



Little Avon Catchment Riverfly Monitoring Summary Report

March 2025



Version history

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Summary

Bristol Avon Rivers Trust (BART) secured funding from the Cotswold National Landscape to carry out SmartRivers macro-invertebrate monitoring on the upper tributaries of the Little Avon within the Cotswolds AONB in autumn 2020 and spring 2021. BART was also successful in securing funding from The Halpin Charitable Trust to carry out further SmartRivers monitoring on the Little Avon catchment in spring and autumn 2022. In total eleven sites were sampled in both spring and autumn.

SmartRivers is a scheme spearheaded by WildFish. It is a water quality monitoring project using macro-invertebrate sampling to collect species level data that can be analysed to learn more about the pollutants that stress our rivers. The purpose of the monitoring was to establish a baseline data set of the macro-invertebrate communities present in the catchment and to identify the main pressures impacting on the different sections of the watercourses. There is also the potential to monitor any changes to these communities over time should further funding become available.

BART is the Bristol Avon Riverfly hub for the Riverfly Monitoring Initiative (RMI). The Riverfly Monitoring Initiative uses citizen science to get people out and about on their local river, enjoying the natural environment, sampling for riverflies and looking for signs of pollution. The scheme is supported by the Riverfly Partnership and more info can be found on their website here: <http://www.riverflies.org/rp-riverfly-monitoring-initiative>.

BART volunteers have 19 active sites in the Little Avon catchment – including sites on the Ozleworth and Dyers Brooks and the Little Avon river. Many of these sites are monitored by the local angling clubs – Charfield and Berkeley Estate. The clubs have regular monitoring data from as far back as 2011 at some sites, providing very valuable long term data sets to help inform work in the catchment.

This report covers the findings of the Little Avon catchment SmartRivers and RMI surveys. Site photos from the SmartRivers surveys are included in Appendix 1. Figure 1 below shows the locations of the SmartRivers sites and Figure 2 shows the locations of the active RMI sites in the catchment. These site maps are also included in Appendix 2 in a larger format.

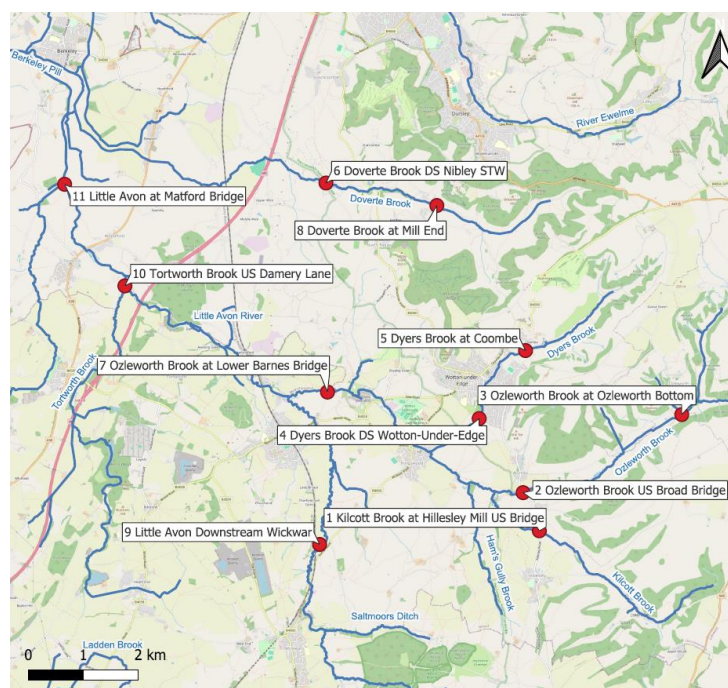


Figure 1 – Map of SmartRivers sites in the Little Avon catchment

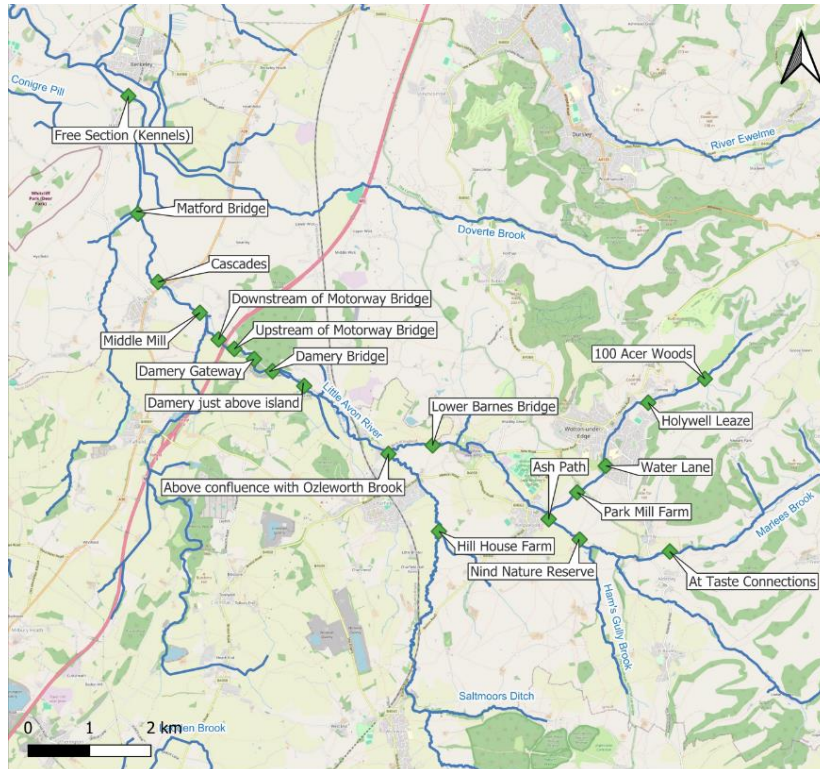


Figure 2 – Map of active RMI sites in the Little Avon catchment

Findings: SmartRivers macro-invertebrate monitoring

The SmartRivers database pressure analysis undertaken by WildFish looked at the macro-invertebrate communities recorded at each of the sites and calculated which of the following pressures were impacting on the assemblages: Pesticides, Nutrients “P”, Organics, Flow and Siltation. A summary of the results is included in Table 1 below:

Site no.	River	Site Name	NGR	BMWP		Chemicals (SPEAR)		Nutrient "P" (TRPI)		Organics (Saprobic)		Siltation (PSI)		Flow (LIFE)	
				Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut	Spr	Aut
Little Avon Headwaters 2020 and 2021															
1	Kilcott Brook	Hillesley Mill	ST 7693090549	75	89	I	I	UI	UI	SI	UI/SI	SI	MI	SI	SI
2	Ozleworth Brook	US Broad Bridge	ST 7663891241	80	85	SI	SI	UI/SI	UI	SI	SI	MI	MI	SI	SI
3	Ozleworth Brook	Ozleworth Btm	ST 7952892642	134	140	UI	UI	UI	UI	UI	UI	UI	UI	UI	UI
4	Dyers Brook	DS Wotton-Under-Edge	ST 7584692586	47	71	I	I/HI	SI/MI	UI/SI	UI	SI	MI	SI	SI	UI
5	Dyers Brook	At Coombe	ST 7669493813	87	76	MI	MI	UI	UI	SI	SI	MI	SI	SI	SI
6	Doverte Brook	DS Nibley STW	ST 7308596863	91	58	MI	HI	UI	UI/SI	SI	SI	SI	MI	SI	SI
Little Avon 2022															
7	Ozleworth Brook	Lower Barnes Bridge	ST 7309293080	120	121	SI	MI	MI	SI	UI	UI/SI	SI	SI	SI	SI
8	Doverte Brook	Mill End	ST 7509696445	42	29	I	I	-	-	SI	SI	SI	SI	SI	SI
9	Little Avon	DS Wickwar	ST 7293590322	77	103	UI	MI	SI	MI	UI	SI	MI	I	SI	MI
10	Tortworth Brook	US Damery Lane	ST 6942295022	101	167	UI	MI	I	SI	UI	UI	MI	MI	SI	SI
11	Little Avon	Matford Bridge	ST 6833996867	134	152	SI	SI	SI	MI	UI	SI	SI	MI	SI	SI

Table 1: SmartRivers Overview

Acronym	Rating
HI	Heavily Impacted
I	Impacted
MI	Moderately Impacted
SI	Slightly Impacted
UI	Unimpacted

Table 2 SmartRivers pressure ratings key

The Little Avon SmartRivers results were very variable between sites and even samples. **The pressure of most consistent concern across the catchment was chemicals.** Most of the sites showed a concerning impact from chemicals and a greater impact was seen in the autumn samples. BART walkovers undertaken in 2022 identified numerous poor agriculture and land management practices in the catchment, likely to be contributing to high chemical loading in the waterbodies. Sewage Treatment works are also a likely source of high chemical loading – there are a number of Sewage Treatment works in the catchment including Wooton Under Edge, Wickwar and Charfield.

Siltation was also flagged as a concern at most of the sites. Excessive sediment caused by anthropogenic factors such as livestock or construction is detrimental to the water quality and ecology of a watercourse, including fish and invertebrates. Impacts on macro-invertebrates include the clogging of gills and the destruction of suitable habitats. BART walkovers undertaken in 2022 found that the most extensive of the sediment issues recorded included the headwaters of the Little Avon. Sources included road and track runoff, areas of land grown for maize with bare soils over winter and no buffer as well as areas with sediment input from bank trampling as a result of poor livestock management.

The catchment suffered from drought conditions in summer 2022. Numerous RMI sites recorded reduced macro-invertebrate scores, often falling below the trigger level in the Little Avon catchment in summer and early autumn 2022. **The impact of the summer low flows is likely to have contributed towards the concerning chemical and sediment stress** exhibited by the macro-invertebrate communities at some of the SmartRivers sites in autumn 2022. This is because during low flow events there is less water available to dilute the impacts of instream pollutants.

This report gives a detailed site by site analysis of the SmartRivers results and highlights potential habitat and water quality issues that are likely to be impacting on the macro-invertebrate assemblages. These include **Sewage Treatment Works** upstream of the sampling sites on the Dovere Brook at Nibley and the Little Avon downstream of Wickwar, **re-enforcement of the channel** at the Dyer's Brook at Coombe site, **artificially straightened channels** on the Tortworth Brook and Ozleworth Brook at Broad bridge sites and riverbank habitat **severely trampled by livestock** at the downstream of Wickwar site.

The site with the most restricted macro-invertebrate assemblages was the Dovere Brook at Mill End. The biological indices at this site were very low indicating poor water quality and habitat in this location. The notes recorded at the time of sampling show that there was very restricted habitat at the site with thick silt / mud recorded in both seasons. The flow was a very slow run flow with 100% silt cover present, steep banks and no macrophytes. The turbidity was moderate / high and there was an odour

present. These features provide very poor habitat variation for macro-invertebrates to live within and are likely to be restricting the macro-invertebrate assemblages in this location.

Low diversity is affecting the calculation of the more sensitive SmartRivers metrics - TRPI (phosphorus) and PSI (sediment) at this site. This means that the pressure scores are unreliable and SmartRivers results for these two pressures should be discounted here. The SmartRivers pressure ratings scores for chemicals were poor in both seasons **indicating that the macro-invertebrates are exhibiting extremely high chemical stress**. Although organics pressure results came out as slightly impacted the high saprobic scores of 2.03 and 2.00 for organics suggest considerable water quality issues are present here. Experts at WildFish state that SmartRivers saprobic scores above 2 should be flagged as problematic.

In 2021 BART carried out walkover surveys on the Little Avon tributaries – including the Doverte Brook. These surveys highlighted severe water quality and sediment issues on the Doverte Brook upstream of the macro-invertebrate sampling location. **Issues recorded included cattle freely accessing the watercourse, a livestock feeder placed less than 10m from the brook with evidence of bank poaching very close to the brook, with sediment and excrement entering the watercourse and a small pig farm set up adjacent to / within the watercourse.** The watercourse had also purposely been modified to enter the pig farm, to provide water for the livestock.

Due to the severity of these findings BART reported the issues to the Environment Agency for further investigation and the Environment Management Team have led an investigation into this problem site. BART staff re-visited the site in January 2022 and found that these issues were still impacting the watercourse. Further issues were also recorded during this visit including a slurry heap leaching down the hill and into the river and tree removal adjacent to the watercourse and these findings were also reported to the Environment Agency alongside the SmartRivers findings for further investigation.

The only SmartRivers site that was unimpacted by chemicals and siltation (and in fact by all the SmartRivers pressures) was the site towards the top of the Ozleworth Brook – at Ozleworth Bottom. This site had an excellent diversity of macro-invertebrates present in both samples and **highlights the macro-invertebrate assemblages that could be living in these water courses if the pressures on them were reduced.**

Findings: Riverfly Monitoring Initiative

Table 3 below shows a summary of the RMI riverfly data, including trigger level breaches for all the active sites in the Little Avon catchment.

River	Site Name	Grid Reference	Average RMI Riverfly Score	Total number of Samples	Trigger Level	Trigger Level Breaches
Dyers Brook	100 Acer Woods	ST 77526 94140	7.4	14	5	0
Dyers Brook	Holywell Leaze	ST 76603 93759	8.2	11	5	1
Dyers Brook	Water Lane	ST 75908 92738	5.7	9	4	0

Dyers Brook	Park Mill Farm	ST 75440 92310	9	9	5	0
Dyers Brook			7.6			
Ozleworth Brook	At Taste Connections	ST 76943 91345	10.9	17	5	0
Ozleworth Brook	Nind Nature Reserve	ST 75478 91546	8	5	6	1
Ozleworth Brook	Ash Path	ST74976 91879	9.2	5	8	0
Ozleworth Brook	Lower Barnes Bridge	ST 73095 93085	8.7	41	6	0
Ozleworth Brook			9.2			
Little Avon	Hill House Farm	ST 73190 91690	10.4	5	8	0
Little Avon	Above confluence with Ozleworth Brook	ST 72376 92950	7.1	15	6	2
Little Avon	Damery just above island	ST 71013 94058	9	39	6	2
Little Avon	Damery Bridge	ST 70500 94300	10.7	47	8	1
Little Avon	Damery Gateway	ST 70200 94500	10.1	46	8	2
Little Avon	Upstream of Motorway Bridge	ST 69881 94665	11.1	127	6	0
Little Avon	Downstream of Motorway Bridge	ST 69626 94820	11.4	125	7	0
Little Avon	Middle Mill	ST 69324 95254	10.1	124	7	1
Little Avon	Cascades	ST 68648 95757	10.6	128	8	5
Little Avon	Matford Bridge	ST 68327 96863	11.2	118	8	1
Little Avon	Free Section (Kennels)	ST 68185 98768	10.2	121	7	2
Little Avon River			10.4			
Little Avon Catchment			10.3			

Table 3 Summary of RMI data

BART volunteers have nineteen active sites in the Little Avon catchment – four sites on the Dyers Brook, four sites on the Ozleworth Brook and eleven sites on the Little Avon river. The long term and very regular sampling that has been undertaken on the Little Avon river itself – thanks mainly to the angling clubs – **has flagged trigger level breaches on 16 occasions**. Riverfly monitors are often the first to spot pollution incidents when their samples show a reduction in diversity and abundance of the eight RMI groups, helping to protect the river ecology and encouraging the Environment Agency to investigate further.

The site with the most trigger level breaches is the Little Avon at Cascades site – towards the bottom of the watercourse near Stone. This has breached its trigger level on 5 occasions – including the drought period of autumn 2022. **Further investigation is recommended into the potential water quality issues affecting this site.**

The drought conditions of Summer 2022 affected many of the rivers in the catchment and the RMI data from sites such as those on the Little Avon river helped to inform the Environment Agency’s drought investigations. **Little Avon sites showing clear drought impacts include Damery Bridge, Damery Gateway and Cascades.**

As well as spotting and flagging potential pollution incidents the regular monitoring can also provide a very useful long term data set, allowing us to target areas for further investigation and scope potential improvement works. The data will also inform us of benefits derived from river restoration, land management improvements or water industry asset upgrades.

Little Avon RMI data shows no clear trend for improvement or deterioration over time at any of the sites. Scores remain stable over the last 14 years. Average riverfly total scores in the Little Avon catchment ranged between 5.7 and 11.4. The highest average riverfly score was on the Little Avon DS Motorway Bridge site, monitored by the Berkeley Estate angling club. The lowest average riverfly score was on the Dyers Brook at Water Lane. This site is downstream of Wotton-Under-Edge and the SmartRivers analysis indicates potential water quality pressures in this location. The low RMI scores supports this finding. Unfortunately there are no BART Detective sites (monitoring water quality via low cost dip stick kits) on the Dyers Brook downstream of Wotton-Under-Edge. **Establishing a BART Detective site in this location could help to provide further evidence and identify potential sources of pollution. Further investigation should, therefore, be undertaken into the cause of the restricted macro-invertebrate communities recorded downstream of Wotton-under-edge, including a review of existing water quality data,** and concerns should be raised with the Environment Agency.

The lowest RMI score on the Little Avon river itself was at the above confluence with the Ozleworth Brook site. This site has an average RMI score of 7.1 which is well below the average RMI score for the Little Avon river (10.4). **Further investigation should be undertaken to determine the reason for the restricted macro-invertebrate communities in this location** and identify opportunities for potential improvement works. Findings should be reported to the Environment Agency.

Overall Recommendations

This report highlights the pressures facing the Little Avon catchment and provides evidence of the stresses exhibited by the macro-invertebrate communities at each of the sites. The Little Avon catchment is split into six waterbodies under the Water Framework Directive. Five of the Little Avon waterbodies are classified as failing to achieve Good Ecological Status under WFD (www.environment.data.gov.uk/catchment-planning/). The Ozleworth Brook waterbody is classed as Good Ecological Status under WFD, although it is still failing its chemical status. BART recommends investment into the catchment to undertake actions to improve the ecological condition of these waterbodies. This macro-invertebrate monitoring report should be referenced to help prioritise areas for action and to identify the works that will be most beneficial for the macro-invertebrate communities.

The Riverfly data discussed in this report has highlighted a number of recommendations for further work to improve the ecological condition of the Little Avon catchment. These include:

- Further investigation into opportunities for habitat improvement works in the sections of the channel with physical modifications including barriers to fish movement and flow and straightened sections of the channel. In stream river restoration works to increase the habitat features available, such as installing large woody debris within the channel, should be considered alongside barrier removal / partial removal;
- Continued communications with the Environment Agency regards the considerable water quality problems highlighted on the Dovere Brook above the Mill End site;
- Continued communications with the Environment Agency regards the impact of drought on the macro-invertebrate communities in the Little Avon catchment;
- Communications with the EA to encourage further monitoring of water abstraction on the Little Avon tributaries in particular. Abstraction should be monitored closely alongside ecological status, and also more wetlands need to be delivered within the catchment in order to replenish the water table and reduce the impact on these rivers and the likelihood of them drying out;
- BART recommend that the EA undertake water quality monitoring investigations on the Dyers brook to assess the conditions and the potential impact of water quality on the ecology of the brook, focusing particularly on the stretch downstream of Wotton-Under-Edge (both RMI data and SmartRivers data suggests potential water quality issues here);
- Establishing a BART Detectives water quality monitoring site on the Dyer's Brook downstream of Wotton-Under-Edge to support the riverfly data;
- Establishing BART Detectives water quality monitoring sites on the Dovere Brook DS Nibley and the Little Avon DS Wickwar to support the riverfly data;
- BART farm visits / landowner engagement along the stretches of riverbank that are heavily poached – including the Little Avon DS Wickwar site;
- Further investigation into the causes of trigger level breaches at the Little Avon at Cascades RMI site;
- Further investigation into the cause of the low RMI average score at the Little Avon above confluence with the Ozleworth Brook RMI site;
- Continued analysis of the BART Detectives data alongside the riverfly data to flag any problematic sites and to better understand the likely causes.

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1. Introduction

1.1 Riverfly Monitoring Overview

In Autumn 2020, Bristol Avon Rivers Trust (BART) secured funding from the Cotswold Area of Outstanding Natural Beauty (AONB) to carry out macro-invertebrate monitoring on the upper tributaries of the Little Avon within the Cotswolds AONB. BART also secured funding from Halpin Charitable Trust to carry out SmartRivers macro-invertebrate monitoring on the Upper and Little Avon catchments in spring and autumn 2022.

SmartRivers is a scheme spearheaded by WildFish. It is a water quality monitoring project using macro-invertebrate sampling to collect species level data that can be analysed to learn more about the pollutants that stress our rivers.

BART collected and analysed six macro-invertebrate samples on four tributaries of the Little Avon within the Cotswolds AONB in autumn 2020. The monitoring was carried out on the Kilcott brook, the Ozleworth brook, the Dyers brook, and the Doverte brook. The monitoring was repeated at the same six sites in spring 2021. BART also collected macro-invertebrate samples at an additional five sites in the Little Avon catchment in spring 2022 and autumn 2022. The monitoring was carried out on the Tortworth Brook, the Doverte Brook, the Ozleworth Brook and the Little Avon itself. This report covers the findings of the macro-invertebrate surveys.

The purpose of the monitoring was to establish a baseline data set of the macro-invertebrate communities present in the catchments and to identify the main pressures impacting on the different sections of the watercourses within these catchments. There is also the potential to monitor any changes to these macro-invertebrate communities over time should further funding become available.

BART is the Bristol Avon Riverfly hub for the Riverfly Monitoring Initiative (RMI). The Riverfly Monitoring Initiative uses citizen science to get people out and about on their local river, enjoying the natural environment and sampling for riverflies. The scheme is supported by the Riverfly Partnership and more info can be found on their website here: <http://www.riverflies.org/rp-riverfly-monitoring-initiative>.

BART volunteers have nineteen active sites in the Little Avon catchment – including sites on the Dyers Brook, the Ozleworth Brook and the Little Avon river itself. This report covers the findings of the Little Avon Catchment RMI surveys.

1.2 Macro-invertebrate Site Locations

The location of each of the SmartRivers sites surveyed as part of the Cotswolds AONB Headwaters project is included in Table 4 and Figure 3. The location of each of the sites surveyed as part of the Little Avon Halpin project is included in Table 5 and Figure 3. A larger version of the site map is also included in Appendix 2.

Site number	Waterbody	Site Name	Macro-invertebrate Site Location
1	Kilcott Brook	Hillesley Mill US Bridge	ST 7693090549
2	Ozleworth Brook	US Broad Bridge	ST 7663891241
3	Ozleworth Brook	At Ozleworth Bottom	ST 7952892642
4	Dyers Brook	DS Wotton-Under-Edge	ST 7584692586
5	Dyers Brook	At Coombe	ST 7669493813
6	Doverte Brook	DS Nibley STW	ST 7308596863

Table 4: Little Avon Headwaters Project SmartRivers Site Locations

Site number	Waterbody	Site Name	NGR
7	Ozleworth Brook	Lower Barnes Bridge	ST7309293080
8	Doverte Brook	Mill End	ST7509696445
9	Little Avon	Downstream Wickwar	ST7293590322
10	Tortworth Brook	Upstream Damery Lane	ST6942295022
11	Little Avon	Matford Bridge	ST6833996867

Table 5: Little Avon Halpin Project SmartRivers Site Locations

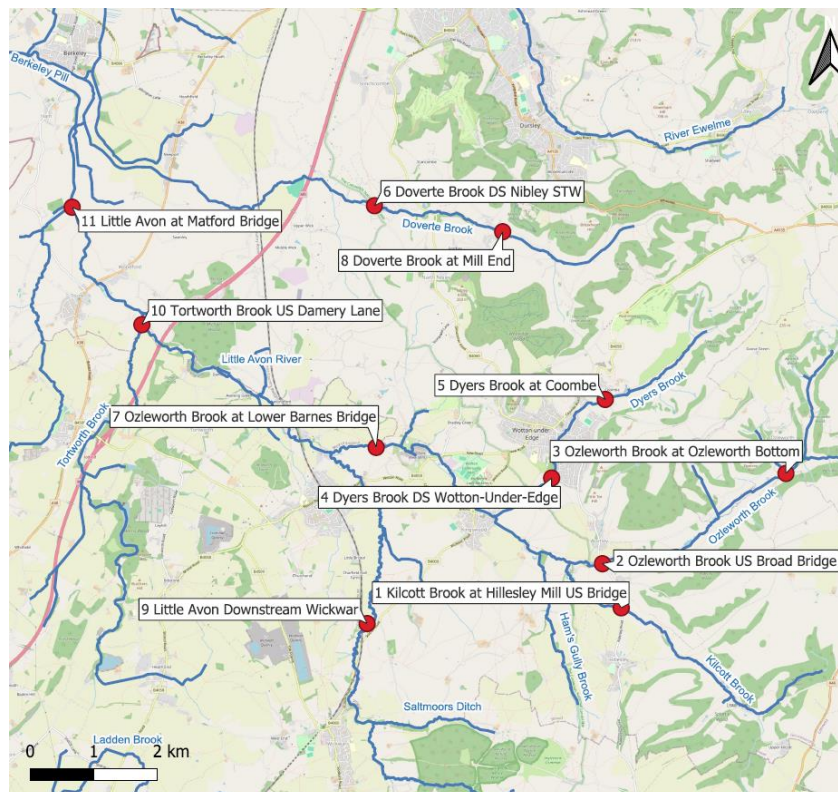


Figure 3 – Map of SmartRivers sites in the Little Avon catchment

BART volunteers have nineteen active RMI sites in the Little Avon catchment – four sites on the Dyers Brook, four sites on the Ozleworth Brook and eleven sites on the Little Avon river. This report covers the findings of the Little Avon Catchment RMI surveys.

The location of each of the active RMI sites in the Little Avon catchment is included in Table 6 and Figure 4. A larger version of the site map is also included in Appendix 2.

River	Site Name	Grid Reference
Dyers Brook	100 Acer Woods	ST 77526 94140
Dyers Brook	Holywell Leaze	ST 76603 93759
Dyers Brook	Water Lane	ST 75908 92738
Dyers Brook	Park Mill Farm	ST 75440 92310
Ozleworth Brook	At Taste Connections	ST 76943 91345
Ozleworth Brook	Nind Nature Reserve	ST 75478 91546
Ozleworth Brook	Ash Path	ST74976 91879
Ozleworth Brook	Lower Barnes Bridge	ST 73095 93085
Little Avon	Hill House Farm	ST 73190 91690
Little Avon	Above confluence with Ozleworth Brook	ST 72376 92950
Little Avon	Damery just above island	ST 71013 94058
Little Avon	Damery Bridge	ST 70500 94300
Little Avon	Damery Gateway	ST 70200 94500
Little Avon	Upstream of Motorway Bridge	ST 69881 94665
Little Avon	Downstream of Motorway Bridge	ST 69626 94820
Little Avon	Middle Mill	ST 69324 95254
Little Avon	Cascades	ST 68648 95757
Little Avon	Matford Bridge	ST 68327 96863
Little Avon	Free Section (Kennels)	ST 68185 98768

Table 6: Active Riverfly Monitoring Initiative (RMI) sites in the Little Avon catchment

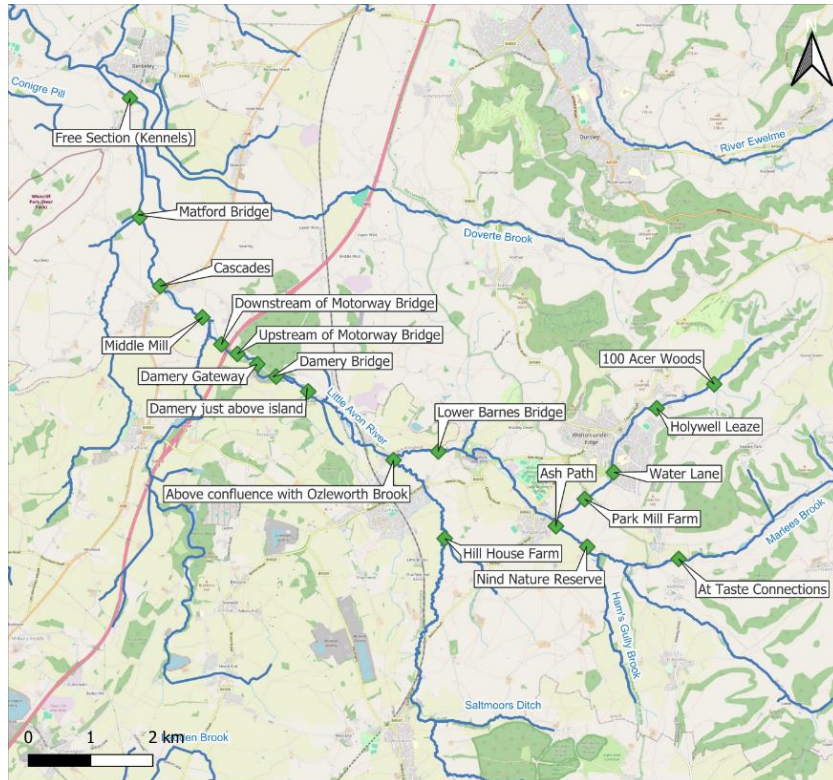


Figure 4 – Map of active RMI sites in the Little Avon catchment

2. Methodologies

2.1 SmartRivers Macro-invertebrate Sampling and Analysis Methodology

One macro-invertebrate kick sample was taken by BART's Aquatic Ecologist Jessy Grant at each of the SmartRivers survey locations during each Smart Rivers seasons. The standard method used at each of the macro-invertebrate sites involved a three-minute kick sample of each habitat in proportion to its occurrence, collecting the macro-invertebrates in a standard, long-handled pond net with a mesh size of 1mm. This was followed by a one-minute hand search of stones and other moveable objects. The sampling method conformed to: BS EN ISO 10870:2012 Water quality - Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters (BSI 2012).

All samples were placed in labelled buckets and taken back to the BART laboratory for further analysis. On return to the laboratory each sample was stored in the fridge. Before analysis, fine silt was washed from the sample by rinsing it with tap water through a 500-um sieve. Larger aperture sieves were then used to split the sample into fractions to enable efficient sorting. Small amounts of the sample were then placed in white trays for analysis, until the entire sample had been processed. Macro-invertebrates were identified as far as taxonomically possible using standard procedures.

Results were entered onto the SmartRivers database for data analysis. The SmartRivers database pressure analysis undertaken by WildFish looked at the macro-invertebrate communities found in each of the surveys and calculated which of the following pressures were impacting most on each of the sites: Pesticides, Nutrients "P", Organics, Flow and Siltation. SmartRivers Pressure Rating scores and biological indices scores were reviewed by BART's Senior Freshwater Ecologist Jessy Grant.

2.2 RMI Sampling and Analysis Methodology

The RMI monitoring methodology copies the standard sampling methodology outlined in section 2.1 above. The monitoring is carried out by a volunteer trained in RMI sampling. The same monitor samples the same site as regularly as possible – aiming for once a month.

Analysis is undertaken bankside following the method outlined in the RMI training. The sample is sorted in a white tray and macro-invertebrates from eight key groups are picked out and counted. The eight RMI groups are: stoneflies, burrowing mayflies, blue winged olive mayflies, olive mayflies, cased caddisflies, caseless caddisflies and shrimps.

Counts are entered by the volunteer onto the Riverfly Partnership's Cartographer database for each of the eight groups. Scores are automatically calculated for each site using the following categories:

1-9 = 1

10 - 99 = 2

100 – 999 = 3

1000+ = 4

An overall score for the sample is calculated by combining the scores for all the groups. This score is compared to a trigger level, set by the Environment Agency. Scores that fall below the trigger could be a sign that there is a pollution incident occurring and follow up is required.

3. Results

3.1 SmartRivers Results

Tables 7 and 8 below show the observed Biological Monitoring Working Party (BMWP), Average Score per Taxon (ASPT), Number of Scoring Taxa and Whalley Hawkes Paisley Trigg (WHPT) biotic scores calculated for all the surveys by the SmartRivers database on Cartographer.

Site No.	Site Name	BMWP		WHPT	
		Autumn 2020	Spring 2021	Autumn 2020	Spring 2021
1	Kilcote Brook at Hillesley Mill US Bridge	89	75	114	85
2	Ozleworth Brook US Broad Bridge	85	80	99	91
3	Ozleworth Brook At Ozleworth Bottom	140	134	144	155
4	Dyers Brook DS Wotton-Under-Edge	71	47	82	63
5	Dyers Brook At Coombe	76	87	86	100
6	Doverte Brook DS Nibley STW	58	91	67	112

Table 7: Biological Indices for Little Avon Headwaters SmartRivers sites

Site No.	Site Name	BMWP		WHPT	
		Spring 22	Autumn 22	Spring 22	Autumn 22
7	Ozleworth Brook at Lower Barnes Bridge	120	121	131.5	127.1
8	Doverte Brook at Mill End	42	29	44	30.2
9	Little Avon Downstream Wickwar	77	103	81.2	108.1
10	Tortworth Brook US Damery Lane	101	167	97.6	181.6
11	Little Avon at Matford Bridge	134	152	152.6	166.3

Table 8: Biological Indices for Little Avon Halpin Project SmartRivers sites

Tables 9, 10, 11 and 12 below show the pressure ratings calculated for all samples. Ratings are calculated for chemicals (SPEAR), nutrients “P” (TRPI), organics (Saprobic value), siltation (PSI) and flow (LIFE).

It should be noted that low diversity can affect the calculation of the more sensitive SmartRivers metrics - TRPI (phosphorus) and PSI (sediment). So, on several occasions – particularly at the sites with very poor diversity (Doverte Brook at Mill End, Sherston Avon DS Foxley Road and Tetbury Avon at Spice Merchant (autumn)) the SmartRivers results for these two pressures should be discounted.

Site No.	Site Name	Chemicals (SPEAR)		Nutrient “P” (TRPI)		Organic (Saprobic value)	
		Autumn 2020	Spring 2021	Autumn 2020	Spring 2021	Autumn 2020	Spring 2021
1	Kilcott Brook at Hillesley Mill US Bridge	M/P	P	UI	UI	UI/SI	SI
2	Ozleworth Brook US Broad Bridge	G	G	UI	UI/SI	SI	SI
3	Ozleworth Brook At Ozleworth Bottom	H	H	UI	UI	UI	UI
4	Dyers Brook DS Wotton-Under-Edge	P / B	P	UI/SI	SI/MI	SI	UI
5	Dyers Brook At Coombe	M	M	UI	UI	SI	SI
6	Doverte Brook DS Nibley STW	B	M	UI/SI	UI	SI	SI

Table 9: Pressure Ratings results for Little Avon Headwaters SmartRivers sites

Site No.	Site Name	Siltation (PSI)		Flow (LIFE)	
		Autumn 2020	Spring 2021	Autumn 2020	Spring 2021
1	Kilcott Brook at Hillesley Mill US Bridge	MI	SI	SI	SI
2	Ozleworth Brook US Broad Bridge	MI	MI	SI	SI
3	Ozleworth Brook At Ozleworth Bottom	UI	UI	UI	UI
4	Dyers Brook DS Wotton-Under-Edge	SI	MI	UI	SI
5	Dyers Brook At Coombe	SI	MI	SI	SI
6	Doverte Brook DS Nibley STW	MI	SI	SI	SI

Table 10: Pressure Ratings results for Little Avon Headwaters SmartRivers sites

No.	Site Name	Chemicals (SPEAR)		Nutrient "P" (TRPI)		Organic (Saprobic value)	
		Spr 22	Aut 22	Spr 22	Aut 22	Spr 22	Aut 22
7	Ozleworth Brook at Lower Barnes Bridge	Good	Mod	Mod	SI	UI	UI/SI
8	Doverte Brook at Mill End	Poor	Poor	-	-	SI	SI
9	Little Avon Downstream Wickwar	High	Mod	SI	MI	UI	SI
10	Tortworth Brook US Damery Lane	High	Mod	I	SI	UI	UI
11	Little Avon at Matford Bridge	Good	Good	SI	MI	UI	SI

Table 11: Pressure Ratings results for Little Avon Halpin Project SmartRivers sites

No.	Site Name	Siltation (PSI)		Flow (LIFE)	
		Spring 22	Autumn 22	Spring 22	Autumn 22
7	Ozleworth Brook at Lower Barnes Bridge	SI	SI	SI	SI
8	Doverte Brook at Mill End	SI	SI	SI	SI
9	Little Avon Downstream Wickwar	MI	I	SI	MI
10	Tortworth Brook US Damery Lane	MI	MI	SI	SI
11	Little Avon at Matford Bridge	SI	MI	SI	SI

Table 12: Pressure Ratings results for Little Avon Halpin Project SmartRivers sites

The key for the pressure ratings categories used in the pressure ratings tables is included as Table 13 below.

Pressure Rating Acronym	Pressure Rating
HI	Heavily Impacted
I	Impacted
MI	Moderately Impacted
SI	Slightly Impacted
UI	Unimpacted

Table 13: SmartRivers Pressure ratings key

3.2 Riverfly Monitoring Initiative Results

The graphs below show the RMI total riverfly scores over time for all the active RMI sites in the Little Avon catchment. The Dyers Brook sites are all included in Figure 5. The Ozleworth Brook sites are all included in Figure 6. The Little Avon river sites are included in Figures 7 to 10. The graphs are taken from BART's Riverhub (<https://riverhub.co.uk/>).



Figure 5 Riverfly Total Scores for the Dyer's Brook RMI Sites

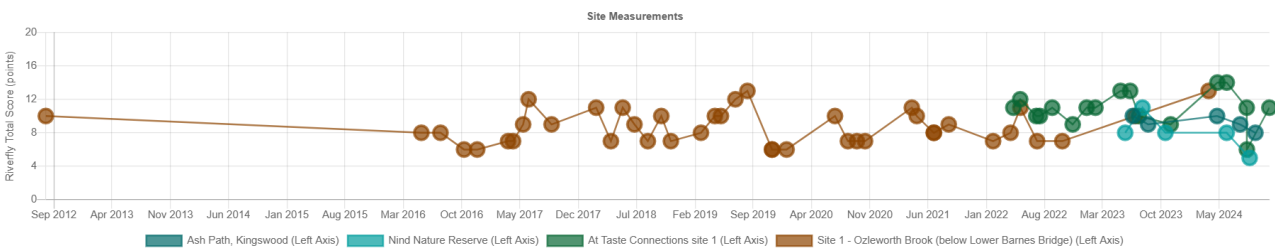


Figure 6 Riverfly Total Scores for the Ozleworth Brook RMI Sites

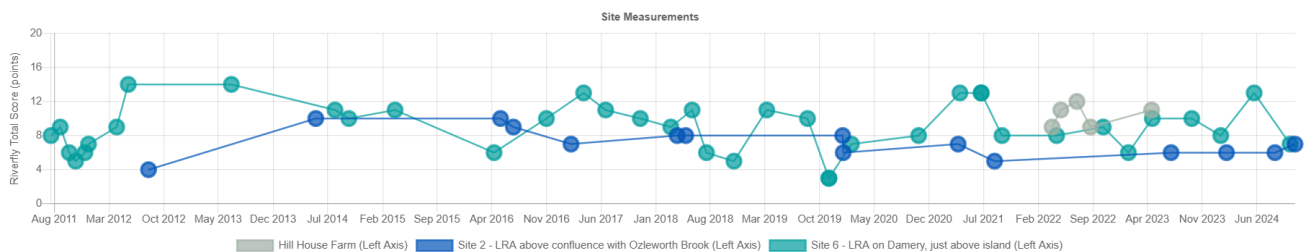


Figure 7 Riverfly Total Scores for the Little Avon three most upstream sites - Hill House Farm, Above confluence with the Ozleworth Brook and At Damery just above island



Figure 8 Riverfly Total Scores for the Little Avon next two sites – moving downstream – Damery Bridge and Damery Gateway

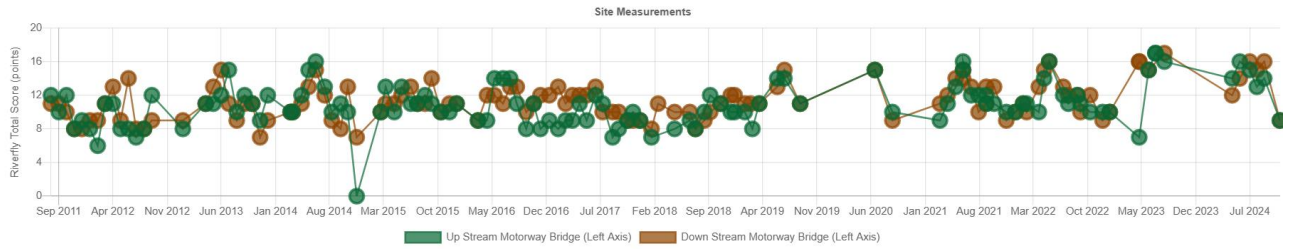


Figure 9 Riverfly Total Scores for the Little Avon next two sites – moving downstream – Upstream Motorway Bridge and Downstream Motorway Bridge

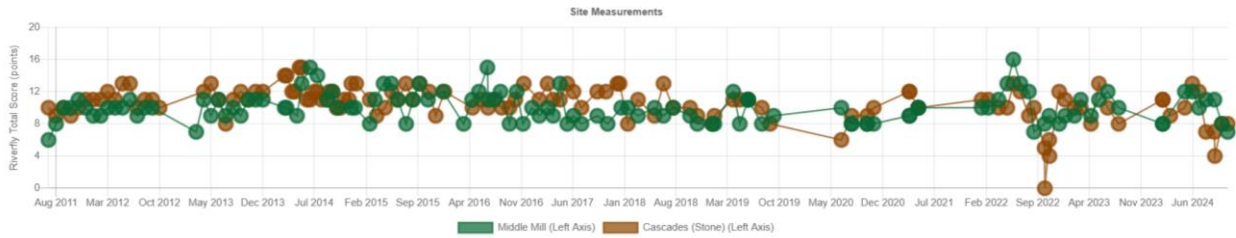


Figure 10 Riverfly Total Scores for the Little Avon next two sites – Middle Mill and Cascades

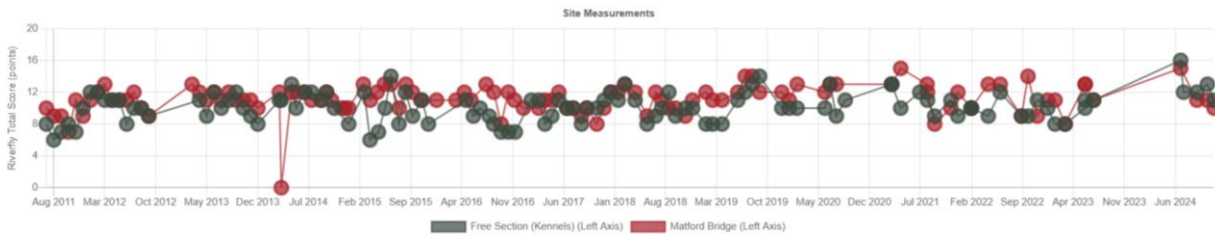


Figure 11 Riverfly Total Scores for the Little Avon two most downstream sites – Matford Bridge and Free Section (Kennels)

The graphs below show the RMI total riverfly scores over time for all of the riverfly sites in the Little Avon catchment. The graphs show the proportion of each of the eight riverfly groups in the samples. The graphs are taken from the Riverfly Partnership’s Data Platform: [Riverfly Data](#)

River **Dyers Brook** Catchment **Bristol Avon** Team **Bristol Avon Rivers Trust**

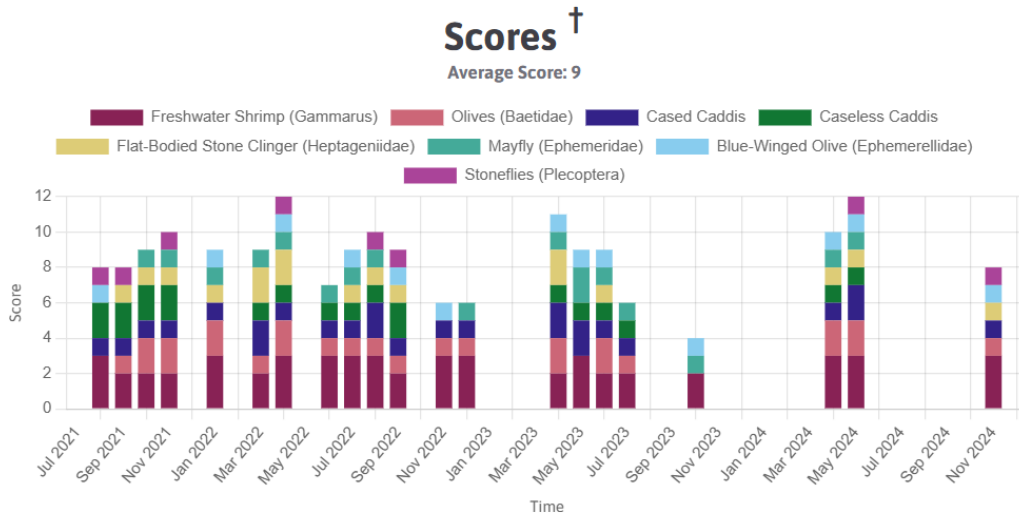


Figure 12 Riverfly Total Scores and taxon abundances for the Dyers Brook RMI sites

River **Ozleworth Brook** Catchment **Little Avon** Team **Bristol Avon Rivers Trust**

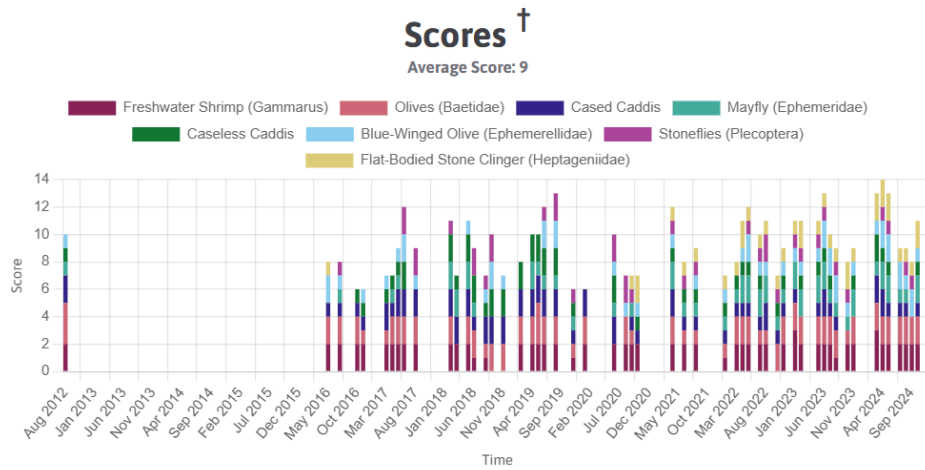


Figure 13 Riverfly Total Scores and taxon abundances for the Ozleworth Brook RMI sites

River **Little Avon** Catchment **Little Avon** Team **Bristol Avon Rivers Trust**

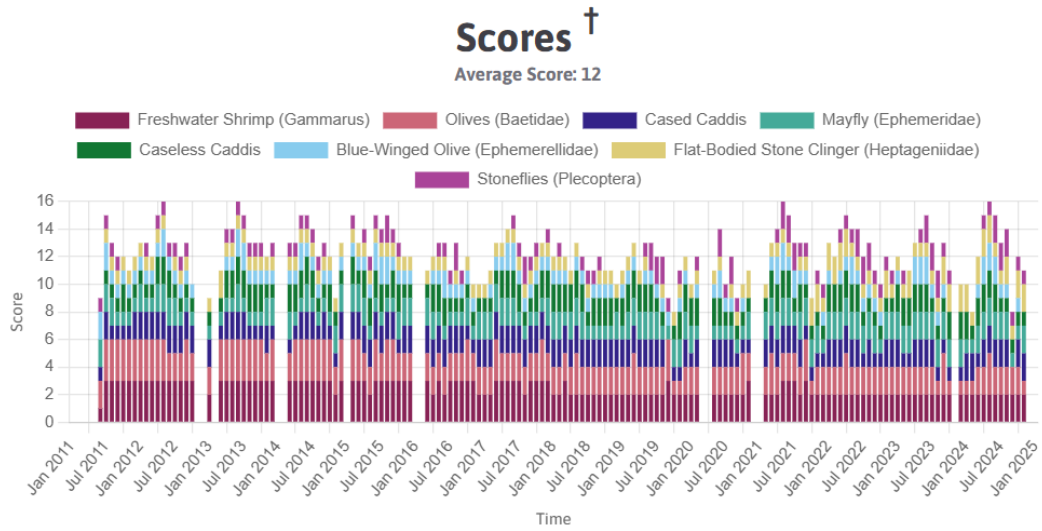


Figure 14 Riverfly Total Scores and taxon abundances for the Little Avon river RMI sites

Catchment **Little Avon** Team **Bristol Avon Rivers Trust**

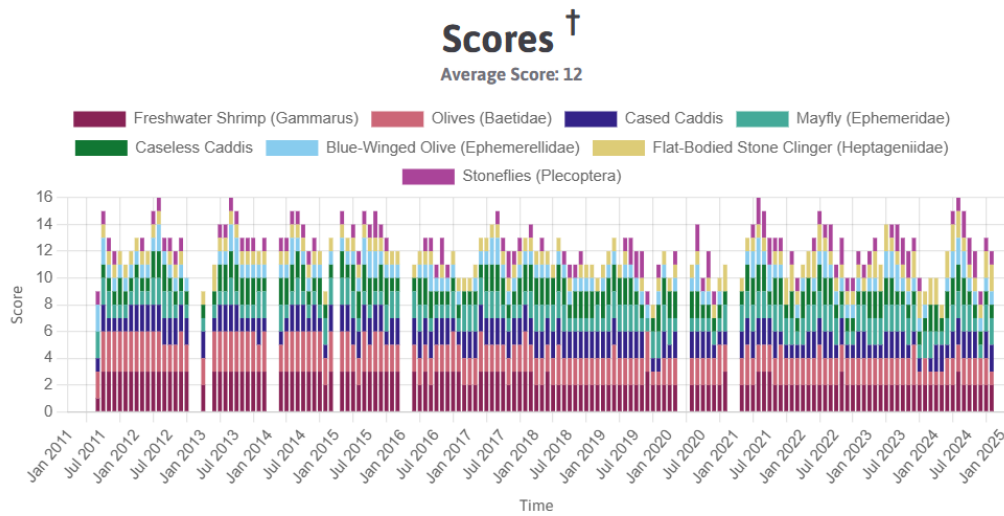


Figure 15 Riverfly Total Scores and taxon abundances for all the Little Avon catchment RMI sites

Table 14 below shows a summary of the RMI riverfly data for the Little Avon catchment

River	Site Name	Grid Reference	Average RMI Riverfly Score	Total number of Samples	Trigger Level	Trigger Level Breaches
Dyers Brook	100 Acer Woods	ST 77526 94140	7.4	14	5	0
Dyers Brook	Holywell Leaze	ST 76603 93759	8.2	11	5	1
Dyers Brook	Water Lane	ST 75908 92738	5.7	9	4	0
Dyers Brook	Park Mill Farm	ST 75440 92310	9	9	5	0
Dyers Brook			7.6			
Ozleworth Brook	At Taste Connections	ST 76943 91345	10.9	17	5	0
Ozleworth Brook	Nind Nature Reserve	ST 75478 91546	8	5	6	1
Ozleworth Brook	Ash Path	ST74976 91879	9.2	5	8	0
Ozleworth Brook	Lower Barnes Bridge	ST 73095 93085	8.7	41	6	0
Ozleworth Brook			9.2			
Little Avon	Hill House Farm	ST 73190 91690	10.4	5	8	0
Little Avon	Above confluence with Ozleworth Brook	ST 72376 92950	7.1	15	6	2
Little Avon	Damery just above island	ST 71013 94058	9	39	6	2
Little Avon	Damery Bridge	ST 70500 94300	10.7	47	8	1
Little Avon	Damery Gateway	ST 70200 94500	10.1	46	8	2
Little Avon	Upstream of Motorway Bridge	ST 69881 94665	11.1	127	6	0
Little Avon	Downstream of Motorway Bridge	ST 69626 94820	11.4	125	7	0
Little Avon	Middle Mill	ST 69324 95254	10.1	124	7	1

Little Avon	Cascades	ST 68648 95757	10.6	128	8	5
Little Avon	Matford Bridge	ST 68327 96863	11.2	118	8	1
Little Avon	Free Section (Kennels)	ST 68185 98768	10.2	121	7	2
Little Avon River			10.4			
Little Avon Catchment			10.3			

Table 14 Summary of RMI data

4. Discussion

4.1 SmartRivers

4.1.1 Little Avon Headwaters AONB Sites

Site 1: Kilcott Brook @ Hillesley Mill US Bridge

The SmartRivers pressure ratings scores were moderate / poor for pesticides in autumn 2020 and poor for pesticides in spring 2021 for Site 1. The site is moderately impacted by siltation in autumn 2021 but only slightly impacted by siltation in spring 2021. There is, therefore, concerning chemical pressure exhibited by the macro-invertebrates at this site in autumn and spring and moderate sediment pressure in autumn.

Flow, nutrients and organics ratings were either slightly impacted or unimpacted and of little concern at this site. The pressure ratings suggest that pressure from pesticides is of most concern at this site with some sediment pressure also likely to be inhibiting the macro-invertebrates.

The notes recorded at the time of sampling showed that silt was present in large quantities (45% cover recorded in the autumn and 55% in the spring) and had built up at the downstream end of the site as well as the presence of overlaying silt on the channel substrate. Sediment entering watercourses can have a detrimental effect on aquatic ecology, including fish and invertebrates. Impacts of excess sediment on fish include the degradation of spawning habitat / redds and the smothering of eggs and yolk-sac fry. Impacts on macro-invertebrates include the clogging of gills and the destruction of suitable habitats. In addition to these direct effects, sediment can adversely impact ecology through transfer of a wide range of industrial and agricultural contaminants into watercourses, including phosphates and nitrates. The presence of large quantities of silt at the site is likely to be restricting the macro-invertebrate assemblages in this location.

Site 2: Ozleworth Brook US Broad Bridge

The SmartRivers pressure ratings scores were moderate for siltation in autumn 2020 and spring 2021 for Site 2. There is, therefore, concerning sediment pressure exhibited by the macro-invertebrates at this site in autumn and spring.

Pesticides, flow, nutrients and organics ratings were either slightly impacted or unimpacted and of little concern at this site. The pressure ratings suggest that pressure from siltation is of most concern at this site.

The notes recorded at the time of sampling showed that the water was deep (average 50cm depth), slow flowing and there were high silt levels present (59% of the substrate type and a thick layer on all the channel substrate). Sediment entering watercourses can have a detrimental effect on aquatic ecology, including fish and invertebrates. The poor habitat conditions at this site and the presence of large quantities of silt are likely to be restricting the macro-invertebrate assemblages in this location. The channel at Site 2 was very straight with ponded areas and associated weirs both upstream and downstream of the site. It is likely that these physical modifications are slowing the flow at the

macro-invertebrate site and causing a build-up of silt in the brook here. Further investigation into these physical modifications is recommended and any options to improve the habitat should be considered. If undertaking measures upstream and downstream to improve the continuity of flow in this section is not possible then in stream river restoration works to increase the habitat features available, such as installing large woody debris within the channel, should be considered.

Site 3: Ozleworth Brook at Ozleworth Bottom

The SmartRivers pressure ratings were unimpacted or high for all pressures at Site 3. There was, therefore, no concerning pressure exhibited by the macro-invertebrates at this site in autumn 2020 or spring 2021.

Site 3 had an excellent diversity of macro-invertebrate taxa present in both autumn 2020 and spring 2021 samples. The notes recorded at the time of sample would support these findings as a variety of substrate types were recorded (boulders, cobbles, pebble, gravel, silt and sand were all recorded in fairly even proportions), riffle, run and pool flow types were present, and the water was flowing quickly in channel. These features provide natural habitat variation for macro-invertebrates to live within.

This site was located towards the top of the Ozleworth Brook watercourse and highlights the macro-invertebrate assemblages that could be living in these water courses if the pressures on them were reduced.

Site 4: Dyers Brook DS Wotton-Under-Edge

The SmartRivers pressure ratings scores were poor / bad for pesticides in autumn 2020 and poor for pesticides in spring 2021 for Site 4. The site is moderately impacted by siltation and nutrients in spring 2021 but only slightly impacted by siltation and nutrients in autumn 2020. There is, therefore, concerning chemical pressure exhibited by the macro-invertebrates at this site in autumn and spring and moderate sediment and nutrient pressure in spring.

Flow and organics ratings were either slightly impacted or unimpacted and of little concern at this site.

The pressure ratings suggest that pressure from pesticides is of most concern at this site with some sediment and nutrient pressures also likely to be inhibiting the macro-invertebrates.

The notes recorded at the time of survey showed that the habitat conditions at Site 4 had changed considerably in the Spring 2021 sample as the result of a natural in stream blockage caused by some large woody debris falling in the watercourse. This had caused the water to back up behind the blockage, replacing the shallow, fast flowing riffle / run habitat recorded in autumn 2020 with a slow, slack / run habitat with a thick silt substrate. The reduction in the number of macro-invertebrates found and the subsequent drops in Number of scoring taxa and BMWP scores between autumn and spring and the increase in sediment, and potentially nutrient pressure in the spring SmartRivers results reflects this change in habitat conditions. The SmartRivers pressure on the site from pesticides was present in both seasons and the change in habitat conditions did not, therefore, have an impact on this.

This site is located downstream of Wotton-Under-Edge. It is recommended that a water quality monitoring project is carried out on the Dyers brook to assess the conditions and the potential impact of water quality on the ecology of the brook, focusing particularly on the stretch downstream of Wotton-Under-Edge.

Site 5: Dyers Brook at Coombe

The SmartRivers pressure ratings scores were moderate for pesticides in autumn 2020 and spring 2021 for Site 5. The site is moderately impacted by siltation in spring 2021 but only slightly impacted by siltation in Autumn 2020. There is, therefore, concerning pesticide pressure exhibited by the macro-invertebrates at this site in Autumn and Spring and moderate sediment pressure in spring.

Flow, nutrients and organics ratings were either slightly impacted or unimpacted and of little concern at this site. The pressure ratings suggest that pressure from pesticides and siltation are of most concern at this site.

Although the channel is very narrow in this location (approximately 2m wide) and straight, small deflectors have been placed in the brook as part of a river restoration project. These features provide natural habitat variation for macro-invertebrates to live within and create a meandering channel with good flow. These features are likely to have reduced the impact of pressures on the macro-invertebrates – particularly pressure from flow and siltation.

Site 6: Dovere Brook DS Nibley STW

The SmartRivers pressure ratings scores were bad for pesticides in autumn 2020 and moderate for pesticides in spring 2021 for Site 6. The site is moderately impacted by siltation in autumn 2020 but only slightly impacted by siltation in spring 2021. There is, therefore, concerning pesticide pressure exhibited by the macro-invertebrates at this site in autumn and spring and moderate sediment pressure in autumn.

Flow, nutrients and organics ratings were either slightly impacted or unimpacted and of little concern at this site. The pressure ratings suggest that pressure from pesticides and siltation are of most concern at this site.

The notes recorded at the time of sampling indicate that there is very poor habitat available at this site and the water was also deep (average 60cm depth) and slow flowing. Very high silt levels were recorded in both samples (90% of the substrate type and a thick layer on all the channel substrate). The poor habitat conditions at this site and presence of large quantities of silt are likely to be restricting the macro-invertebrate assemblages at Site 6. Further investigation is recommended into the reasons for the slow, backed up, heavily silted channel in this location. If undertaking measures upstream and downstream to improve the continuity of flow in this section is not possible then in stream river restoration works to increase the habitat features available, such as installing large woody debris within the channel, should be considered.

The site is immediately downstream of Nibley sewage treatment works and further investigation into the water quality of the brook in this location is recommended. Additional macro-invertebrate monitoring is also recommended above the sewage treatment works to allow comparison between macro-invertebrate assemblages.

4.1.2 Little Avon Halpin Project SmartRivers Sites

Site 7: Ozleworth Brook at Lower Barnes Bridge

Site 7 had an excellent diversity of macro-invertebrate taxa present in both spring and autumn samples. The BMWP scores were excellent in both samples, well within the “High – unimpacted” water quality category at 120 and 121. The Number of Scoring Taxa were also high with 21 scoring taxa present in both seasons. ASPT scores were close to 6 (5.71 and 5.76), and amongst the highest found at the Little Avon sites.

The macro-invertebrate assemblages present at the site indicate that there is a good variety of available habitat types and that water quality in this location can support a good diversity of macro-invertebrates.

The notes recorded at the time of sampling show that there was a range of different habitat and flow types available at the site including run and pool flow types, exposed tree roots and large amounts of water crowfoot (*Ranunculus sp.*) present. The water was clear with no overlaying silt recorded in spring and 20% overlaying silt cover recorded in autumn. These features all provide natural habitat variation for macro-invertebrates to live within.

The SmartRivers pressure ratings scores were mainly good. The site was unimpacted or slightly impacted by all pressures in both seasons except for moderate phosphorus pressure exhibited by the macro-invertebrates in spring and moderate chemicals pressure exhibited in autumn. Some sediment and flow impacts were also indicated, although these were slight.

It should be noted that the catchment suffered from drought conditions in summer 2022. Numerous Anglers Riverfly Monitoring Initiatives (ARMI) sites recorded reduced macro-invertebrate scores, often falling below the trigger level in the Little Avon catchment in summer and early autumn 2022. The impact of the summer low flows does not appear to have had a detrimental effect on the macro-invertebrate assemblages recorded in the SmartRivers early autumn sample (collected in late September). It is likely that the excellent range of habitat types – including in stream submerged macrophytes and other important natural features and the lack of sediment pressure at the site has given the macro-invertebrate communities reasonable resilience to any pressures from low flows.

Ozleworth Brook at Lower Barnes Bridge is a regularly monitored ARMI site. Data from 2022 shows a drop in scores in autumn. The score does not, however, drop below the trigger (warning) level set for this site and the scores are seen to drop to similar levels in previous years. Again, this RMI data suggests that the variety of natural features present at the site has allowed the macro-invertebrates to remain resilient to any pressures from low flows.

Site 8: Doverte Brook at Mill End

Site 8 had a very restricted diversity of macro-invertebrate taxa present in both spring and autumn samples. The BMWP scores were moderate in spring (very close to the border with the poor category) and poor in autumn indicating that the site is polluted or impacted. The Number of Scoring Taxa were also very low with only 9 scoring taxa present in spring and 7 in autumn. Site 8 was the only Little Avon site to have ASPT scores below 5 (4.67 and 4.14).

The macro-invertebrate assemblages present at the site indicate that there is a very limited variety of available habitat types and that water quality in this location is not able to support a good diversity of macro-invertebrates.

The notes recorded at the time of sampling show that there was very restricted habitat at the site with thick silt / mud recorded in both seasons. The flow was a very slow run flow with 100% silt cover present, steep banks and no macrophytes. The turbidity was moderate / high and there was an odour present. These features provide very poor habitat variation for macro-invertebrates to live within and are likely to be restricting the macro-invertebrate assemblages in this location.

Low diversity is affecting the calculation of the more sensitive SmartRivers metrics - TRPI (phosphorus) and PSI (sediment) at this site so the SmartRivers results for these two pressures should be discounted here. The SmartRivers pressure ratings scores for chemicals were poor in both seasons indicating that the macro-invertebrates are exhibiting extremely high chemical stress. Although organics pressure results came out as slightly impacted the high saprobic scores of 2.03 and 2.00 for organics suggest considerable water quality issues are present here. Experts at WildFish state that SmartRivers saprobic scores above 2 should be flagged as problematic.

In 2021 BART carried out walkover surveys on the Little Avon tributaries – including the Doverte Brook. These surveys highlighted severe water quality and sediment issues on the Doverte Brook upstream of the macro-invertebrate sampling location. Issues recorded included cattle walking and bathing within the watercourse, a livestock feeder placed less than 10m from the brook with evidence of poaching very close to the brook, with sediment and excrements entering the watercourse and a small pig farm set up adjacent to / within the watercourse. The watercourse had also purposely been modified to enter the pig farm, to provide water for the livestock.

Due to the severity of these findings BART reported the issues to the Environment Agency for further investigation. Rozy Gray, BART Project Manager re-visited the site in January 2022 and found that these issues were still impacting the watercourse. Further issues were also recorded during this visit including a slurry heap leaching down the hill and into the river and tree removal adjacent to the watercourse.

The macro-invertebrate assemblages recorded at Site 8 were poor. The SmartRivers pressure ratings found extremely high chemical stress at this site and the organics ratings suggested considerable water quality issues. The sediment and phosphorus metrics could not be used as there were so few taxa present. It is extremely likely that the polluting inputs entering the Doverte brook upstream of the macro-invertebrate site, as reported by BART to the Environment Agency, are responsible for the very poor macro-invertebrate assemblages recorded at the site.

Site 9: Little Avon DS Wickwar

Site 9 had a good to excellent diversity of macro-invertebrate taxa present in the samples. The BMWP scores were good in spring and excellent in autumn. The Number of Scoring Taxa were also highest in autumn (19) and a little lower in spring (15). ASPT scores were also good - both above 5 (5.13 and 5.42).

The macro-invertebrate assemblages present at the site indicate that there is a good variety of available habitat types and that water quality in this location can support a good diversity of macro-invertebrates.

The notes recorded at the time of sampling show that there was a restricted range of habitat and flow types available at the site - run and pool flow types. The banks were very steep and collapsing in places and the substrate had high levels of silt (30%) and an overlaying silt cover in both seasons (30% thick overlaying silt in Spring and 100% overlaying thick silt in Autumn). The water had high to moderate turbidity and there was very slow flow present with the water backing up behind the Large Woody Debris (LWD) in the channel.

Although the biological indices scores were higher in autumn than spring at this site, the SmartRivers Pressures ratings are all poorer in autumn compared to spring suggesting considerable water quality pressures on the macro-invertebrate communities, particularly in autumn. There were concerning chemical, phosphorus, sediment and flow stress exhibited by the macro-invertebrate communities in autumn. Although organics pressure results came out as slightly impacted in both seasons the high Autumn saprobic score of 2.09 for organics suggest considerable water quality issues are present here. Experts at WildFish state that SmartRivers saprobic scores above 2 should be flagged as problematic.

Stress from sediment and flow was also exhibited by the macro-invertebrate communities in spring.

It should be noted that the catchment suffered from drought conditions in summer 2022 and the impact of the summer low flows could have had a detrimental effect on the macro-invertebrate assemblages recorded in this late September sample. The low flows could have exacerbated the impact of the pressures contributing to the very high chemical, phosphorus, sediment and flow stress exhibited by the macro-invertebrate communities in autumn.

The conditions at the site are also likely to have contributed towards stresses on the macro-invertebrate communities. The steep banks were recorded as collapsing in places – this would add sediment to the river at the macro-invertebrate site location. Severe poaching and a very muddy track were recorded immediately upstream of the site causing significant sediment input into the river here. Other impacts on the stretch upstream of Site 9 recorded during BART's walkovers include culverting of the river under the railway track- potentially impacting the flow at the site and Wickwar Sewage Pumping Station which is located downstream of Wickwar – potentially contributing towards the concerning chemical and phosphorus stresses and the high saprobic score in autumn (suggesting considerable water quality issues).

Site 10: Tortworth Brook US Damery Lane

Site 10 had an excellent diversity of macro-invertebrate taxa present in both spring and autumn samples. The BMWP scores were excellent in both samples, just above the border with good water quality in spring (101) and well within the “High – unimpacted” water quality category in autumn (167), this was the highest of all the Little Avon BMWP scores. The Number of Scoring Taxa scores were also high with 19 scoring taxa present in Spring and 28 in autumn – again the highest of all the Little Avon samples. ASPT scores were also high (5.32 and 5.96), particularly in autumn, once again the highest found at the Little Avon sites.

The macro-invertebrate assemblages present at the site indicate that there is a good variety of available habitat types and that water quality in this location can support a good diversity of macro-invertebrates.

The notes recorded at the time of sampling show that there was a range of different habitat and flow types available at the site including riffle and run flow types and exposed tree roots. An eel was recorded in the autumn sample. The site was, however, straight with very steep banks and appeared to have been historically re-sectioned. The water was moderately turbid with overlaying silt recorded in Spring and slightly turbid with similar amounts of overlaying silt cover recorded in autumn. The substrate notes recorded high levels of silt in spring (45%) compared with autumn (25%). The site conditions, therefore, include features that do provide natural habitat variation for macro-invertebrates to live within as well as features that are likely to be negatively impacting the macro-invertebrate assemblages.

The SmartRivers pressure ratings scores found moderate sediment stress exhibited by the macro-invertebrates in both seasons at this site. This correlates with the silty conditions recorded at the time of the surveys. Considerable phosphate stress was indicated in Spring and moderate chemical stress was indicated in autumn. There was some flow stress evident – more pronounced in spring.

The conditions at the site and pressures on the upstream stretch of river are likely to have contributed towards the stresses on the macro-invertebrate communities. This stretch of river had very steep banks with no tree cover in places to stabilise the banks and as a result in some places the banks are eroding. The brook is very straight and is likely to have been historically re-sectioned. Extensive straightening of watercourses causes several impacts to the river’s ecological quality, including a reduction in flow diversity, a reduction in depth diversity and disrupted sediment and substrate transport. Other impacts on the stretch upstream of Site 4 recorded during BART’s walkovers include overland crop run off from arable fields being irrigated in winter, overland crop run off from arable fields with no buffer, saturated farm tracks adjacent to the watercourse and poaching from livestock. All these factors are potentially contributing towards the concerning sediment, chemical and phosphorus stresses exhibited by the macro-invertebrate assemblages at this site.

Site 11: Little Avon at Matford Bridge

Site 11 had an excellent diversity of macro-invertebrate taxa present in both spring and autumn samples. The BMWP scores were excellent in both samples, both well within the “High – unimpacted” water quality category (134 and 152). The Number of Scoring Taxa scores were also high with 25 scoring taxa present in Spring and 27 in Autumn. ASPT scores were above 5 in both seasons (5.36 and 5.63).

The macro-invertebrate assemblages present at the site indicate that there is a good variety of available habitat types and that water quality in this location can support a good diversity of macro-invertebrates.

The notes recorded at the time of sampling show that there were limited flow types available at the site with only fast run flow present. Some habitat diversity was provided in the form of exposed tree roots as well as 10% macrophytes and a small amount of moss. An eel was recorded in the autumn sample and returned to the river. The water depth in autumn was far lower than in spring and a note was made of a thick silt layer covering the bed as well as an algal covering in autumn. Filamentous algae known as blanketweed (*Cladophora agg.*) was recorded in higher abundance in autumn (40% cover) compared to spring (20% cover). The site was straight with very steep banks and appeared to have been historically re-sectioned. The water was moderately turbid with a high percentage of overlaying silt recorded in autumn (70%) compared to spring (20%). The site conditions, therefore, include features that do provide natural habitat variation for macro-invertebrates to live within as well as features that are likely to be negatively impacting the macro-invertebrate assemblages. Conditions appear more impacted in autumn compared to spring.

Although the biological indices scores were higher in autumn than spring at this site, the SmartRivers pressures ratings are poorer in autumn compared to spring suggesting considerable water quality pressures on the macro-invertebrate communities, particularly in autumn. The SmartRivers pressure ratings scores found concerning phosphorus and sediment stress exhibited by the macro-invertebrates in autumn at this site. This correlates with the silty conditions and higher levels of algae recorded at the time of the autumn survey. Some flow and chemical stress were indicated in both seasons with impacts slightly more evident in autumn.

The catchment suffered from drought conditions in summer 2022. Numerous RMI sites recorded reduced macro-invertebrate scores, often falling below the trigger level in the Little Avon catchment in summer and early autumn 2022. The impact of the summer low flows is likely to have contributed towards the concerning phosphorus and sediment stress exhibited by the macro-invertebrate communities in autumn. It should be noted, however, that there was still an excellent diversity of macro-invertebrate taxa recorded in autumn, suggesting that the communities here were either not impacted by low flows or have good resilience to the low flow conditions.

Other impacts on the stretch upstream of Site 11 recorded during BART's walkovers include incised channel with bank erosion and bare maize fields with no buffer zone – all these features are likely to be causing sediment to enter the river. Site conditions recorded during the survey suggested that sediment levels were higher during the autumn sample, again potentially the result of the recent low flows. The average river depth recorded during the autumn sample was lower (20cm) than during the spring sample (40cm).

Little Avon at Matford Bridge is a regularly monitored ARMI site. Data from 2022 shows a drop in scores in summer. The score does not, however, drop below the trigger (warning) level set for this site and the scores are seen to drop to similar levels in previous years.

4.2 Riverfly Monitoring Initiative

4.2.1 Dyers Brook RMI sites

There are four riverfly sites on the Dyers Brook – the tributary of the Little Avon that runs through Wotton-Under-Edge. Starting from the most upstream these are 100 Acer Woods, Holywell Leaze, Water Lane and Park Mill Farm. Riverfly total scores at the Dyers Brook sites ranged from 3 (at Holywell Leaze in October 2023) to 13 (Holywell Leaze in Jan 2022). Most samples scored between 6 and 10. Survey results are from Sept 2021 to present day. The trigger level for the Water Lane site is 4, the trigger level for the other sites is 5.

Scores fell below trigger level on one occasion – at Holywell Leaze in October 2023. The Water Lane site scored 4 in August 2022 and October 2023. The August 2022 site could have been the result of drought conditions in the catchment putting extra pressure on the macro-invertebrate communities. The Holywell Leaze site scored 3 in October 2023 with only 50 shrimps and one blue winged olive present. There was no obvious signs of pollution present at the time of survey. Scores were also low in summer 2022 with scores of 5 and 6; these low scores could have been the result of drought conditions in the catchment.

All of the eight RMI groups have been recorded in the Dyers Brook with Shrimps being the most abundant of the RMI groups.

4.2.2 Ozleworth Brook RMI sites

There are four riverfly sites on the Ozleworth Brook – the tributary of the Little Avon that runs from Ozleworth, through Kingswood and joins the Little Avon downstream of Charfield. Starting from the most upstream these are At Taste Connections, Nind Nature Reserve, Ash Path and below Lower Barnes Bridge. Riverfly total scores at the Ozleworth Brook sites ranged from 5 (at Nind Nature Reserve in August 2024) to 14 (at Taste Connections in April and May 2024). Most samples scored between 6 and 11. Survey results are from 2012 to present day at the Lower Barnes Bridge site, with regular sampling since 2016. At Taste Connection site was first monitored in April 2022, Nind Nature reserve monitoring began in May 2023 and Ash Path monitoring began in June 2023.

The trigger levels are variable on the Ozleworth Brook– between 5 and 8. The Taste Connections site has been sampled 17 times, scores range between 6 and 14 with the vast majority of scores between 9 and 13 and has never fallen below the trigger level of 5. The Nind Nature Reserve site has been sampled 5 times with scores ranging between 5 and 11. Three of the five samples scored an 8 and the site has fallen below the trigger level of 6 on one occasion – August 2024. Low flows were recorded at the time of the trigger level breach. The Ash Path site has been sampled 5 times with scores staying very stable and only ranging between 8 and 10. No samples have fallen below the trigger level of 8. The Lower Barnes Bridge site has been monitored 41 times and has never fallen below the trigger level of 6.

All of the eight RMI groups have been recorded in the Ozleworth Brook. Shrimps being the most abundant of the RMI groups with an average score of 56 and caseless caddisflies are the least abundant with an average score of 2.

4.2.3 Little Avon river RMI sites

There are eleven Little Avon river sites registered under the BART hub. The extensive and dedicated monitoring by Charfield and Berkely Estate Angling clubs has meant that some of the sites have been regularly sampled since 2011 and in total there have been over 950 samples taken on the Little Avon river.

The most upstream site is monitored by a dedicated volunteer (Hill House Farm). Next downstream are the two sites monitored by Charfield Anglers (Above confluence with Ozleworth Brook and Damery just above island), then eight monitored by Berkeley Estate (Damery Bridge, Damery Gateway, Upstream of Motorway Bridge, DS of motorway bridge, Middle Mill, Cascades (Stone), Matford Bridge and finally Free section (Kennels)).

The most upstream site – Hill House Farm is a new addition to the historic monitoring on the Little Avon by the angling clubs. This site has been sampled five times between March 2022 and April 2023. Scores for the site range between 9 and 11. It is understood that the site is still active. There is excellent data available for the Charfield Anglers sites as Above confluence with Ozleworth Brook and Damery just above island have been sampled since 2012 and 2011 respectively. Scores for the Above confluence with the Ozleworth Brook site range between 4 and 10 with the vast majority of samples scoring between 6 and 10. These are relatively low scores for the Little Avon river. Samples breached the trigger level of 6 in August 2012 and August 2021 (4 and 5 respectively). Scores for the Damery, just above island site are generally higher than the other Charfield Anglers site– scoring between 3 and 14 with most samples scoring between 8 and 13. Samples fell below the trigger level of 6 on two occasions – in Nov 2018 (5) and Nov 2019 (3). These are incredibly low scores for this site and suggest some kind of pollution incident.

The next two sites downstream- Damery Bridge and Damery Gateway were both first sampled in 2019, have very regular sampling and their scores correlate very closely with each other. Highest scores are often seen in May and June, which is a common trend for riverfly sites. Scores on the Damery Bridge site range between 6 and 18 – which is a large variation. However most samples score consistently between 9 and 12. The Damery Gateway site shows a little less variation, ranging from 7 and 15. Again most scores are in the fairly narrow range between 8 and 11. The samples fell below the trigger level of eight at both sites in October 2022. The sites were sampled again by the dedicated monitors as per the trigger level breach protocol and both remained below trigger. The Environment Agency were contacted and investigated the trigger level breaches as part of their drought investigations. The Damery Gateway site also breached trigger level in Jan 2024 with a score of 7. The site was re-sampled and the score was also a 7, confirming the breach.

The next two sites downstream- Upstream Motorway Bridge and Downstream Motorway Bridge were both first sampled in 2011, have very regular sampling and their scores correlate very closely with each other. Highest scores are often seen in May and June, which is a common trend for riverfly sites. Scores at the Upstream Motorway site range between 6 and 17 – with the exception of November 2014 when the site scored 0. The reason for this score is unknown and is very likely to have been a database input error so will not be counted as a trigger level breach in this report. Most samples scored between 8 and 13. The Downstream Motorway site scores are very similar and range from 7 to 17 with most samples scoring between 8 and 13 again. The samples did not fall below the trigger levels of 6 at the Upstream site and 7 at the downstream site.

The next two sites downstream- Middle Mill and Cascades were both first sampled in 2011, have very regular sampling and there is quite a lot of correlation between scores. Highest scores are again often seen in May and June, which is a common trend for riverfly sites. Scores at the Middle Mill site range between 6 and 16 with most samples scoring between 8 and 13. The site only falls below the trigger

level of 7 when it scores a 6 in the first sample. The Cascades site scores range from 6 to 16, although again most samples score between 8 and 13. The scores fall below trigger level of 8 in June 2020 (6 – no details in the database), September 2022 (a score of 5 triggering an alarm followed by a score of 0 in the follow up sample – this 0 score could be a database input error and will be ignored in this report) and then in October 2022 (a 6 triggering an alarm followed by a 4 in the follow up sample). The September and October 2022 trigger level breaches were reported to the Environment Agency. The Environment Agency investigated the trigger level breaches as part of their 2022 drought investigations. The Damery beats also breached trigger level in October 2022, as discussed above, suggesting wider geographical impacts. The Cascades site also breached trigger level in July 2024 with a score of 7 and again in August 2024 with a score of 7. The site was re-sampled a day after the August sample and scored a 4, confirming the trigger level breach.

The furthest downstream Little Avon sites- At Matford Bridge and Free Section (Kennels) were also both first sampled in 2011, have very regular sampling and as with the other sites their scores correlate with each other. Highest scores are often seen in Spring and early summer which is a common trend for riverfly sites. Scores at the Matford Bridge site range between 7 and 15 – with the exception of March 2014 when the site scored 0 which may have been a database entry error and will be ignored in this report. Most samples scored between 8 and 13. The Free Section (Kennels) site scores were similar, although often a little lower. Scores ranged from 6 to 16 with most samples scoring between 7 and 12. The samples fell below the trigger of 8 at the Matford Bridge site in October 2011 (7). The Free Section (Kennels) fell below its trigger of 7 in Aug 2011 and March 2015 (score of 6 on both occasions).

All of the eight RMI groups have been recorded in the Little Avon catchment , not surprisingly given the length of time some of the sites have been surveyed and the number of samples taken. Shrimps are by far the most abundant of the eight RMI groups with an average score of 113. Stoneflies were the least abundant of the RMI groups with an average score of 3.

The taxon abundances for the Little Avon catchment as a whole are very similar to the Little Avon river results as a very high proportion of samples are from the Little Avon river itself. All of the eight RMI groups have been recorded in the Little Avon catchment , not surprisingly given the length of time some of the sites have been surveyed and the number of samples taken. Shrimps are by far the most abundant of the eight RMI groups with an average score of 114. Stoneflies were again the least abundant of the RMI groups with an average score of 3.

5 Findings and Recommendations

5.1 SmartRivers Overall Findings

The Little Avon SmartRivers results were very variable between sites and even samples. **The pressure of most consistent concern across the catchment was chemicals.** Most of the sites showed a concerning impact from chemicals and a greater impact was seen in the autumn samples. BART walkovers undertaken in 2022 identified numerous poor agriculture and land management practices in the catchment, likely to be contributing to high chemical loading in the waterbodies. Sewage Treatment works are also a likely source of high chemical loading – there are a number of Sewage Treatment works in the catchment including Wooton Under Edge, Wickwar and Charfield.

Siltation was also flagged as a concern at most of the sites. Excessive sediment caused by anthropogenic factors such as livestock or construction is detrimental to the water quality and ecology of a watercourse, including fish and invertebrates. Impacts on macro-invertebrates include the clogging of gills and the destruction of suitable habitats. BART walkovers undertaken in 2022 found that the most extensive of the sediment issues recorded included the headwaters of the Little Avon. Sources included road and track runoff, areas of land grown for maize with bare soils over winter and no buffer as well as areas with sediment input from bank trampling as a result of poor livestock management.

The catchment suffered from drought conditions in summer 2022. Numerous RMI sites recorded reduced macro-invertebrate scores, often falling below the trigger level in the Little Avon catchment in summer and early autumn 2022. The impact of the summer low flows is likely to have contributed towards the concerning chemical and sediment stress exhibited by the macro-invertebrate communities at some of the SmartRivers sites in autumn 2022.

This report gives a detailed site by site analysis of the SmartRivers results and highlights potential habitat and water quality issues that are likely to be impacting on the macro-invertebrate assemblages. These include Sewage Treatment Works upstream of the sampling sites on the Dovere Brook at Nibley and the Little Avon downstream of Wickwar, re-enforcement of the channel at the Dyer's Brook at Coombe site, artificially straightened channels on the Tortworth Brook and Ozleworth Brook at Broad bridge sites and riverside habitat severely trampled by livestock at the downstream of Wickwar site.

The site with the most restricted macro-invertebrate assemblages was the Dovere Brook at Mill End. The biological indices at this site were very low indicating poor water quality and habitat in this location. The notes recorded at the time of sampling show that there was very restricted habitat at the site with thick silt / mud recorded in both seasons. The flow was a very slow run flow with 100% silt cover present, steep banks and no macrophytes. The turbidity was moderate / high and there was an odour present. These features provide very poor habitat variation for macro-invertebrates to live within and are likely to be restricting the macro-invertebrate assemblages in this location.

Low diversity is affecting the calculation of the more sensitive SmartRivers metrics - TRPI (phosphorus) and PSI (sediment) at this site. This means that the pressure scores are unreliable and SmartRivers results for these two pressures should be discounted here. The SmartRivers pressure ratings scores for chemicals were poor in both seasons indicating that the macro-invertebrates are exhibiting extremely high chemical stress. Although organics pressure results came out as slightly impacted the high saprobic scores of 2.03 and 2.00 for organics suggest considerable water quality

issues are present here. Experts at WildFish state that SmartRivers saprobic scores above 2 should be flagged as problematic.

In 2021 BART carried out walkover surveys on the Little Avon tributaries – including the Dovere Brook. These surveys highlighted severe water quality and sediment issues on the Dovere Brook upstream of the macro-invertebrate sampling location. Issues recorded included cattle freely accessing the watercourse, a livestock feeder placed less than 10m from the brook with evidence of bank poaching very close to the brook, with sediment and excrements entering the watercourse and a small pig farm set up adjacent to / within the watercourse. The watercourse had also purposely been modified to enter the pig farm, to provide water for the livestock.

Due to the severity of these findings BART reported the issues to the Environment Agency for further investigation and the Environment Management Team have led an investigation into this problem site. Rozy Gray, BART Project Manager re-visited the site in January 2022 and found that these issues were still impacting the watercourse. Further issues were also recorded during this visit including a slurry heap leaching down the hill and into the river and tree removal adjacent to the watercourse and these findings were also reported to the Environment Agency alongside the SmartRivers findings for further investigation.

The only SmartRivers site that was unimpacted by chemicals and siltation (and in fact by all the SmartRivers pressures) was the site towards the top of the Ozleworth Brook – at Ozleworth Bottom. This site had an excellent diversity of macro-invertebrates present in both samples and highlights the macro-invertebrate assemblages that could be living in these water courses if the pressures on them were reduced.

5.2 RMI Overall Findings

The long term and very regular sampling that has been undertaken on the Little Avon river – thanks mainly to the angling clubs – has flagged trigger level breaches on 16 occasions. Riverfly monitors are often the first to spot pollution incidents when their samples show a reduction in diversity and abundance of the eight RMI groups, helping to protect the river ecology and encouraging the Environment Agency to investigate further.

The site with the most trigger level breaches is the Little Avon at Cascades site – towards the bottom of the watercourse near Stone. This has breached its trigger level on 5 occasions – including the drought period of autumn 2022. Further investigation is recommended into the potential water quality issues affecting this site.

The drought conditions of summer 2022 affected many of the rivers in the catchment and the RMI data from sites such as those on the Little Avon river helped to inform the Environment Agency's drought investigations. Little Avon sites showing clear drought impacts include Damery Bridge, Damery Gateway and Cascades.

As well as spotting and flagging potential pollution incidents the regular monitoring can also provide a very useful long term data set, allowing us to target areas for further investigation and scope potential improvement works. The data will also inform us of benefits derived from river restoration, land management improvements or water industry asset upgrades.

Little Avon RMI data shows no clear trend for improvement or deterioration over time at any of the sites. Scores remain stable over the last 14 years. Average riverfly total scores in the Little Avon catchment ranged between 5.7 and 11.4. The highest average riverfly score was on the Little Avon DS

Motorway Bridge site, monitored by the Berkeley Estate angling club. The lowest average riverfly score was on the Dyers Brook at Water Lane. This site is downstream of Wotton-Under-Edge and the SmartRivers analysis indicates potential water quality pressures in this location. The low RMI scores support this finding. Unfortunately there are no BART Detective sites (monitoring water quality) on the Dyers Brook downstream of Wotton-Under-Edge. Establishing a BART Detective site in this location could help to provide further evidence and identify potential sources of pollution. Further investigation should, therefore, be undertaken into the cause of the restricted macro-invertebrate communities recorded downstream of Wotton-under-edge and concerns should be raised with the Environment Agency.

The lowest RMI score on the Little Avon river itself was at the above confluence with the Ozleworth Brook site. This site has an average RMI score of 7.1 which is well below the average RMI score for the Little Avon river (10.4). Further investigation should be undertaken to determine the reason for the restricted macro-invertebrate communities in this location and identify opportunities for potential improvement works.

5.3 Overall Recommendations

This report highlights the pressures facing the Little Avon catchment and provides evidence of the stresses exhibited by the macro-invertebrate communities at each of the sites. The Little Avon catchment is split into six waterbodies under the Water Framework Directive. Five of the Little Avon waterbodies are classified as failing to achieve Good Ecological Status under WFD (www.environment.data.gov.uk/catchment-planning/). The Ozleworth Brook waterbody is classed as Good Ecological Status under WFD, although it is still failing its chemical status. BART recommends investment into the catchment to undertake actions to improve the ecological condition of these waterbodies. This macro-invertebrate monitoring report should be referenced to help prioritise areas for action and to identify the works that will be most beneficial for the macro-invertebrate communities.

The Riverfly data discussed in this report has highlighted a number of recommendations for further work to improve the ecological condition of the Little Avon catchment. These include:

- Further investigation into opportunities for habitat improvement works in the sections of the channel with physical modifications including barriers to fish movement and flow and straightened sections of the channel. In stream river restoration works to increase the habitat features available, such as installing large woody debris within the channel, should be considered alongside barrier removal / partial removal;
- Continued communications with the Environment Agency regards the considerable water quality problems highlighted on the Dovere Brook above the Mill End site;
- Continued communications with the Environment Agency regards the impact of drought on the macro-invertebrate communities in the Little Avon catchment;
- Communications with the EA to encourage further monitoring of water abstraction on the Little Avon tributaries in particular. Abstraction should be monitored closely alongside ecological status, and also more wetlands need to be delivered within the catchment in order to replenish the water table and reduce the impact on these rivers and the likelihood of them drying out;
- BART recommend that the EA undertake water quality monitoring investigations on the Dyers brook to assess the conditions and the potential impact of water quality on the ecology of the brook, focusing particularly on the stretch downstream of Wotton-Under-Edge (both RMI data and SmartRivers data suggests potential water quality issues here);

- Establishing a BART Detectives water quality monitoring site on the Dyer's Brook downstream of Wotton-Under-Edge to support the riverfly data;
- Establishing BART Detectives water quality monitoring sites on the Doverte Brook DS Nibley and the Little Avon DS Wickwar to support the riverfly data;
- BART farm visits / landowner engagement along the stretches of riverbank that are heavily poached – including the Little Avon DS Wickwar site;
- Further investigation into the causes of trigger level breaches at the Little Avon at Cascades RMI site;
- Further investigation into the cause of the low RMI average score at the Little Avon above confluence with the Ozleworth Brook RMI site;
- Continued analysis of the BART Detectives data alongside the riverfly data to flag any problematic sites and to better understand the likely causes.

6 References

BS EN ISO 10870:2012 Water quality - Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters

Researchgate.net (2021) https://www.researchgate.net/figure/BMWP-Classes-Scores-Categories-and-Interpretation-of-the-Result_tbl1_326649205

RiverHub Data Platform 2024: <https://riverhub.co.uk/>

7 Appendices

Appendix 1 – Site photos



Little Avon Tribs Macro-invertebrate site 1: Kilcote Brook at Hillesley Mill



Little Avon Tribs Macro-invertebrate site 2: Ozleworth Brook US Broad Bridge



Little Avon Tribs Macro-invertebrate site 3: Ozleworth Brook at Ozleworth Bottom



Little Avon Tribs Macro-invertebrate site 4: Dyers Brook DS Wotton-Under-Edge



Little Avon Tribs Macro-invertebrate site 5: Dyers Brook at Coombe



Little Avon Tribes Macro-invertebrate site 6: Doverte Brook DS Nibley STW



Little Avon Macro-invertebrate site 7: Ozleworth Brook at Lower Barnes Bridge



Little Avon Macro-invertebrate site 8: Dovere Brook at Mill End



Little Avon Macro-invertebrate site 9: Little Avon DS Wickwar

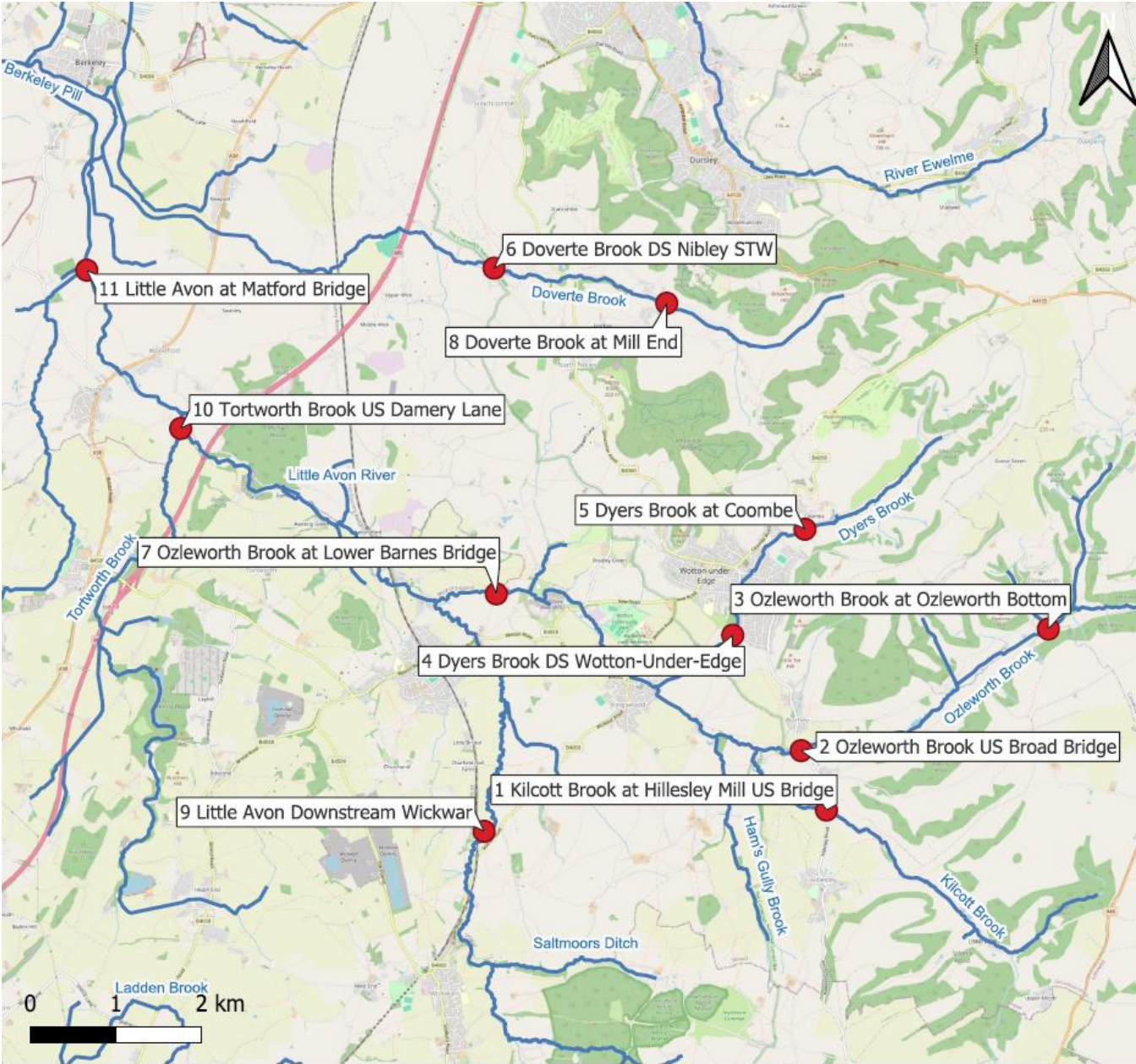


Little Avon Macro-invertebrate site 10: Tortworth Brook US Damery Lane

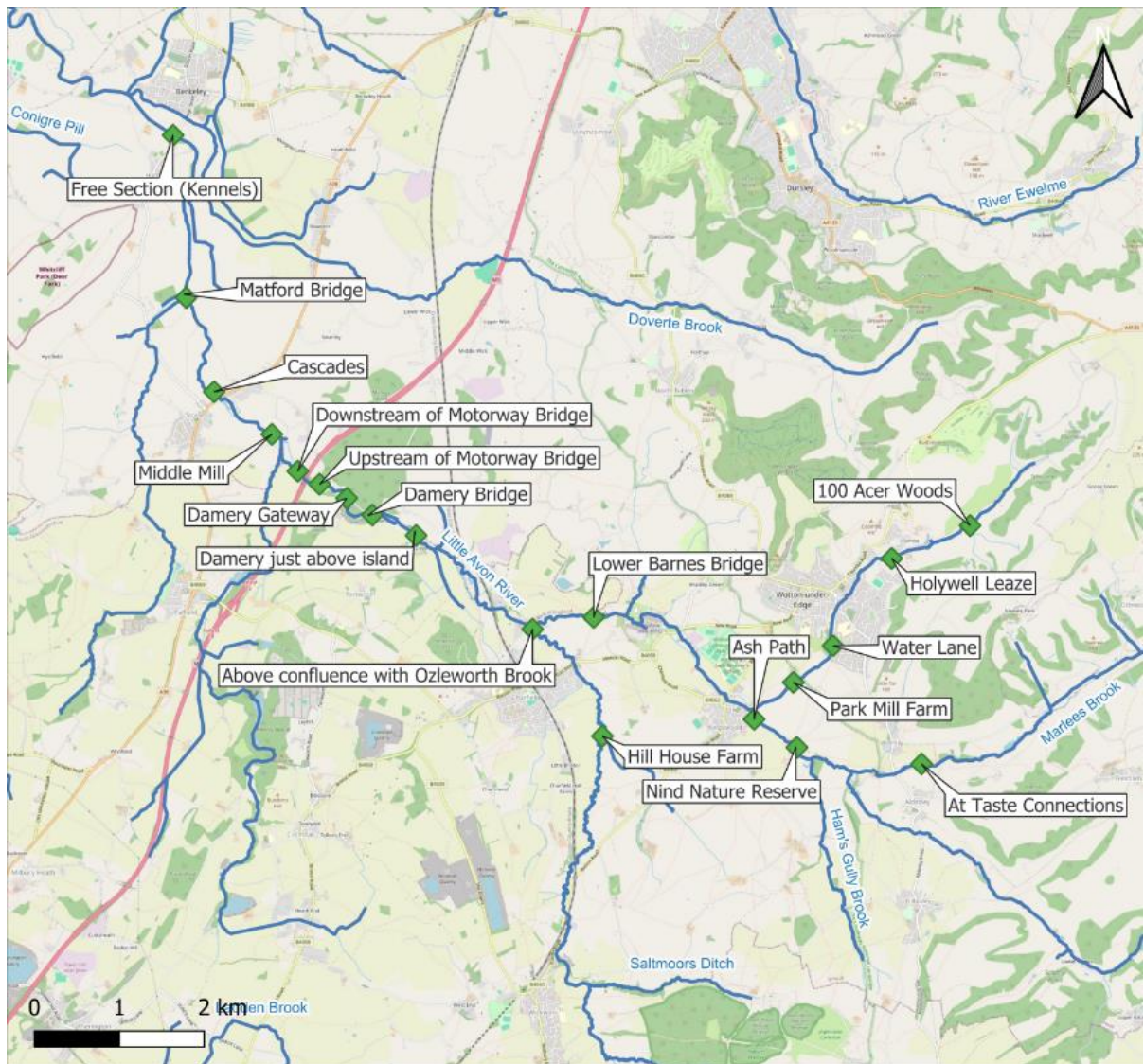


Little Avon Macro-invertebrate site 11: Little Avon at Matford Bridge

Appendix 2– Site maps



Map of SmartRivers sites in the Little Avon catchment



Map of active RMI sites in the Little Avon catchment