Blackwell Hall Farm - Baseline report

Part A – Modular River Survey

Smarter Water Catchment Programme

July 2024

Working in partnership

Contents

List of figures

1   Introduction

This report contains a description of the baseline Modular River Survey (MoRPh) data captured by citizen scientists engaged on the River Chess at the Blackwell Hall Farm site (Figure 1.1) located approximately 3km south east of the town centre of Chesham, immediately downstream of Chesham Sewage Treatment Works. The channel flows south east, and is culverted under Blackwell Hall Lane at the upstream end of the site (Figure 1.2)

MoRPh is a bankside surveying technique developed by Queen Mary University of London that enables non-specialists to gather scientific data on the physical, ecological and hydrological condition of water bodies and adjacent land. Short lengths or 'subreaches' of the river are surveyed and the results are used to calculate 14 indicies that represent physical habitat mosaics and human pressures. The surveys allow independent monitoring and evaluation of our river restoration projects. We can therefore be held to account if project goals are no longer being met, and can investigate and intervene if necessary, to ensure the long term-success of restoration work.

A programme of recruitment and training was started in early 2022, kindly funded by a grant from the Chess Smarter Water Catchments Programme. As of January 2024, our volunteers have undertaken 158 MoRPh surveys throughout the Chess catchment This demonstrates a huge commitment from volunteers who have not only provided their time but have also co-ordinated to ensure surveys are completed in pairs, and demonstrated a great level of rigour to ensure the data gathered and uploaded is of the best quality possible.

Figure 1.1: General view of the River Chess at the Blackwell Hall Farm site (subreach 5) taken during the baseline MoRPh surveys.

In this report, we summarise the findings of the baseline MoRPh surveys at the Blackwell Hall Farm site (Figure 1.2). We make comparisons with the online MoRPh database[1] which contains all the data collected by citizen scientists since the Modular River Survey began in 2016, and have filtered the surveys undertaken on chalk streams[2]. This is used to help us measure the current condition of the river in comparison to the wider River Chess catchment and other chalk streams across the UK. We have summarised the baseline conditions of the Blackwell Hall Farm site because future river restoration works are planned for the River Chess catchment. To set river restoration objectives, it is necessary to understand the site, as the baseline conditions will help us decide which restoration activities are most suitable.
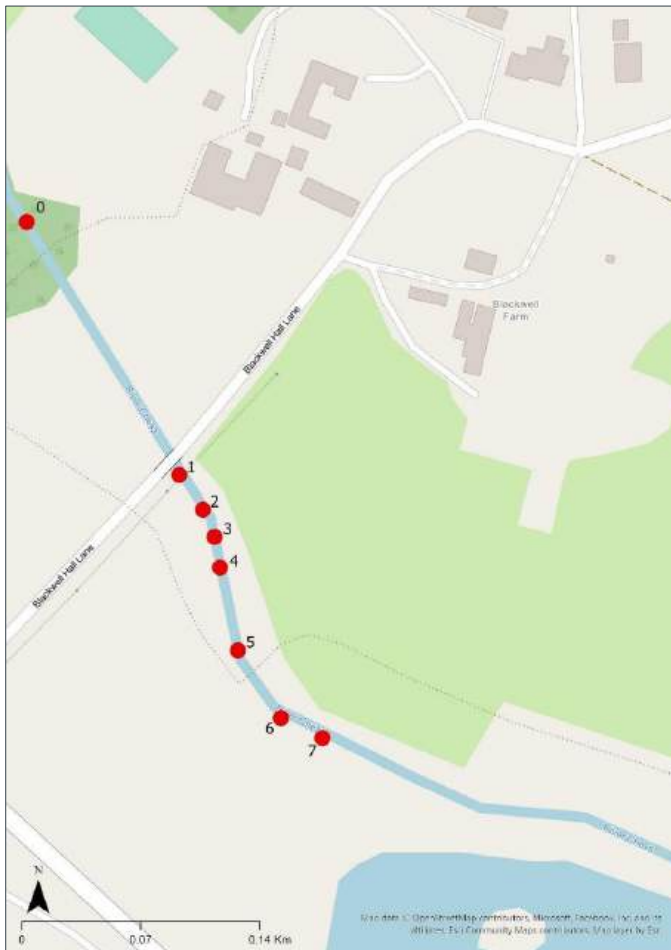
Figure 1.2 Map of the River Chess at the Blackwell Hall Farm site, showing the locations of the MoRPh subreaches (red circles).

We have summarised the baseline conditions of the Blackwell Hall Farm site because future river restoration works are planned for the River Chess catchment. To set river restoration objectives, it is necessary to understand the site, as the baseline conditions will help us decide which restoration activities are most suitable. In this report, we also summarise the restoration activities that are planned for the Blackwell Hall Farm site and we link the activities to the baseline conditions gathered from the pre-restoration MoRPh surveys.

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[1] MoRPh Citizen Science Map, https://modularriversurvey.org/map/, accessed 12/02/24

[2] Sites from the MoRPH database were filtered based on whether they were undertaken within 50m of a chalk stream (utilising: DEFRA Priority Habitat Chalk rivers and Streams, https://naturalengland-defra.opendata.arcgis.com/datasets/1bb8e710c8254e8fa33e95c7bc13229e, accessed 12/02/24)

It is worth noting that the analysis within this report is based on the average values from the baseline citizen science MoRPh surveys. Therefore, we have not discussed the possible differences in the results due to surveys undertaken in multiple seasons.

2   What did we learn from the baseline MoRPh surveys?

2.1   Site overview

Baseline surveys were undertaken on eight subreaches[3] of the River Chess (Figure 1.2) at the Blackwell Hall Farm site in November 2023. The river has been affected by centuries of historical modification, including canalisation and drainage for flood defence, farming and fishing pursuits, urban development and for industries such as milling. At the upstream end of the Blackwell Hall Farm site, the channel is culverted under Blackwell Hall Lane Road (Figure 2.1). It is likely the channel has been historically modified (artificially straightened) due to agricultural land use. The land use is predominantly agriculture, and the floodplain is used for sheep and cattle grazing. Extensive grazing by livestock on the floodplain has led to poaching of the channel banks. As a result, there has been increased erosion of the channel banks and excess sediment runoff into the channel. There is also an outfall associated with the Chesham Sewage Treatment works discharging at the downstream end of the site (Figure 2.1). There was existing fencing along the channel banks at the site therefore, the surveyor's access to the channel banks was restricted at some subreaches. This may have limited the surveyor's ability to accurately see and survey all the features in each subreach.

Figure 2.1: Photo of the culvert under Blackwell Hall Lane Road, taken at Subreach 1 (left). Photo of the outfall associated with the Chesham Sewage Treatment Works, taken at Subreach 7 (right).

The baseline MoRPh data (Figure 2.5 and Figure 2.6) shows the number of flow types (Index 1) was recorded as two at the majority of subreaches (Figure 2.2). This is on average relatively low, about the same as the UK chalk stream average, but below the number of flow types that the river should naturally contain (pre-modification). Index 2 illustrates the highest energy flow types recorded were rippled, unbroken standing wave and smooth.

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[3] Subreaches are sections or 'reaches' of the river that have been divided up to undertake the survey following the standard MoRPH methodology

Figure 2.2: Photos of the lack of flow diversity taken at Subreach 1 (left) and Subreach 5 (right).

The bed material was mostly made up of sand but gravel material was the coarsest bed material type recorded at all subreaches. The extent of bed siltation was very variable, ranging from 0 to 6, and higher amounts of bed siltation can be detrimental for aquatic species and water quality. The subreaches with the highest bed siltation, were those with very little riparian cover. These subreaches are likely to have been impacted by livestock grazing and poaching the banks, causing excess sedimentation runoff into the channel (Figure 2.8). Additionally, the downstream subreaches are wider than those upstream also contributing to excess siltation. There was also an outfall located at subreach 7, and silt was likely being deposited at the confluence of the main channel with the effluent outfall flow.

On average, channel physical habitat complexity (Index 8) was about average for UK chalk streams and the River Chess catchment whereas the average number of aquatic vegetation morphotypes[4] (Index 9) was higher than the UK rivers and UK chalk stream averages (Figure 2.3).

Figure 2.3: Evidence of the average channel phsyical habitat diversity and aquatic vegetation morphotypes. Taken at Subreach 3 (left) and Subreach 5 (right).

Riparian physical habitat complexity (Index 10) and the riparian vegetation structural complexity (Index 11) were both on average poor in comparison with the average for all UK rivers and UK chalk streams. The small variation in riparian physical habitat further illustrates the low complexity of the riparian habitat. This is likely reflecting the absence of riparian vegetation at some subreaches and the highly overgrown vegetation at other subreaches (Figure 2.4).

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[4] Organisms that share particular physical characteristics (size, height etc.)

Figure 2.4: Photos of the variation of riparian vegetation complexity shown by a lack of riparian physcial habitat and structural complexity at Subreach 1 (left) and more complex and highly overgrown riparian vegetation at Subreach 6 (right).

A small amount of human pressure on the bank top was recorded at all subreaches likely due to the managed riparian cover on both banks (Index 12). Channel reinforcement was recorded at subreach 7 due to the artificial outfall structure (Index 13). No non-native invasive plant species were recorded at any of the subreaches (Index 14).

Average Index value at Blackwell Hall Farm

● 0 ● 1 ● 2 ● 3 ● 4 ● 5 ● 6 ● 7

Index value comparisons

● Pre-projectChess mid-reach ● Chess data ● UK Chalk Streams ● UK MoRPh Database
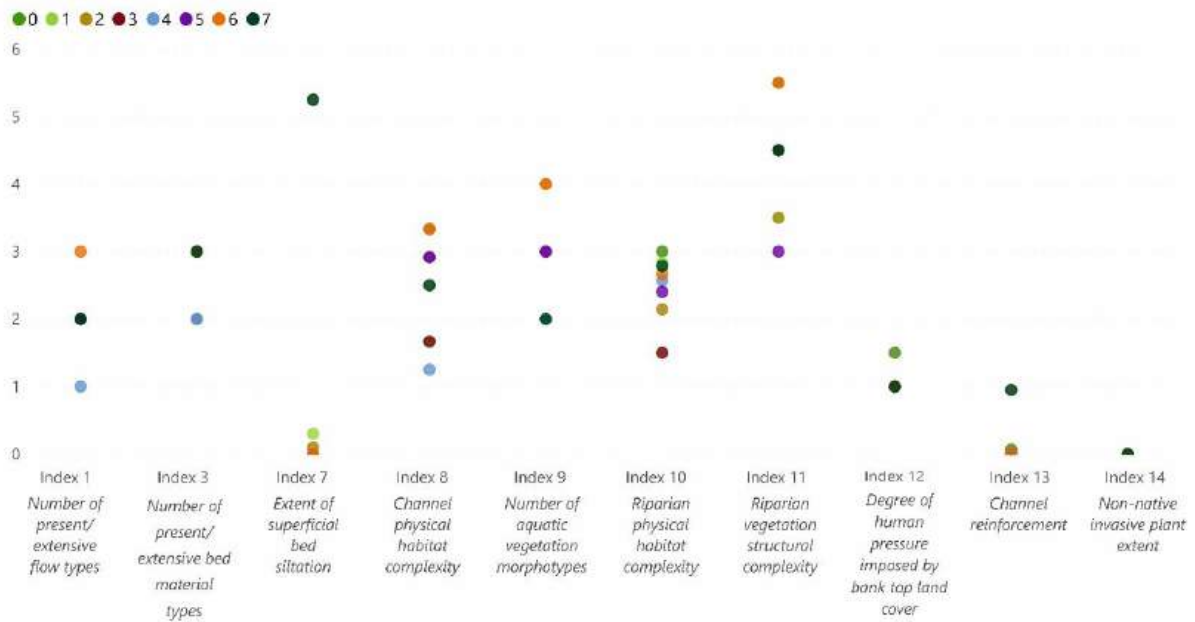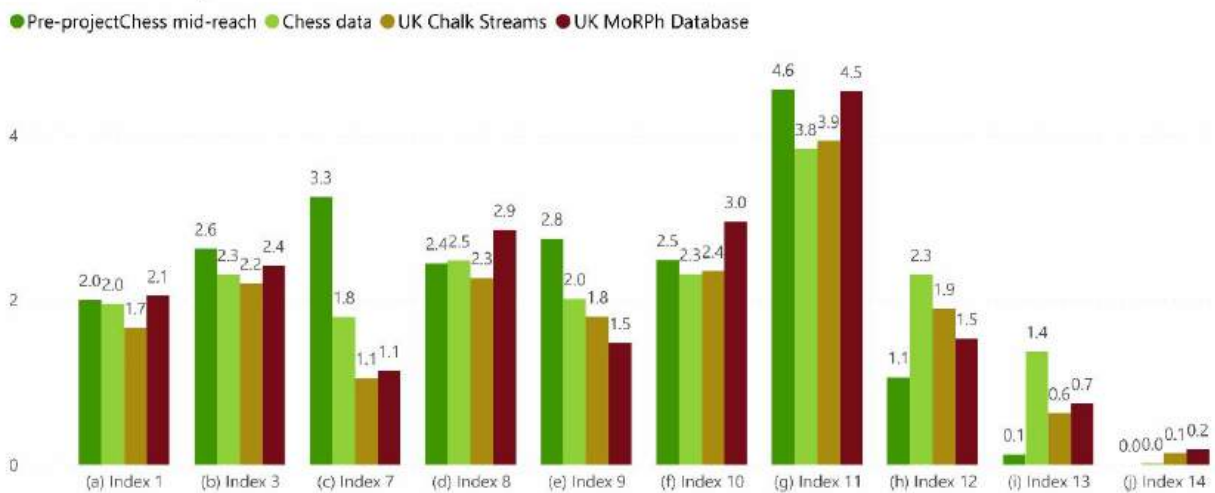
Dataset	Index 1	Index 3	Index 7	Index 8	Index 9	Index 10	Index 11	Index 12	Index 13	Index 14
Chess data	1.96	2.31	1.80	2.48	2.02	2.32	3.84	2.31	1.38	0.00
UK MoRPh Database	2.05	2.42	1.14	2.86	1.48	2.95	4.54	1.53	0.75	0.19
UK Chalk Streams	1.67	2.21	1.05	2.27	1.80	2.35	3.93	1.90	0.63	0.14
Pre-projectChess mid-reach	2.00	2.63	3.26	2.45	2.75	2.49	4.56	1.06	0.13	0.00
Total	**1.92**	**2.39**	**1.81**	**2.51**	**2.01**	**2.53**	**4.22**	**1.70**	**0.72**	**0.08**

Contains MoRPh Rivers Citizen Science data, licensed for access under the Creative Commons Attribution Non-Commercial 4.0 license, availiable at https://modulamversurvey.org/map, accessed 17/01/24.

Figure 2.5: Summary of the baseline averages of the MoRPh indexes[5] per subreach from the Blackwell Hall Farm site. Also shown are index value comparisons for all MoRPh surveys on the River Chess (light green), UK average chalk stream values (brown), and average values for all rivers within the Citizen Science MoRPh database (red).

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[5] Indexes 2,4,5,6, are excluded from these plots as they are not numbers between 0 and 10.
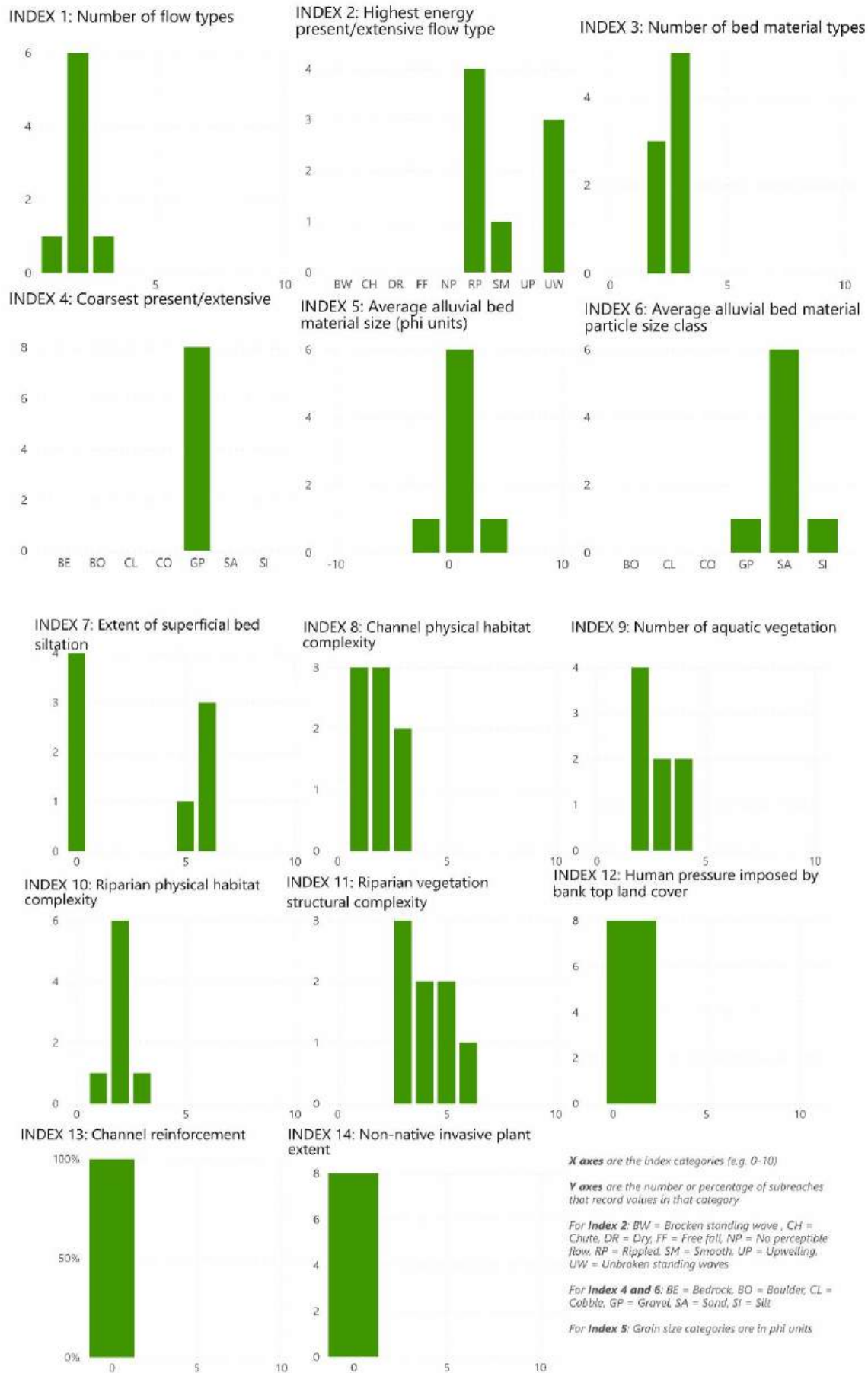
Figure 2.6 Frequency distributions of MoRPh Index values 1-14 comparing the baseline data.

2.2   Channel bed siltation

A detailed breakdown of bed siltation along the channel within the site is shown in Figure 2.7. Index 7 illustrates the extent of silt of the channel bed recorded by the trained citizen science surveyors. UK chalk streams are expected to have relatively low levels of silt across the channel bed as a high proportion of the flow is groundwater fed.

Figure 2.7: Index 7 at each subreach.

Within the site, the extent of bed siltation recorded varied extensively which can be linked to the bank conditions. In subreaches with little riparian cover there may be higher extents of bed siltation due to livestock grazing and poaching and little silt trapping, as shown by the photo of Subreach 2 (Figure 2.8). However, although riparian cover may reduce silt reaching the river, silt will also settle around fallen trees and create local high levels of siltation (Figure 2.8).

Figure 2.8: Left photo showing the agricultural land use on the bank top and lack of riparian vegetation, taken at Subreach 2. Right photo showing overgrown riparian vegetation, taken at Subreach 6.

2.3   Aquatic vegetation

A detailed breakdown of changes in aquatic vegetation are shown in Figure 2.9. Index 9 indicates the number of different aquatic vegetation morphotypes identified by the trained citizen science surveyors. In this instance 'morphotype' describes groups of vegetation with the same overall shape and function (e.g. fine-leaved plants submerged under the water, broad-leaved plants emerging from the water, plants floating freely on the water surface, filamentous algae). The greater the number of aquatic vegetation morphotypes the higher the score, and the more biodiverse the aquatic vegetation is within the reach. The numbers of aquatic vegetation morphotypes was relatively good on average within the site however, Figure 2.9 illustrates the variability of Index along the channel, with the highest scores at subreach two

11

and subreach six. The numbers of aquatic vegetation morphotypes are likely to change based on light levels in the channel and marginal vegetation trailing into the channel.

Figure 2.9: Index 9 at each subreach.

3   River intervention works.

As outlined above, the baseline conditions as summarised by the MoRPh surveys have generally shown poor morphological and ecological conditions at the site (minimal flow diversity and poor riparian habitat). This is likely related to the agricultural land use causing excess bank erosion, and lack of riparian vegetation maintenance.

Interventions proposed at the Blackwell Hall Farm site includes fencing organised by the Smart Water Catchment project. As shown by the baseline MoRPh survey, the site has been affected by siltation. This can be attributed to road runoff at Chesham town centre that is washed downstream and is likely to be exacerbated by livestock (primarily sheep and cattle) poaching the river banks. Through this project our aim will be to limit the access of livestock to the channel banks to allow the condition of the banks to repair enabling riparian vegetation to establish and prevent further silt runoff. Our project will include:

- Installation of 310m of stock proof fencing along both banks of a portion of the River Chess that passes through Blackwell Farm. The new fencing will exclude livestock from the river and river banks where they have unrestricted access. The new fence will be set back 3-5m from the channel banks.
- Two new metal gates that will allow livestock to cross the river at one dedicated point, at designated times. To enable livestock to access the fields on each side of the river channel but otherwise exclude livestock from the river banks.
- A slip-rail set that allows livestock periodic access to the river for conservation grazing and vegetation management on the banks. The slip-rail set will allow livestock access to the river at certain times of the year to graze the vegetation on the banks of the river and act as a management tool to prevent unchecked growth. The slip-rail set has the dual benefit of preventing livestock river bank access throughout the year, but allowing it infrequently to provide management. Erasing the need for employing more costly management techniques.
- Cutting approximately 140m of an overgrown hedge along the north side of the river. The field boundary and existing fence-line are overtaken by the hedge along the river. It will be cut back to allow for removal of the old fence and installation of the new fence along the same fence line.

Due to the intervention works above, we would expect to see future improvements in many of the indices as the system adjusts following intervention work. In future post-intervention MoRPh surveys this could include:

- Restricting livestock access leading to a reduction in poaching and excess siltation.
- Improvements in the physical habitat and riparian vegetation complexity which we hope will happen as the channel banks are allowed to recover now that livestock access is restricted.

4 Conclusions

MoRPh surveys of the baseline River Chess at the Blackwell Hall Farm site have enabled us to understand the pre restoration conditions. From this, we can make the following conclusions:

- The baseline conditions of the site as recorded by the MoRPh surveys are in-channel conditions lower than average compared to UK chalk streams due to a lack of flow diversity and high amounts of bed siltation.
- Poor riparian conditions due to a lack of riparian vegetation diversity and complexity.
- The sub optimal conditions of the site can be attributed to the agricultural land use, and lack of riparian vegetation maintenance.
- A project is proposed at the site based on the baseline conditions (poor riparian condition and moderate siltation due to livestock grazing and poaching) and aims to restore a more diverse and naturally functioning river.
- The intervention activities proposed will include installation of stock-proof fencing, to allow livestock periodic access to the river for conservation grazing and vegetation management on the banks while excluding access throughout the year. Restricting livestock from grazing on the river will allow the condition of the banks to repair enabling riparian vegetation growth and reduce further bank erosion and sediment runoff to the channel.
- In future MoRPh surveys, we would expect to see improvements in the extent of bed siltation and riparian vegetation indices as livestock access continues to be restricted and the channel banks are allowed to naturally recover from extensive grazing that has been occurring.

MoRPh citizen science surveys are a great technique for non-specialists to gather scientific evidence on the conditions of waterbodies. They are also a valuable way for the community to feel more engaged with their local river. We hope that these surveys have enabled volunteers to explore unfamiliar parts of the River Chess and appreciate it in a new way and are excited to see the results of future surveys.

MANY THANKS FOR ALL THE EFFORT WITH SURVEYING AND WE HOPE YOU'VE ENJOYED OUR REPORT. WE WOULD LOVE TO HEAR ANY FEEDBACK AT CHESSCS@CHILTERNS.ORG.UK

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