.
- Fallen trees and trailing branches should be retained at water level. If fallen trees present a flood risk they can be manoeuvred into the channel margins and securely pinned down on to the riverbed or bank.
- Tree-hinging could be used to increase cover at and below water level and could be combined with a strategic approach to managing the existing tree stock.
- Retain parts of the fully tree-lined reaches due to the value of shade and its cooling affect.
- The invasive non-native plants, Japanese knotweed, floating pennywort and orange balsam were present and should be eradicated.
- The eroding shaded bank slopes are a source of fine sediment input to the river. The worst affected areas should be opened to allow then to become re-vegetated.

## 1.0 Introduction

This report is the output of a site visit undertaken by Rob Mungovan of the Wild Trout Trust to the Colne Brook at Iver on the 8th August 2018. The weather conditions were in the midst of a heat wave which had seen exceptionally low rain fall for the last 50 days. Comments in this report are based on observations on the day of the site visit.

Normal convention is applied throughout the report with respect to bank identification, i.e. the banks are designated left bank (LB) or right bank (RB) whilst looking downstream.

The visit was undertaken at the request of Tom White (Groundworks South) as a result of an Environmental Undertaking issued against Affinity Water. Tom White accompanied the author for the visit. In addition to comments made upon the river the recipient also requested descriptions of adjacent land use and its habitat potential, and a list of all species observed.

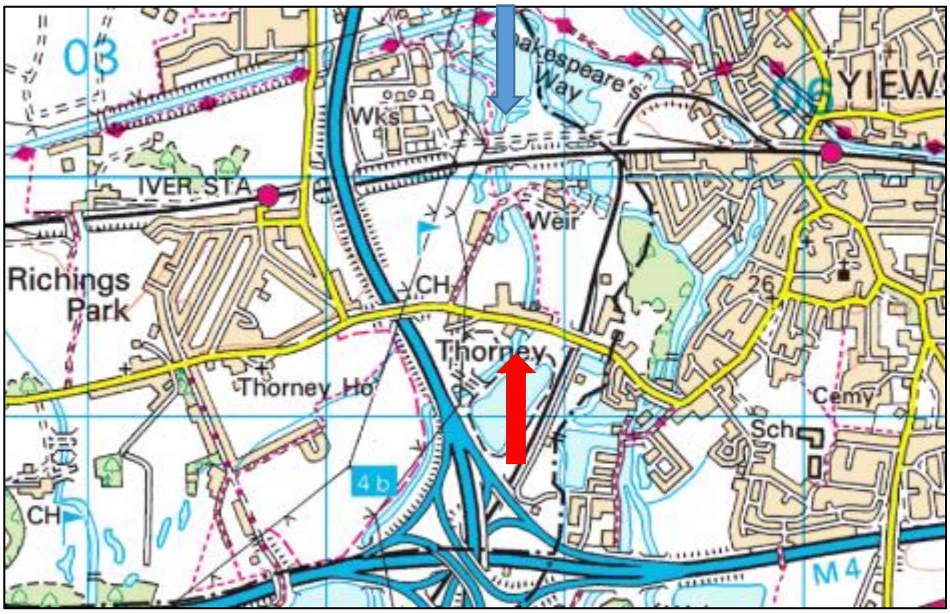
## 2.0 Catchment Overview

The Colne Brook is a distributary of the River Colne and runs from Uxbridge Moor to the River Thames at Hythe End, Wraysbury.

The reach visited flows through the Thorney Park Golf Course with a public footpath along its length. At Thorney Mill Road there was once a mill which backed-up water through the golf course. The mill no long stands and the river flows beneath the Thorney Mill Road following the removal of a weir.

Land use in the vicinity of the Colne Brook is a mix of housing with gardens abutting the river, a golf course through which the river flows, and scrub habitats with small blocks of woodland. The upper extent of the visit ended at the Iver North Waste Water Treatment Works (WWTW), an Affinity Water site.

The Colne Brook received no tributary streams within the reach visited.




Map 1 - Location of the Colne Brook, South Buckinghamshire. Red arrow is downstream limit and blue arrow is upstream limit. Scale 1:50,000, 1 grid square = 1 km2, © Ordnance Survey.

| | **River Colne Brook** |
|---|---|
| **River** | Colne Brook |
| **Waterbody Name** | Colne Brook |
| **Waterbody ID** | GB106039023010 |
| **Management Catchment** | Colne |
| **River Basin District** | Thames |
| **Current Ecological Quality** | Overall classification of **Moderate** for the 2016 cycle |
| **U/S Grid Ref inspected** | TQ 0469180137 |
| **D/S Grid Ref inspected** | TQ 0482379337 |
| **Length of river inspected** | ~840m in total |

Table 1 – Data from http://environment.data.gov.uk/catchment-planning/WaterBody/GB106039023010

Under the Water Framework Directive (WFD), the Colne Brook is designated as a 'Heavily Modified Waterbody' and is assessed against 'Ecological Potential'. The waterbody achieves an overall classification of 'moderate'. However, its rating for phosphates is 'poor' and is a limiting factor affecting the overall waterbody classification.

Tables 1 and 2 summarise the environmental data collected for the WFD assessment for the Colne Brook. In the last (2016) assessment cycle, it was classified 'moderate' ecological potential. Parameters that make up this overall classification include 'moderate' for fish (up from 'bad' in 2015) and 'moderate' for physio-chemical quality elements. Interestingly the invertebrates were not sampled in 2015 and 2016, with a major pollution event having occurred from the Iver North WWTW in November 2015. Appendix 2 details the fish killed in that incident. Note that no brown trout were found.

Reasons for Not Achieving Good status (RNAG) under the WFD assessment cycle include physical modification (this is clearly apparent upon walking the river), diffuse pollution as a consequence of urbanisation, diffuse pollution as a consequence of contaminated land and point source pollution from sewage discharge. All of these issues restrict the river's ability to support wild brown trout. Measures described in this report may be able to address some aspects of physical modification but underlying water quality issues may present a chemical barrier to wild brown trout recolonising the river.

The extensive vegetation growth is a possible indicator of the high phosphate loading of the water. Excessive weed growth may lead to water quality problems particularly in periods of low flow and high temperatures when vegetation can cause a wide diurnal oxygen fluctuation, resulting in a sag in dissolved oxygen concentrations at night. Rivers downstream of water treatment works can be particularly susceptible to low dissolved oxygenate concentrations, especially in hot weather. However, during the visit no fish were seen in distress.

The reach visited is not subject to angling. No fish stocking has been recorded at the site, even following the 2015 pollution incident. Hence all fish observed (dace, perch and minnow) are considered to be natural occurrences. Stocking of the Colne Brook has occurred further downstream at Horton (see appendix 3). Wild brown trout populations do occur in the River Colne's tributaries including the Misbourne, Gade, Chess and Ver, and if conditions were suitable and connectively were good trout could in theory colonise the Colne Brook. Brown trout stocking has taken place on the River Colne in 2014 (see appendix 4).

The river is not subject to any statutory nature conservation designations.

No signs of otter nor water vole were seen.

Cycle 2 classifications

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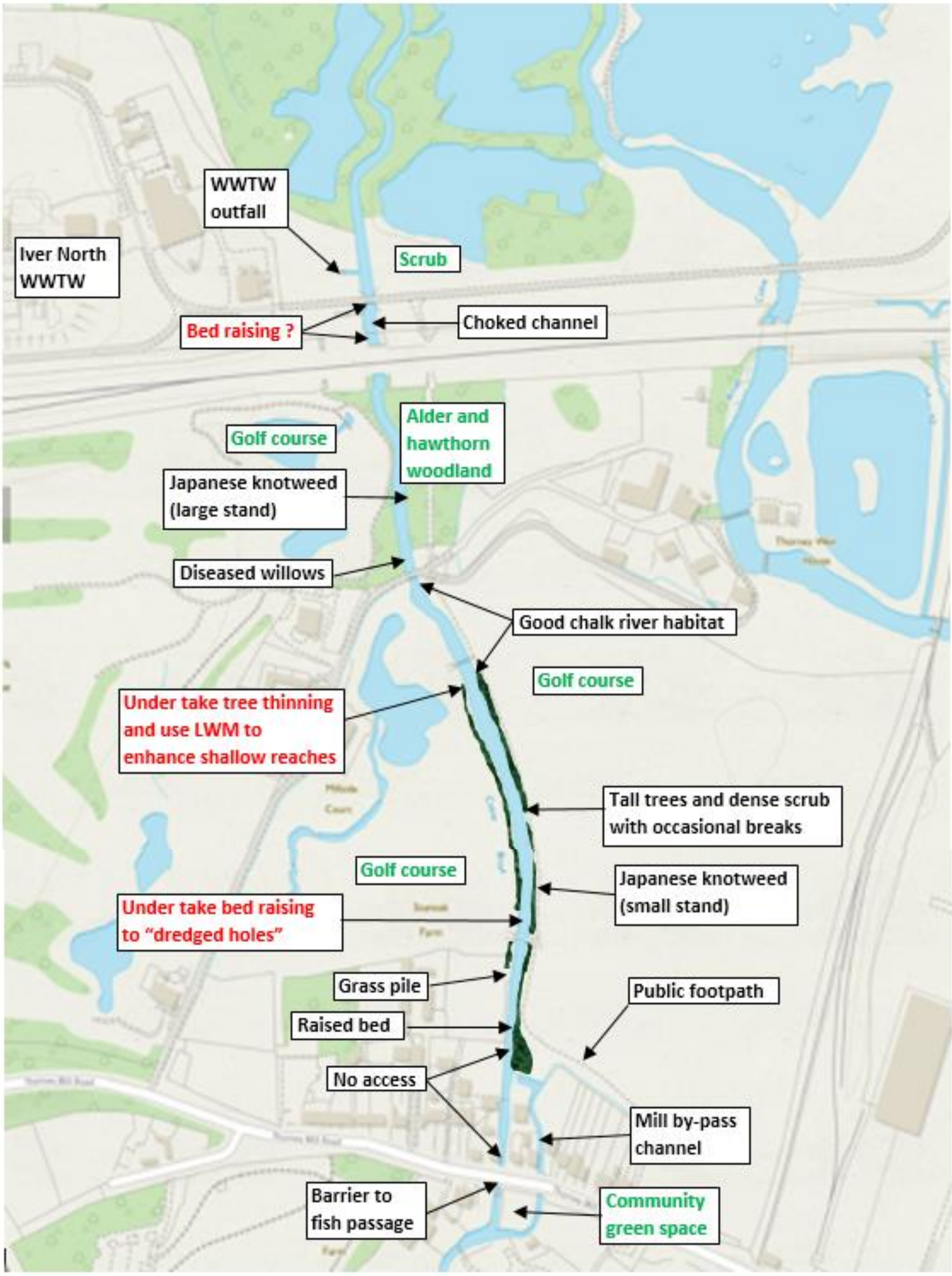
| Classification Item | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|
| **Overall Water Body** | Moderate | Moderate | Moderate | Moderate |
| Ecological | Moderate | Moderate | Moderate | Moderate |
| Supporting elements (Surface Water) | Moderate | Moderate | Moderate | Moderate |
| Biological quality elements | Poor | Poor | Bad | Moderate |
| Fish | Poor | Poor | Bad | Moderate |
| Invertebrates | High | High | - | - |
| Hydromorphological Supporting Elements | Supports Good | Supports Good | Supports Good | Supports Good |
| Physico-chemical quality elements | - | Moderate | Moderate | Moderate |
| Acid Neutralising Capacity | - | - | High | High |
| Ammonia (Phys-Chem) | - | High | High | High |
| Dissolved oxygen | - | High | High | High |
| pH | - | High | High | High |
| Phosphate | - | Poor | Poor | Poor |
| Temperature | - | High | High | High |
| Specific pollutants | Moderate | Moderate | High | High |
| Chemical | Fail | Fail | Good | Good |

Table 2 – Data from http://environment.data.gov.uk/catchment-planning/WaterBody/GB106039023010



Map 2 – Habitat features observed during the visit.

## 3.0 Habitat Assessment

River levels did not appear particularly low. This is probably a consequence of the Iver North WWTW being at the top of the reach which provides a steady flow input, and the fact that aquifer replenishment was significant for the chalk rivers following high spring rainfall. However, when stone turning it was noticeable that the river temperature appeared much warmer than would be expected for a chalk river. This is put down to the warmer temperature of treated effluent entering the river (in combination with the heat wave).

The visit commenced downstream of the Thorney Mill Road bridge. Here the channel was ~5m wide with a gravel bed consisting of well-graded particles but the substrate was black suggesting that it had been stable and partially compacted for many years (pic 1). The gravel was relatively easy to dislodge by foot and contained a high sand component. The sand limits the value of the gravel as a spawning substrate for brown trout. However, for many coarse fish species the gravel is considered adequate.

The water depth varied from ~0.05m to ~0.2m and was characterised by a glide habitat. Water crowfoot was present but was limited in size due to shade. There was minimal habitat due to the shade and hard edge surfaces. Only one yellow flag iris was present together with a limited amount of trailing willow branches. The RB was a garden with a hard concrete edge providing access down to the river. The RB provided no habitat value to the river.

Pic 1 – The riverbed downstream of Thorney Mill Road bridge was dominated by coarse gravel which was partially compacted with little depth variation. The inset shows the gravel to be cleaner than it first appears.

The former mill by-pass channel enters from the LB. Its channel is ~2m wide with ~0.1m depth of water over silty gravel. The channel is reported to suffer from intermittent water quality problems (possibly as a result of garden rubbish dumping). The by-pass channel is being left as an over-grown backwater and was not the focus of the visit.

The parcel of land between the Colne Brook and the mill by-pass channel is the site of a former house which following its demolition has left a small community green space. This space has potentially 35m of river frontage.

However, connection to the river is prevented by a high wall and railings (pics 2 & 3). The community green space would be greatly enhanced with a natural river frontage.

Pic 2 – The concrete retaining wall is left from the house that once stood behind the wall and railings.

Pic 3 – The community green space could be enhanced if it had a visual connection to the river.

Moving upstream, the double culvert bridge that supports the Thorney Mill Road is encountered. The drop beneath the bridge is estimated to be ~0.8m and results in water rapidly flowing down a smooth concrete flume for a length of ~1.2m (pic 4). The resulting rapid shallow-water prevents most fish from swimming up and through the culverts (it may be possible for adult trout to traverse the structure in higher flow conditions). Consequently the bridge is programmed to have a series of baffles attached to it to aid fish passage and natural recolonization of the Colne Brook.

Pic 4 – The double culvert and ramp arrangement that forms the Thorney Mill Road bridge.

Pic 5 – The Colne Brook looking upstream from the Thorney Mill Road bridge. The sheet steel piling supports houses which are situated close to the top-of-bank.

For ~100m above the bridge it was not possible to access the river due to private gardens. However, access was gained via a public footpath which ran adjacent to the river. Looking downstream towards the site of the removed mill weir it was apparent that the river channel had been deepened by historic dredging. However, it was interesting to note a limited number of occurrences where the bed was still raised with gravel present. It is believed that these discrete spots are in fact the original riverbed having been missed during past dredging (pic 6). These original bed occurrences could become important geomorphological features in planning river restoration as they provide spot levels for the riverbed pre-dredging.

Pic 6 – At a few locations a raised gravel bed was observed and is thought to be the remnants of the original river bed pre-dredging (red oval).

Pic 7 – Where the river has been deepened it is now dominated by fine sediments with the clay bed being revealed at some locations (inset).

The LB was dominated by dense trees and scrub which prevented access to the river. The RB had occasional trees. None of the trees were of any great size or age suggesting clearance in previous decades to facilitate river maintenance. The resultant tree canopy is now uniform as many trees are of a similar age and height. The re-growth of trees and scrub is desirable as long as it doesn't result in an entirely tree enclosed tunnel with an over-shaded and featureless river running through it. Tree cover along a river is important for invertebrate habitat and as sources of large woody material (LWM).

Whilst tree-shade is important for keeping rivers cool, too much shade will suppress the growth of aquatic and marginal plants. This can lead to a reduction in plant diversity and a subsequent decline in invertebrate numbers. Thus a balance needs to be struck along the lines of 60:40 to light and shade. Furthermore, fine sediment input may increase as banks are left bare of vegetation and become prone to erosion if tree roots are not able to bind fine sediment.

Moving upstream into the golf course the bed is deeper with only minimal deposits of gravel. The gravel has certainly been removed through dredging and has not been replaced due to poor coarse sediment transfer. The bed is dominated by fine sediment with outcrops of clay and/or chalk (pic 7).

Occasional riffles were observed which represent important juvenile brown trout habitat in a river restricted in such habitat. The fast water within the riffles had excellent water crowfoot growth, particularly where full sunlight reached the channel. Water crowfoot is important for retaining water depth, increasing in-channel cover, providing shade, and as a spawning substrate for many coarse fish species. The plant is typical of clean swift flowing rivers especially chalk rivers.

Once more the river became almost totally enclosed by tree canopy, providing an interesting contrast to the open reaches, and with trailing branches to water level (pic 8) represents potentially good brown trout habitat (closer inspection of depth and flow was not possible). Where the canopy is broken, dense aquatic vegetation of unbranched bur reed and yellow water lilies grew.

Pic 8 – The occurrence of trees trailing down to water level should be encouraged.

Fallen trees, large branches and stems are collectively referred to as LWM. The presence of LWM is extremely important within a river. It increases the available surface area on to which algae will grow and undertake photosynthesis thus initiating nutrient cycling. The algae can also become a source of food for invertebrates thus increasing the total biomass that a river can support. LWM can also provide underwater cover, offering protection for fish against otters or fish-eating birds.

LWM is also a key element in kick-starting geomorphic processes such as bed and bank scour, leading to the development of river features such as pools and riffles (where gradient allows). Furthermore, the sorting of bedload material can encourage the marginal deposition of fine sediment or enable it to be deposited on the floodplain when out-of-channel flow is experienced.

Fallen trees can be managed to retain their habitat value by winching them to a secure bankside position and securing them with stakes and fencing wire/or cable rope. Where riparian trees require thinning and their habitat potential as fallen LWM would otherwise be removed, a technique known as tree-hinging can be used (pic 34). Tree-hinging is similar to hedge laying in that it retains a living hinge that secures the cut stem to the tree stump. The hinge continues to allow the tree to live so structural strength is retained. With the tree-top laid at water level it provides excellent in-stream cover and flow deflection. To remove naturally occurring fallen trees would result in habitat degradation. These two approaches would be suitable for some of the trees within the reach visited. Alternatively, felled riparian trees can be used as a source of material to construct brushwood mattresses. These structures can be used for natural bank protection purposes (outside of bends) or as a matrix to collect fine sediments which will consolidate over time leading to the formation of a new bank (inside of bends).

Pic 9 – Where access to the river could be gained through the dense tree and scrub cover there was an attractive swift flowing river but habitats for wild brown trout could be improved.

The river would benefit from habitat enhancement and management. For example, the tree cover was at a high level with few branches trailing down to water level. Trailing branches are particularly important as overhead cover for a wide range of fish, especially trout, creating micro-pocket water and increasing the number of lies within a river. The branches also present opportunities for invertebrates to fall into the channel where they become food for fish. Branches that extend into the water may provide a means for some aquatic invertebrates to return beneath the water in order to lay their eggs. As trees have matured and stabilised the banks at some locations their roots provide excellent cover for invertebrates and small fish, with elm and alder being particularly notable at this site.

The management of the golf course requires extensive grass cutting. At one location the grass cuttings have been dumped on the bank-top resulting in their gradual fall to the river. The introduction of grass cuttings to the river is detrimental as it will add nutrients to the water. The grass dump should be moved away from the river.

Pic 10 – The dumping of waste grass cuttings presents a pollution threat to the river. The activity should be stopped and the waste removed from the edge of the river.

As the river was followed upstream its width varied from ~4m to ~9m with a maximum depth of ~1m. The banks were relatively steep and where the tree canopy was dense marginal vegetation was limited (pic 11). However, there is a relatively short reach (~100m) that contrasts quite dramatically with the rest of the river visited. At this point the banks are low and gently grade down to the river (pics 12 & 13). The graduation to water provides a greater extent of hydrological niches and consequently plant diversity is greater with extensive marginal growth of watercress, brooklime and bittersweet. Where the bed shallowed there were riffles. Shallow glides were dominated by a relatively silt-free coarse substrate which is considered suitable for brown trout to spawn upon.


Pic  11 – Slower and deeper glides were becoming dominated by unbranched bur reed with the controlling influence of shade clearly visible.


Pic 12 – The Colne Brook showing the chalk river form that is expected of it; low gently shelving margins, abundant marginal cover, a shallow depth with variation and diversity of vegetation growth.

Pic 13 – A gentle transition from the top of bank to water allows a greater diversity of plants. This picture shows an attractive stand of marsh woundwort.

Wild brown trout require diverse habitat, food, spawning and nursery areas as well as good water quality. Vital aspects of habitat diversity are created through active geomorphic processes which are a product of gradient and stream power, causing erosion and subsequent deposition. As sediments are transported they will be deposited according to flow. This may enable the development of riffles and glides which are extremely important as fish spawning areas. Trout (as well as chub, dace and minnows) will spawn upon well-sorted gravels (particularly in the range 15mm to 40mm) that are relatively stable within a river. It was very encouraging to see a large shoal (100+) of minnows which had gathered to spawn.

Riffles provide valuable habitat for juvenile trout which keeps them from competing with (or from being eaten by) adult trout (who tend to favour the cover of deeper water found in pools or glides). The Colne Brook did not have extensive riffles. Whilst adults may be able to find spawning areas it is considered that juvenile habitat is currently acting as a bottleneck to the river containing greater numbers of wild brown trout.

The shallow open reach is being naturally narrowed by its marginal vegetation (pic 14). In addition to providing extensive cover, the narrowing increases the water velocity which aids fine sediment transfer thus enabling a degree of self-cleansing as vegetation dies-back in the autumn and water velocity increases as the river level drops (following the flush-out of vegetation). The ability of chalk rivers to cleanse themselves of summer vegetation and fine sediment build-up is important if spawning substrate is to be revealed ahead of the winter spawning period.

Pic 14 – Watercress provides channel narrowing which in addition to increasing marginal cover cleanses the bed of fine sediment sustaining conditions for typical chalk rivers plants of starwort and water crowfoot.

It was noted that the watercress was dying-back (note the brown colouration of plants (pic 15)). The cause is believed to be either the mustard or flea beetle which commonly feed upon watercress and other plants of the Cruciferae family. This occurrence has been seen before and is not considered a cause for alarm.

Pic 15 – Die back of watercress due to insect infestation.

There are a few mid-channel stands of common club rush and reed canary grass which act as anchor points for watercress and brooklime. These mid-channel stands of vegetation create further flow diversity and cover habitat. Their occurrence is not a problem in shallow reaches.

Pic 16 – Tree cover over shallow reaches suppresses the growth of both marginal and aquatic vegetation. The tree on the RB is suitable for hinging into the river.

Shaded shallow reaches were wide and exhibited little in the way of flow diversity or bed depth variation. Such areas would benefit from a reduction of shade in order to establish marginal vegetation which would initiate natural channel narrowing and flow diversity, similar to pic 12.

Pic 17 – The banks of some of the most densely shaded reaches were devoid of marginal growth. The banks were largely bare earth which is susceptible to erosion by rain and frost action resulting in the addition of fine sediment to the river.

Pic 18 – Floating penny wort (red arrows) an invasive non-native species is growing amongst the native flora of the river.

In places the riverbed is covered by a dense growth of lesser water parsnip. This is quite desirable as the plant creates a huge amount of surface area which is utilised by invertebrates and small fish. The plant dies back in winter and can be washed away in high flows to reveal the gravel bed again. Lesser water parsnip can tolerate partial shade.

Pic 19 – Orange balsam (Impatiens capensis), an invasive non-native species, was present throughout much of the open reaches.

The upper most reach of the golf course has been deepened by dredging to a depth of ~1.2m and is consequently invaded by yellow water lilies and branched bur reed which grow in silt conditions with little bed scour to prevent their dominance (pic 20).

Pic 20 – The river has again been deepened through dredging. Note the dominance of yellow water lily.

At the upper most extent of the golf course a raised marker line was noted in the ground reading "Do not remove - flood protection". Prior to any work that may increase flood risk the gravity of this warning must be understood.


Pic 21 – Flood protection warning sign in the ground (red line).

On the approach to the WWTW a number of dead and dying willows were observed (pic 22). It is believed that these trees are dying as a result of honey fungus and no action is recommended. These trees will become a future source of LWM.

Pic 22 – A willow tree (one of many) believed to have honey fungus.

Japanese knotweed was observed at two locations. The largest stand was immediately adjacent to the river and was being prevented from spreading by the dense shade cast by hawthorn trees (pic 23). As an invasive non-native species, Japanese knotweed presents a serious risk to the Colne Brook. The plant is spread by root propagules and is very adept at colonising riverbanks. Once present, its tall growth enables it to outcompete many native plants. The knotweed then establishes monocultures further reducing low-growing species, such as grasses, which are crucially important for binding the soil. Furthermore, knotweed dies back in the winter leaving riverbanks almost completely devoid of vegetation and prone to erosion by rain and scour. It is prudent to undertake control of knotweed when it is in low numbers before it becomes a problem.

Upstream of the golf course within the wooded area, a large mound of spoil was found (pic 24). The spoil is believed to be former river dredgings. If the dredgings consist of a high proportion of coarse sediment it may be possible to re-use it for riverbed restoration.

Relatively young alder trees line the LB bank as one approaches the railway line. Immediately downstream of the railway bridge the riverbed was shallower suggesting that it had not been subject to extensive dredging. Again, these more natural areas of riverbed form can be used to guide riverbed restoration.

Pic 23 – Japanese knotweed, an invasive non-native species, growing on top of the riverbank.

Pic 24 – A spoil pile from historic river dredging.

Downstream of the Iver North WWTW the channel is entirely choked with vegetation and very little open water is present. The dense vegetation and tall banks prevent access to investigate bed depths and bank form. However, there does appear to be a slight vegetated berm extending out from the RB (pic 25, see red line). This reach could be further investigated once the vegetation has died back.

Pic 25 – The choked river downstream of the Iver North WWTW.

At the end of the reach visited the channel is again over-shaded which suppresses vegetation growth. The outfall from the WWTW was found and gave no cause for concern.

Pic 26 – This picture was taken in a shaded reach immediately above pic 25. Without further investigation it is assumed that the reach below the bridge has a similar bed depth (i.e. is over-deep).

On the opposite side of the river from the WWTW there is an extensive area of scrub. Scrub is an important habitat for breeding birds providing both a source of food (berries) and dense cover for nesting. The dry open soils beneath and between trees are often important for terrestrial invertebrates and reptiles. These habitats are complementary to the river corridor and provide an important undisturbed area in contrast to the golf course.

Pic 27 – The land opposite the Iver North WWTW is scrub land, a much undervalued habitat particularly on the edge of urban areas.

A short period of time was spent investigating the aquatic invertebrates as they are indicators of water quality. A qualitative assessment was used that saw a 30 second kick sample and 30 second net sweep undertaken together with stone turning.

The first site investigated was downstream of the Thorney Mill Road bridge. The sample contained much fine sediment once the gravel had been dislodged. The sample was surprising low in its general number of invertebrates with ~20 *Gammarus* observed. Several (~3) mayfly larvae were caught (*Ephemera danica*). River limpet were also present but the samples were dead. Hoglouse and flat worms were present but the sample was otherwise impoverished from what one would expect from a chalk river. Stone turning revealed a bullhead fish and a large signal crayfish. There were a low number of *Agapetus sp* clinging beneath large stones. No stone crawling mayflies were observed. The water was comfortable to put ones hands into, usually chalk rivers feel very cold when immersing hands. It is likely the upstream WWTW is causing water temperature to be unnaturally elevated. Overall the sample gave the impression of a restricted invertebrate fauna.

The second site investigated was immediately upstream of the Thorney Mill Road bridge. The sampling was the same as for the first location. The water velocity at this location was more rapid than the first and the riverbed was covered in places by aquatic vegetation dominated by water crowfoot. The sample contained many more *Gammarus* (100+) which were abundant amongst the organic matter collected at the base of aquatic plants. A greater number of *Agapetus* were caught as well as flatworms and a live river limpet (in addition to empty shells). The overall impression was that this location had more invertebrates but that the range of families represented was still restricted (pic 28).

Pic 28 – Invertebrate sampling revealed a suspected impoverished fauna. Clockwise from top left;
Hoglouse – tolerant of poor water quality and found where one would have expected Gammarus.
Mayfly larvae (E. danica) – generally seen as a good water quality indicator, low numbers observed.
Signal crayfish – an invasive non-native species which is known to reduce invertebrate numbers and richness, generally considered very disruptive to aquatic ecosystems once present in large numbers.
Gammarus (freshwater shrimp) – were found in good numbers in rapid water amongst plant matter.

With the Colne Brook prone to diffuse and point source pollution (list as RNAG) it is likely that it may continue to suffer water quality issues into the future. It may therefore seem an unrealistic target to aim for the Colne Brook to sustain a wild trout population at present. That said, there is much opportunity to improve in-channel and riparian habitat to support an improved coarse fish population. Many of the techniques that have been developed by the WTT to help improve trout populations will also benefit a wide range of coarse fish species.

A species list of all plants and animals observed during the visit can be found in Appendix 1.

## 4.0 Recommendations

The river is limited in juvenile brown trout habitat. The shallow glides and riffles present an opportunity for safe in-channel working. It would be possible to conceive a habitat enhancement scheme to increase the juvenile trout holding potential of the river through the application of approaches such as flow deflectors (pic 29), brushwood berms (pic 30) and the fixing of LWM to the riverbed (pic 31). Additionally, in gravel rich rivers that are subject to poor flow and depth diversity, a technique known as dig and dump can be used. This sees an excavator working from within the river to locally re-distribute bed material to create pools. The material excavated from the pools is used to pinch in the channel to locally increase water velocity upstream of a pool (pic 32), thus keeping it energised and cleansed of silt. The WTT would be able to provide further support on this issue. These habitat enhancement approaches alone cannot bring about true river restoration.

Pic 29 – A flow deflector used to focus flow and scour into the centre of the channel.

Pic 30 – A brushwood berm used to encourage marginal deposition, which in turn will become a rooting a substrate for plants and is also excellent cover for fry.

Pic 31 – LWM fixed to the riverbed to create areas of local scour and in-channel cover.

Pic 32 – The technique of dig and dump can be used in shallow gravel-rich rivers where the gradient will allow the formation of new pools and riffles. The excavated bed material is used to narrow the channel leading into a pool.

The river has been over-dredged in many locations and it would appear that there is little downstream transfer of coarse sediment. The river is unable to restore its proper riverbed profile without significant intervention. The usual approach to addressing historic dredging is to undertake riverbed restoration through the placement of gravel and stone.

Restoration of the riverbed to the level that is was pre-dredging would enable the establishment of proper sediment transfer through the processes of scour and deposition. There appeared to be a number of "high spots" where the original riverbed has escaped dredging. Before riverbed restoration can be properly proposed it would be advisable to undertake longitudinal bed and bank level surveys in order to better understand the riverbed gradient and top-of-bank heights together with cross section. The EA may already hold such data and should be approached.

The reach of river immediately upstream of the railway line to the WWTW access road, provides a discrete area (~30m) in which to undertake riverbed raising with no residential properties in the vicinity nor any requirement for tree removal. It is also assumed that Affinity Water control the land, this should be clarified.

Riverbed restoration should increase water velocity which in turn should aid fine sediment transfer leaving a clean gravel bed. This approach is likely to reduce the dominance of bur reeds, and to a lesser extent yellow water lily.

Pics 33 – Raising the riverbed to the form that it was pre-dredging restores sediment transfer, flow diversity and hugely increases the range of aquatic niches. Bed raising on the River Gwash used 300T of mixed grade stone to raise the bed ~0.5m over ~100m (at ~5m width).

Some reaches have become over-shaded. Shallow reaches have the greatest capacity to self-restore once light is let in again. Such reaches should be mapped and a tree management plan drawn-up. Tree hinging into the shallow reaches would speed-up self-recovery as LWM kick-starts the processes of scour, sediment transfer and deposition.

Pic 34 – An example of tree hinging, a simple and effective technique for increasing cover and scour in a river.

Pic 35 – Removal of the shade-casting canopy has allowed the native marginal plants to grow. Once the marginals become established they consolidate silt and bring about further channel narrowing (in this pic brushwood ledges have been used to accelerate the process).

Tree management should also have regard to the need to retain trees, particularly over pools, for their shade to aid summer cooling and for controlling vegetation growth. Trailing branches at water level should not be removed unless absolutely necessary as trailing branches will increase the holding capacity for fish.

Fallen trees, where present, represent important habitat features and should be retained and if deemed a flood risk made secure. To remove naturally occurring fallen trees would result in habitat degradation.

The use of LWM in the form of brushwood mattresses could help to speed up deposition and consolidation of fine sediment. Stable silt bars then provide an opportunity for colonisation by vegetation and provide further marginal habitat for invertebrates.

The Japanese knotweed, floating penny wort and orange balsam are all invasive non-native species and should be eradicated through plant specific control (balsam can be pulled or strimmed, penny wort can be collected and removed from the river but knotweed requires repeat control with an EA approved herbicide) in order to prevent them from dominating the aquatic and riparian flora.

## 5.0 Making it Happen

It is a legal requirement that (most) works to 'Main River' sites like the Colne Brook require written EA consent prior to their implementation, either in-channel or within 8 metres of the bank.

The Wild Trout Trust can provide further assistance in the following ways:

- Assisting with the preparation and submission of an Environmental Permit to the EA (formerly referred to as Land Drainage or Flood Defence consents).

- Running a training /demonstration day to demonstrate the techniques described in this proposal.

We have 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 stocks and managing invasive species.

The DVD is available to buy for £10.00 from our website shop www.wildtrout.org/product/rivers-working-wild-trout-dvd-0 or by calling the WTT office on 02392 570985.

The WTT website library has a wide range of materials in video and PDF format on habitat management and improvement: www.wildtrout.org/content/library

## 6.0 Acknowledgement

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## 7.0 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.

## 8.0 Appendix 1

A list of all species observed during the visit.

| **Common name** | **Latin name** |
|---|---|
| Common alder | Alnus glutinosa |
| Hawthorn | Crataegus mongyna |
| Willow sp. | Salix sp. |
| Ash | Fraxinus excelsior |
| Guelder rose | Viburnum opulus |
| Blackthorn | Prunus spinosa |
| Greater burdock | Arctium lappa |
| Bramble | Rubus fruticosus |
| Starwort | Callitriche sp. |
| Water crowfoot | Ranunculus sp. |
| Lesser water parsnip | Berula erecta |
| Duckweed | Lemna minor |
| Common club rush | Schoenoplectus lacustris |
| Orange balsam | Impatiens capensis |
| Japanese knotweed | Fallopia japonica |
| Floating pennywort | Hydrocotyle ranunculoides |
| Brooklime | Veronica beccabunga |
| Water forget-me-not | Myosotis scorpioides |
| Watercress | Rorippa nasturtium-aquaticum |
| Watermint | Mentha aquatica |
| Reed sweet grass | Glyceria maxima |
| Unbranched bur reed | Sparganium emersum |
| Branched bur reed | Sparganium erectum |
| Gypsywort | Lycopus europaeus |
| Sycamore | Acer pseudoplatanus |
| Buddleja | Buddleja davidii |
| Yellow flag iris | Iris pseudacorus |
| Purple loosestrife | Lythrum salicaria |
| Stinging nettle | Urtica dioica |
| Field bindweed | Convolvulus arvensis |
| Ivy | Hedra helix |
| Common reed | Phragmites australis |
| Lesser pond sedge | Carex acutiformis |
| Elder | Sambucus nigra |
| Dogwood | Cornus sanguinea |
| Bittersweet | Solanum dulcamara |
| Elm sp | Ulmus sp |
| Yellow water lily | Nuphar lutea |

| | |
|---|---|
| Field maple | Acer campestre |
| Arrowhead | Sagittaria sagittifolia |
| Poplar sp | Populus sp. |
| Angelica | Angelica archangelica |
| Hazel | Corylus avellana |
| Marsh woundwort | Stachys palustris |
| Yellow cress | Rorippa amphibia |
| A colonial algae | Batrachospermum sp |
| Common hogweed | Heracleum sphondylium |
| Teasel | Dipsacus fullonum |
| Creeping cinquefoil | Potentilla reptans |
| Common knapweed | Centaurea nigra |
| Canada goose | Branta canadensis |
| Moorhen | Gallinula chloropus |
| Collarded dove | Streptopelia decaocto |
| Great tit | Parus major |
| Robin | Erithacus rubecula |
| Swallow | Hirundo rustica |
| Kingfisher | Alcedo atthis |
| Dace | Leuciscus leuciscus |
| Perch | Perca fluviatilis |
| Minnow | Phoxinus phoxinus |
| Comma | Polygonia c-album |
| Large white | Pieris brassicae |
| Speckled wood | Pararge aegeria |
| Banded demoiselle | Calopteryx splendens |

# 9.0 Appendix 2

The carcass count data following the November 2015 pollution incident from the WWTW:

| **Species** | **<15cm** | **15-25cm** | **25-35cm** | **>35cm** | **Total weight (g)** |
|---|---|---|---|---|---|
| Chub | 12 | 11 | 3 | 4 | |
| Perch | 34 | 23 | 9 | | |
| Pike | 2 | 3 | | 6 | |
| Roach | 32 | 1 | | | |
| Dace | 21 | | | | |
| Bullhead | 42 | | | | |
| Total | 143 | 38 | 12 | 10 | 205 |
| **Other fish** | | | | | |
| 1 Eel | | | | | 750g |
| 38 unspecified species found elsewhere | | | | | |

## 10.0 Appendix 3

Consented coarse fish introductions:

| | | | |
|---|---|---|---|
| 12 December 2012 | Colne Brook - Horton | TQ01757491 | Chub 8-15 cm - No 1000 roach 8-15 cm - No 1000 dace 8-15 cm - No 500 |
| 19 December 2012 | Colne Brook - Horton | TQ01757491 | Barbel 8-15 cm - No 250 bream, common 8-15 cm - No 250 |

## 11.0 Appendix 4

Consented brown trout introductions:

| | | | |
|---|---|---|---|
| 01 May 2014 | River Colne | TQ04309340 | Brown trout 26 cm - No 200 |