



SmartRivers

MULTI - YEAR DATA BREAKDOWN & NEXT STEPS



BART SmartRivers hub supported by Bristol Water and D'oyly Carte Charitable Trust

SmartRivers national programme supported by the Esmée Fairbairn Foundation, John Ellerman Foundation and the Fishmonger's Company

RIVER CHEW
FEBRUARY 2022

Executive Summary

Bristol Avon Rivers Trust (BART) secured funding from Bristol Water and D'oyly Carte Charitable Trust to carry out SmartRivers macro-invertebrate monitoring on the river Chew in 2019, 2020 and 2021. The purpose of the monitoring was to establish a baseline data set of the macro-invertebrate communities present in the river Chew, to monitor changes over time and identify the main pressures impacting on the different sections of the river. This report covers the findings of all the macro-invertebrate surveys.

FINDINGS

Biological Monitoring Working Party Scores

A variety of taxa were found at the five sites including cased caddisflies, caseless caddisflies, stoneflies, mayflies, beetles, fly larvae, freshwater shrimps and worms. The diversity varied between sites and sometimes seasons, from excellent to moderate. Site 1 (Shrowle), 3 (Stanton Drew) and 4 (Parsonage Farm) had Biological Monitoring Working Party (BMWP) scores from all samples that indicated good or excellent water quality. The highest BMWP score was at Shrowle in spring 2021. DS Chew Reservoir had lower BMWP scores than all the other sites which indicated moderate water quality, with the exception of spring 2021 when the BMWP score was higher, indicating good water quality. Dapps Bridge had BMWP scores that indicated good or excellent water quality with the exception of autumn 2020.

Number of Scoring Taxa (NTaxa) scores

NTaxa scores indicated restricted habitat availability at some of the sites; particularly at DS Chew Reservoir and Dapps Bridge. The lowest NTaxa scores were at DS Chew Reservoir. The notes recorded at the time of sampling show that although there was a range of different flow types available at the site including pool, run and slack flow types, the site was mainly a very slow run habitat with very sluggish, ponded flow and high levels of silt – above 65%. The site was also very heavily shaded. 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.

Biometric scores

The results from the pressure analysis revealed siltation to be the pressure of most consistent concern at all the sites (apart from Shrowle). Excessive sediment caused by anthropogenic factors 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.

The site with least pressures exhibited was Shrowle. All pressure ratings were good or above. Shrowle is located the furthest upstream of all the Chew SmartRivers sites, it is closest to the source of the river and is located upstream of Chew Valley Reservoir.

DS Chew Reservoir had the greatest number of pressures exhibited. Severe sediment, flow, organics and nutrient "P" issues were indicated. Chemical ratings were extremely concerning in 2019 and 2020, although 2021 scores showed minimal chemical impact. The pressure ratings and the biological indices together suggest that in this location the river is severely impacted by a number of pressures, resulting in a very restricted macro-invertebrate community. Chew Valley Reservoir upstream of the site, the concrete gauging weir immediately upstream, a large weir located downstream of the site and livestock encroachment are likely to be contributing to the issues indicated here.

The macro-invertebrate communities at Stanton Drew, Parsonage Farm and Dapps Bridge indicated impacts from a variety of different pressures, some seasonal. At Stanton Drew Site 3 pressure from siltation and chemicals are of most consistent concern, whilst chemicals and nutrients "P" may be having a significant seasonal impact. At Parsonage Farm, pressure from siltation and nutrients "P" are of most concern, potentially exacerbated in autumn time. At Dapps Bridge, chemicals and siltation are likely to be having most impact on the invertebrate community, with a possible nutrient "P" issue in spring 2021.

There were no obvious trends in the biological indices over the years. However, for the most part greater pressure was indicated by the invertebrate communities in autumn. This is a trend commonly seen and can usually be attributed to reduced dilution following the summer period.

RECOMMENDATIONS

BART and S&TC recommend:

- Continuing to monitor the five Chew sites twice annually to better understand the pressures impacting each site.
- Liaise with EA to understand what their future monitoring plan looks like. Explore whether SmartRivers could fill gaps from reduced EA monitoring.
- Comparing this dataset with Bristol Water's data in order to develop trends on the impacts acting upon each of the sites.
- Reviewing and analysing the data collected by the ARMI volunteer monitors on the Chew alongside the SmartRivers findings to ensure this valuable data set also contributes towards the discussions.
- Develop a targeted action plan to work towards reducing impacts at the worst sites.

“Siltation was the pressure of most consistent concern at all the sites - apart from Shrowle”

INTRODUCTION

The River Chew

The River Chew is a small rural lowland water course rising in the Mendip Hills in the south west of England and discharging into the River Avon at Keynsham, midway between the cities of Bristol and Bath. The River Chew catchment covers an area of approximately 145 km² and is hydrologically complex owing to the permeability and the presence of reservoirs, particularly the Chew Valley Lake which supplies potable water to the City of Bristol.

The catchment experienced extensive flooding during the summer flood event of July 1968 during which the historic bridge at Pensford was completely destroyed. In addition to flood aspects the river has ecological challenges and does not meet the Water Framework Directive standards for good ecological status. In fact, two of the four waterbodies have deteriorated to Poor status. The other two are moderate with failures for fish and phosphate. Other reasons for failure include rural land management, fish barriers and water industry infrastructure. New homes throughout the catchment, in particular in Keynsham and surrounds will place even a greater pressure on the watercourse and the life which depends on it.



To date, statutory monitoring programmes and local knowledge have been used to identify the main pressures and likely reasons for failure to meet water quality standards. However, this existing data can often be insufficient at providing evidence for effectively prioritising and targeting works which will reduce sediment load and nutrients entering the watercourse. The Environment Agency monitoring programmes have been reduced, resulting in less data being collected.

SmartRivers can help fill this void, whilst helping provide evidence for targeted catchment improvements.

INTRODUCTION

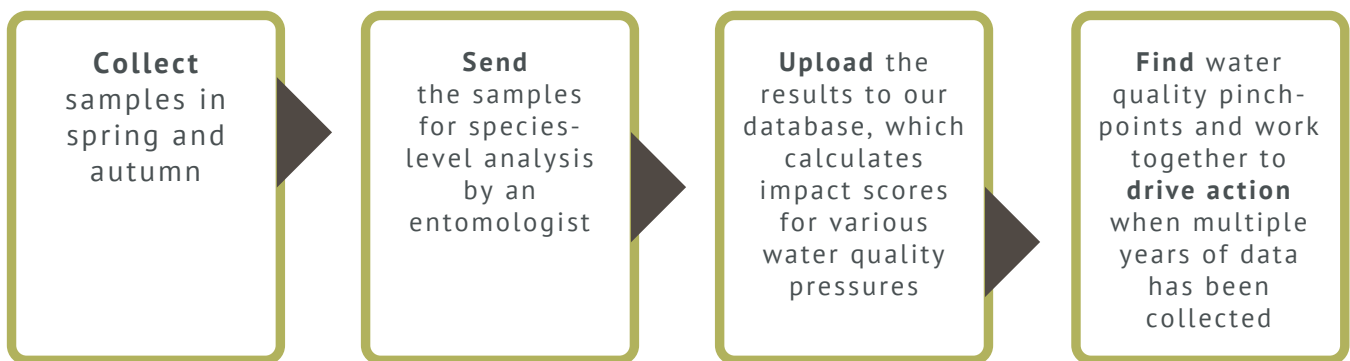
What is SmartRivers?

SmartRivers is an evidence collection project, that feeds directly into S&TC's 'Water Action' policy work to improve water quality.

Volunteers collect near-professional standard samples of invertebrates, which are analysed to species level, to indicate what water quality pressures are impacting rivers and where.



How does it work?



What do hubs get out of it?

1

Pinpoint where your invertebrate communities are most stressed and find out by what? Use SmartRivers evidence to drive further investigations and focus action to make a difference on the ground.

2

Find out if your actions have improved the river biologically. SmartRivers can be used to measure the impact of river restoration works or changes to land management.

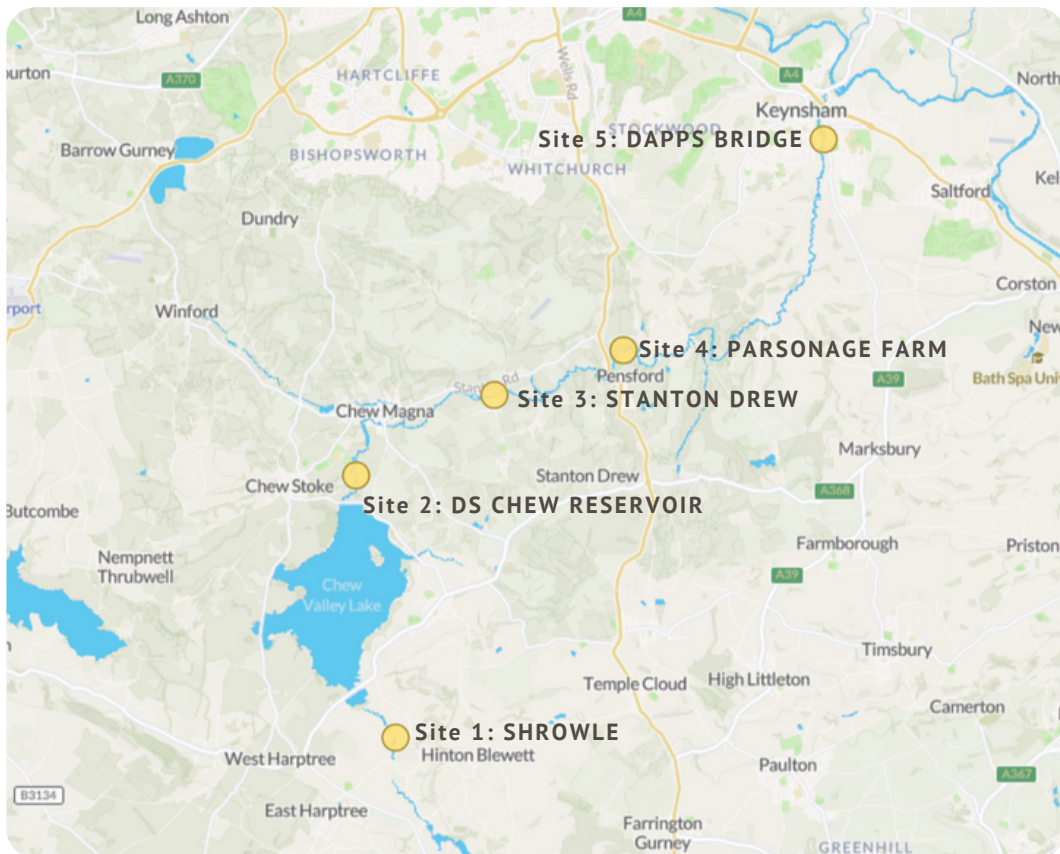
3

Help rivers nationally. Many improvements to water quality can only be driven by suitable policy and proper enforcement of these policies. S&TC will use your data as evidence to make this happen.

PROGRESS TO DATE

Sample sites and collection tracker

BART collected macro-invertebrate samples at five sites on the river Chew in autumn 2019, autumn 2020, spring 2021 and autumn 2021. The 2019 samples were sent off for external analysis via S&TC; all of the other samples were analysed in the laboratory by BART's Aquatic Ecologist Jessy Grant. Macro-invertebrates were identified as far as taxonomically possible using standard procedures.



Spring				Autumn			
	2020	2021	2022		2019	2020	2021
Site 1	✗	✓	—	Site 1	✓	✓	✓
Site 2	✗	✓	—	Site 2	✓	✓	✓
Site 3	✗	✓	—	Site 3	✓	✓	✓
Site 4	✗	✓	—	Site 4	✓	✓	✓
Site 5	✗	✓	—	Site 5	✓	✓	✓

WATER QUALITY PINCH-POINTS

River Chew

The macro-invertebrate species results were entered onto the SmartRivers database for pressure analysis. Below are the impact scores indicated by the invertebrate communities at the sample sites monitored (from upstream to downstream). The scores are highlighted using a traffic light colour scale to highlight water quality pinch points along the system.

UPSTREAM -----> DOWNSTREAM

SEDIMENT

	SHROWLE	DS RESERVOIR	STANTON DREW	PARSONAGE FARM	DAPPS BRIDGE
autumn 2019	unimpacted	very high	moderate	moderate	high
spring 2020	NA	NA	NA	NA	NA
autumn 2020	low	high	moderate	moderate	high
spring 2021	low	high	moderate	low	low
autumn 2021	unimpacted	very high	moderate	high	low

PHOSPHORUS

	SHROWLE	DS RESERVOIR	STANTON DREW	PARSONAGE FARM	DAPPS BRIDGE
autumn 2019	unimpacted	high	unimpacted	unimpacted	unimpacted
spring 2020	NA	NA	NA	NA	NA
autumn 2020	unimpacted	low	low	low	unimpacted
spring 2021	unimpacted	high	high	low	moderate
autumn 2021	unimpacted	high	low	moderate	unimpacted

CHEMICAL

	SHROWLE	DS RESERVOIR	STANTON DREW	PARSONAGE FARM	DAPPS BRIDGE
autumn 2019	low	moderate	moderate	moderate	high
spring 2020	NA	NA	NA	NA	NA
autumn 2020	low	very high	moderate	low	moderate
spring 2021	unimpacted	unimpacted	moderate	unimpacted	moderate
autumn 2021	low	low	moderate	unimpacted	low

ORGANIC

	SHROWLE	DS RESERVOIR	STANTON DREW	PARSONAGE FARM	DAPPS BRIDGE
autumn 2019	unimpacted	moderate	unimpacted	low	low
spring 2020	NA	NA	NA	NA	NA
autumn 2020	unimpacted	moderate	low	low	low
spring 2021	unimpacted	low	low	unimpacted	unimpacted
autumn 2021	unimpacted	moderate	low	low	low

FLOW

	SHROWLE	DS RESERVOIR	STANTON DREW	PARSONAGE FARM	DAPPS BRIDGE
autumn 2019	unimpacted	moderate	unimpacted	low	low
spring 2020	NA	NA	NA	NA	NA
autumn 2020	unimpacted	moderate	low	low	low
spring 2021	unimpacted	moderate	low	low	low
autumn 2021	unimpacted	high	low	low	low

The water quality impact scores suggest that the site downstream of Chew reservoir is a water quality pinch-point. The invertebrate community exhibited very high stress from sediment, phosphorus and chemicals, as well as considerable stress from flow and organic enrichment. Stanton Drew also exhibited persistent stress from sediment and chemicals, as did Dapps Bridge intermittently. The furthest upstream site (Shrowle) indicated minimal stress.

SITE BREAKDOWN

Shrowle



Shrowle had a good or excellent diversity of macro-invertebrate taxa present in all samples. The BMWP scores were good or excellent in all samples, although scores did vary considerably. The spring 2021 score was much higher than the other samples, particularly compared with autumn 2019 and autumn 2021. The spring 2021 BMWP score was in fact the highest of all the Chew samples at all sites. ASPT scores were also high – close to 6 in autumn 2020 and 2021 and above 6 in autumn 2019 and spring 2021 with the highest score of all the samples for all Chew sites in spring 2021. Both indices, therefore, suggest good water quality in this location.

The number of scoring taxa (NTaxa) at the site was very variable between samples from 12 in autumn 2019 to 26 in spring 2021. The spring score was the highest of all the Ntaxa for the SmartRivers Chew 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 is able to 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, run, pool and slack flow types, an unvegetated point bar and a variety of different substrate types. The river was meandering at Site 1 with natural earth banks. A small amount of in stream macrophytes (*apium nodiflorum*) were recorded during each of the surveys. No overlaying silt has been recorded at the site. These features provide natural habitat variation for macro-invertebrates to live within.

The SmartRivers pressure ratings scores were good or high for chemicals in all samples, suggesting this is not an issue here. The site was unimpacted or slightly impacted by all the other pressures: organics, nutrients “P”, flow and siltation in all samples. The pressure ratings and biological indices suggest that in this location the river is fairly natural. The lack of significant pressures in this location is likely to be because the site is the most upstream sites of all the Chew SmartRivers sites, it is closest to the source of the river and is located upstream of Chew Valley Reservoir. This section of river is not, however, without issues as it is downstream of Litton reservoir, so still heavily modified, and also has inputs from Harptree sewage treatment works upstream.

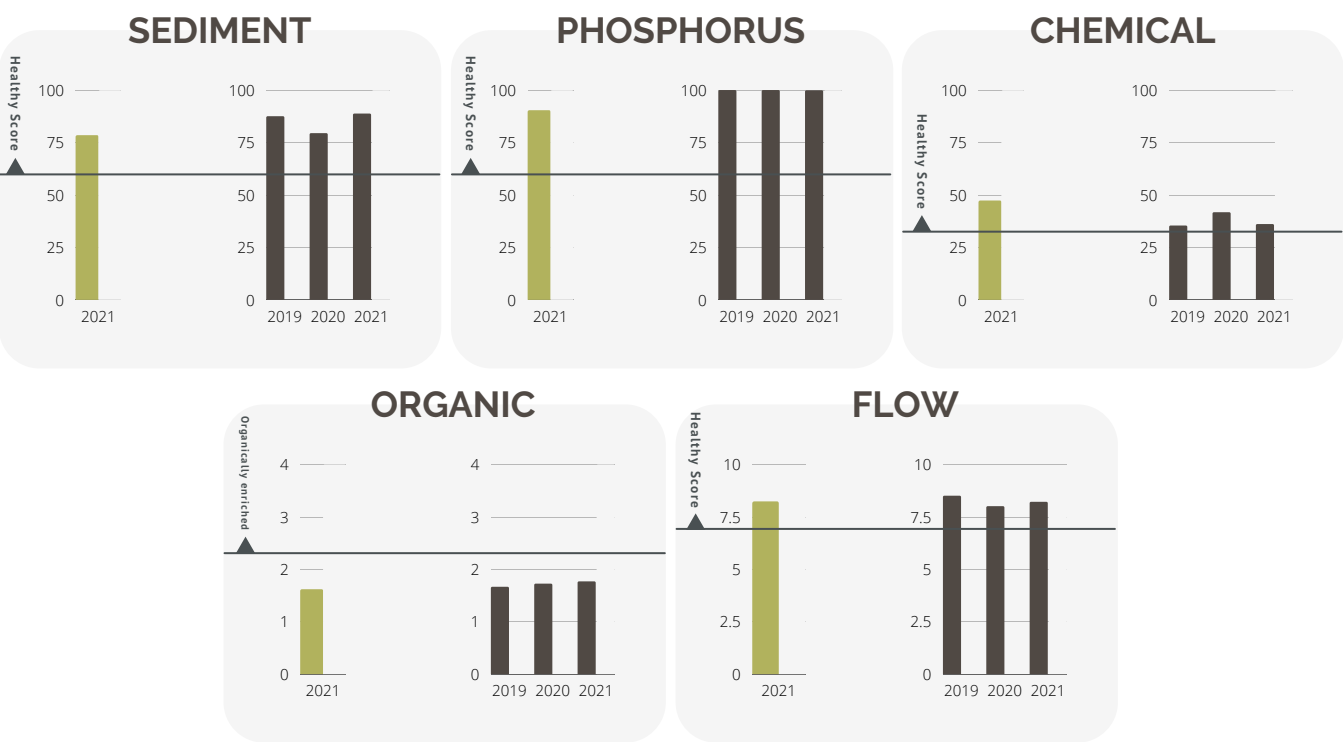
PRESSURE METRICS

No moderate water quality stress scores were indicated at Shrowle.

	2021		2019	2020	2021
PSI (sediment)	78.57	PSI (sediment)	87.50	79.41	88.89
TRPI (phosphorus)	90.48	TRPI (phosphorus)	100	100	100
SPEAR (chemical)	47.40	SPEAR (chemical)	35.29	41.64	36.17
Organic (saprobic)	1.62	Organic (saprobic)	1.66	1.72	1.77
LIFE (flow)	8.24	LIFE (flow)	8.50	8.00	8.22

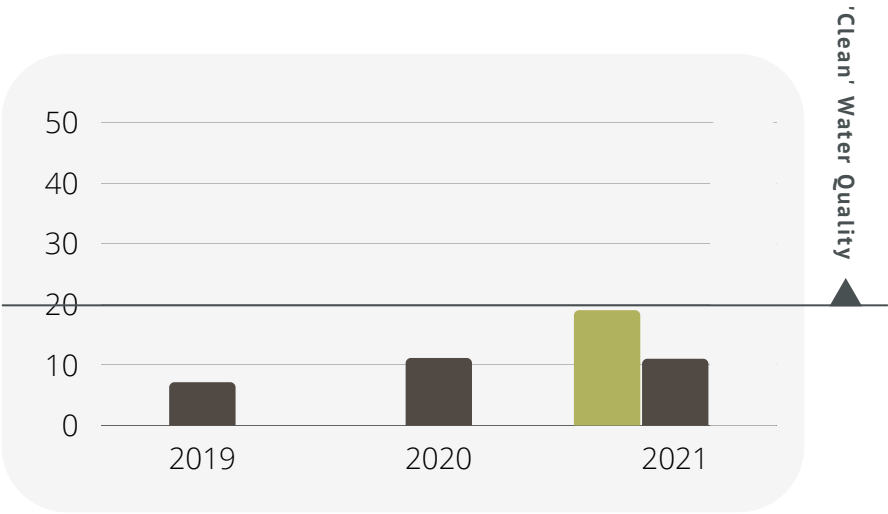
Spring

Autumn



EPT (SP) - MAYFLY/STONEFLY/CADDISFLY SPECIES)

A greater number of these species indicates higher water quality.



EPT species at Shrowle indicate moderate water quality, apart from autumn 2019 where it was poor (below 9).

CONSERVATION 'VALUE'

CCI can indicate exceptionally rich or regionally unusual invertebrate populations.

GENERAL WATER QUALITY (ORGANIC)

BMWP/ASPT are a general index of biological quality. Invertebrates, mostly at family-level, all have scores related to organic pollution sensitivity. **BMWP** is the sum of these scores, **ASPT** is the sum of these scores divided by how many invertebrates were assigned a tolerance score.

	CCI	BMWP	ASPT
autumn 2019	3.33	73.00	6.08
spring 2020	NA	NA	NA
autumn 2020	9.64	113.00	5.95
spring 2021	12.00	170.00	6.54
autumn 2021	4.36	97.00	5.71

≥15 = high conservation value

≥71 = good water quality

≥5 = good water quality

SITE BREAKDOWN

DS Chew Reservoir



DS Chew Reservoir had a very limited range of macro-invertebrate taxa present in all samples, with the exception of spring 2021. The BMWP scores were moderate for 2019 and 2020, good for spring 2021 and moderate again for autumn 2021. The scores were very low in autumn 2020 and autumn 2021 - very close to the poor category border. These were the lowest BMWP scores recorded at all the Chew sites. ASPT scores were at the lowest end of the range of all the Chew sites and fell below 5 in 2019 and 2020; both indices, therefore, suggest macro-invertebrate assemblages are severely restricted by water quality in this location.

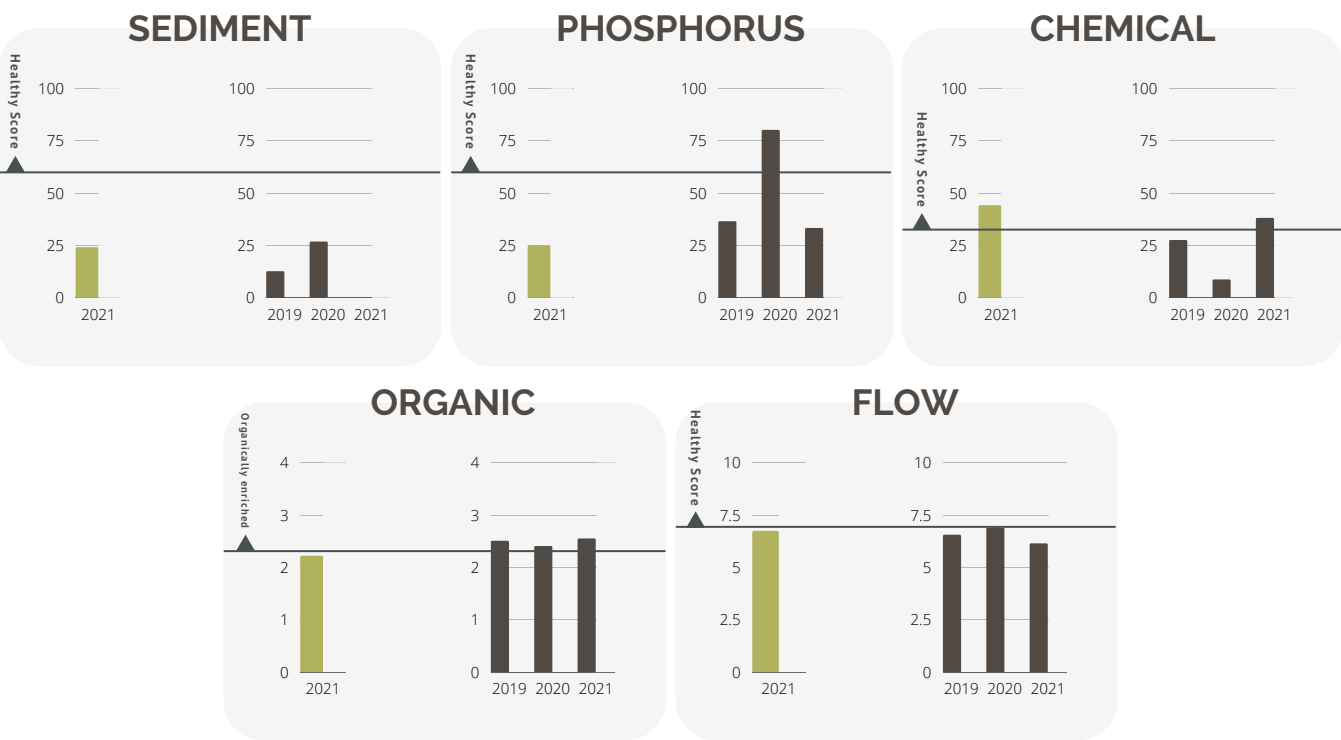
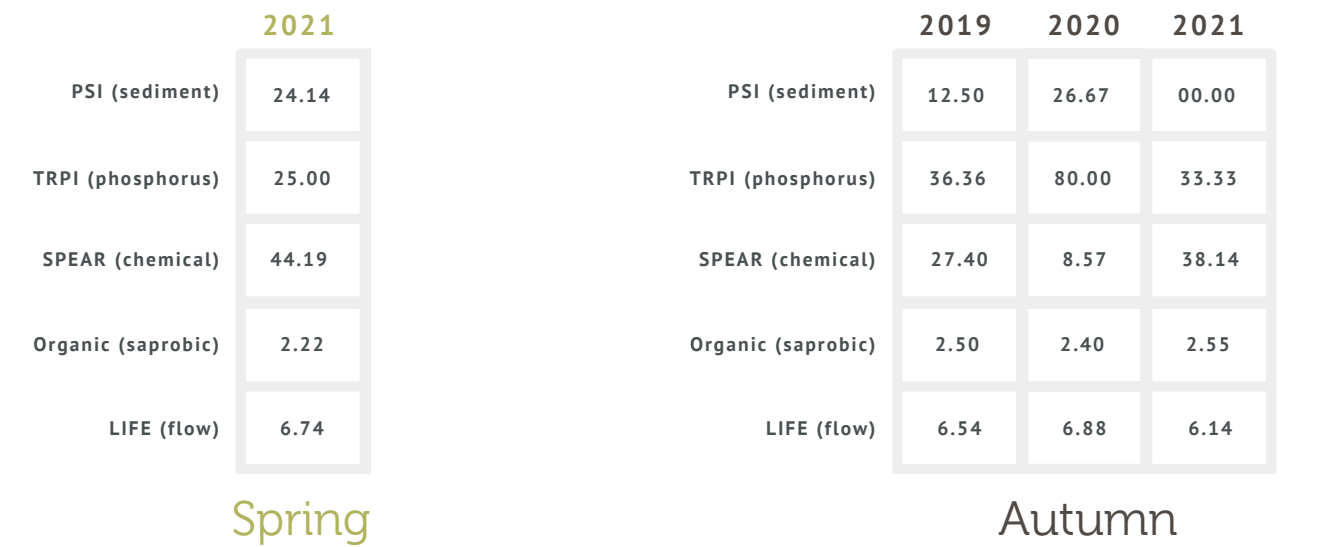
The number of scoring taxa (NTaxa) at the site were again very low, ranging from 9 to 17. As with the ASPT and BMWP scores the highest NTaxa score was in spring 2021. The macro-invertebrate assemblages present at the site suggest that the habitat is restricted in this location. The notes recorded at the time of sampling show that although a range of different flow types were available at the site (including pool, run and slack flow types), the site was mainly a very slow run habitat, often recorded as slack, with sluggish, ponded flow and very high levels of silt – above 65%. The site was also very heavily shaded. 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.

SmartRivers pressure ratings for chemicals were moderate in 2019 and poor in 2020 but then improved to good in the 2021 samples, suggesting that historic chemical pressures are not currently impacting on the macro-invertebrates. All of the other pressure ratings scores were moderate or worse for nearly all of the samples. The macro-invertebrate communities are, therefore, indicating that there are severe sediment, flow, organic and nutrient “P” issues at this site.

The location of Chew Valley Reservoir upstream of the site and the compensation flow concrete gauging weir immediately upstream are likely to be contributing to the pressures here. This stretch of river is also significantly impounded by Dumpers Lane weir downstream and has become over wide due to livestock encroachment.

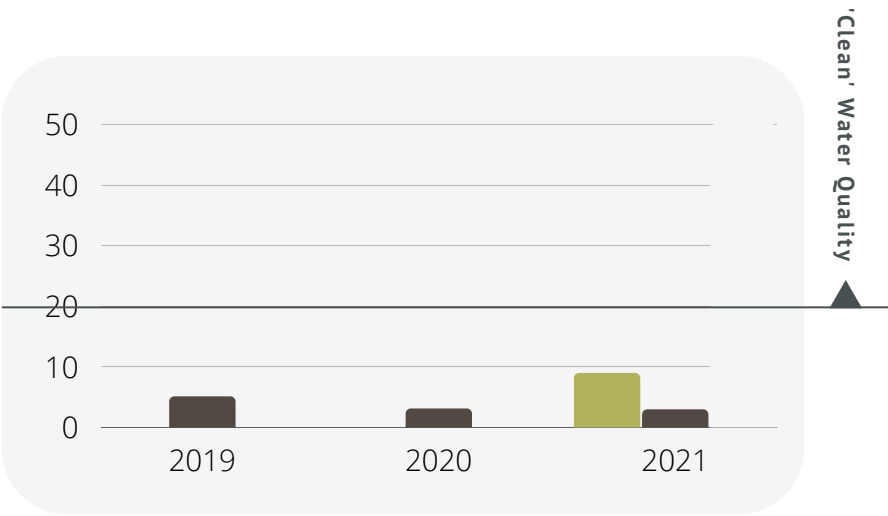
PRESSURE METRICS

Very high stress from sediment, phosphorus and chemicals was exhibited by the invertebrate community at the downstream Chew Reservoir site throughout the survey period. Some considerable stress from flow and organic enrichment was also indicated.



EPT (SP) - MAYFLY/STONEFLY/CADDISFLY SPECIES)

A greater number of these species indicates higher water quality.



EPT species indicated poor water quality (9 or below) for all sample events at DS Chew Reservoir.

CONSERVATION 'VALUE'

CCI can indicate exceptionally rich or regionally unusual invertebrate populations.

GENERAL WATER QUALITY (ORGANIC)

BMWP/ASPT are a general index of biological quality. Invertebrates, mostly at family-level, all have scores related to organic pollution sensitivity. BMWP is the sum of these scores, ASPT is the sum of these scores divided by how many invertebrates were assigned a tolerance score.

	CCI	BMWP	ASPT
autumn 2019	8.33	69.00	4.93
spring 2020	NA	NA	NA
autumn 2020	1.29	41.00	4.56
spring 2021	7.86	91.00	5.35
autumn 2021	1.17	46.00	5.11

≥15 = high conservation value

≥71 = good water quality

≥5 = good water quality

SITE BREAKDOWN

Stanton Drew



Stanton Drew had a good to excellent diversity of macro-invertebrate taxa present in all samples. The BMWP scores were good or excellent in all samples and scores did not vary much between samples. ASPT scores were also high and very consistent. Both indices, therefore, suggest good water quality in this location.

The number of scoring taxa (NTaxa) at the site ranged between 18 and 21, again very similar scores in all samples. The macro-invertebrate assemblages present at the site indicate that there is a good variety of habitat types available. The notes recorded at the time of sampling show that a range of different habitat and flow types were available at the site (including riffle, run and slack flow types, depending on the season) and the water was moving quickly through the main channel and was slow/slack at the edges. A variety of different substrate types were recorded in all the samples. A small amount of in stream macrophytes (*sparganium emersum*) and filamentous algae (*cladophora agg.*) were recorded and mosses (*fontinalis antipyretica*) were also present at the site. These features provide natural habitat variation for macro-invertebrates to live within.

The SmartRivers pressure ratings scores were moderate for SPEAR in all samples, suggesting chemicals are an issue at this site. There was also considerable sediment pressure indicated by the macro-invertebrate communities at this site in all samples. Flow and organics ratings were either slightly impacted or unimpacted, of little concern, but very concerning nutrient “P” pressure was exhibited in spring 2021. The pressure ratings suggest that pressure from siltation and chemicals are of most consistent concern at this site whilst nutrients “P” could be having a significant seasonal impact.

PRESSURE METRICS

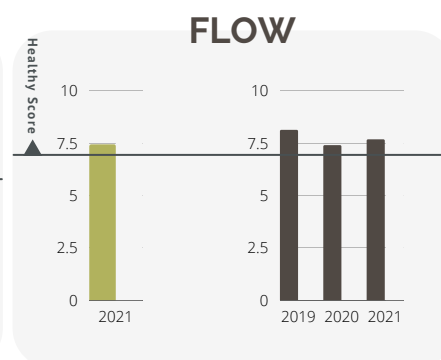
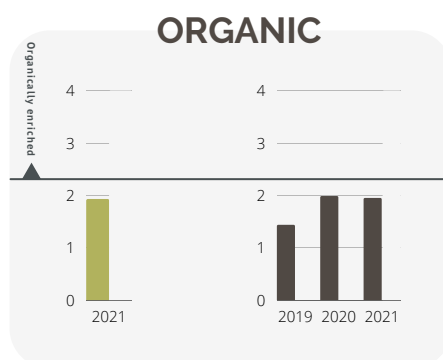
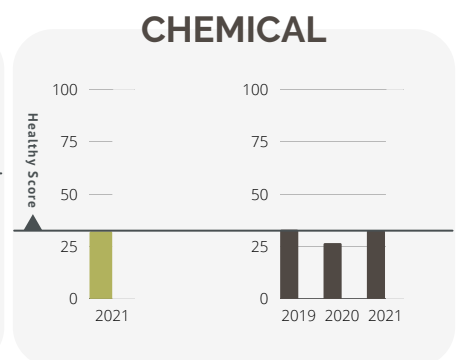
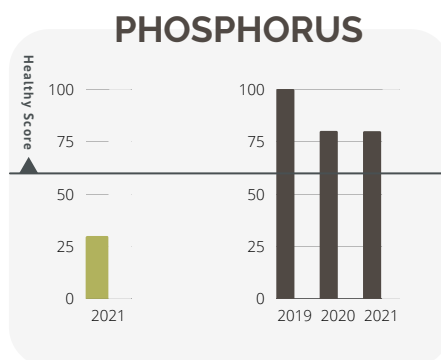
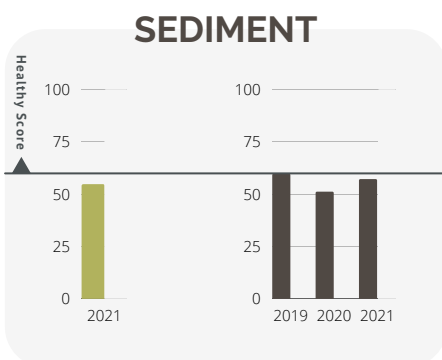
The invertebrate community at Stanton Drew exhibited persistent stress from sediment and chemicals. Considerable phosphorus stress was also indicated in spring 2021.

	2021
PSI (sediment)	54.72
TRPI (phosphorus)	30.00
SPEAR (chemical)	32.21
Organic (saprobic)	1.93
LIFE (flow)	7.43

Spring

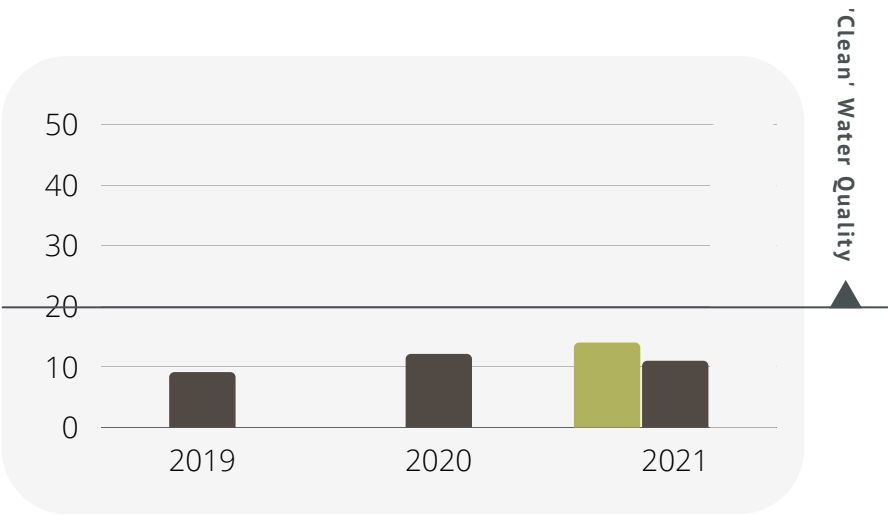
	2019	2020	2021
PSI (sediment)	59.57	50.98	57.14
TRPI (phosphorus)	100	80.00	80.00
SPEAR (chemical)	32.84	26.42	32.63
Organic (saprobic)	1.43	1.98	1.95
LIFE (flow)	8.11	7.38	7.67

Autumn



EPT (SP) - MAYFLY/STONEFLY/CADDISFLY SPECIES)

A greater number of these species indicates higher water quality.



EPT species at Stanton Drew indicated moderate water quality, apart from autumn 2019 where it was poor (only 9 species).

CONSERVATION 'VALUE'

CCI can indicate exceptionally rich or regionally unusual invertebrate populations.

GENERAL WATER QUALITY (ORGANIC)

BMWP/ASPT are a general index of biological quality. Invertebrates, mostly at family-level, all have scores related to organic pollution sensitivity. **BMWP** is the sum of these scores, **ASPT** is the sum of these scores divided by how many invertebrates were assigned a tolerance score.

	CCI	BMWP	ASPT
autumn 2019	4.62	100.00	5.56
spring 2020	NA	NA	NA
autumn 2020	6.15	120.00	5.71
spring 2021	8.24	111.00	5.29
autumn 2021	6.79	112.00	5.60

≥15 = high conservation value

≥71 = good water quality

≥5 = good water quality

SITE BREAKDOWN

Parsonage Farm



Parsonage Farm had a good to excellent diversity of macro-invertebrate taxa present in all samples. The BMWP scores were all good or excellent. The spring 2021 score was much higher than the other samples. ASPT scores were also high – close to 6 in autumn 2019 and 2021 and above 6 in autumn 2020 and spring 2021. Both indices, therefore, suggest good water quality in this location.

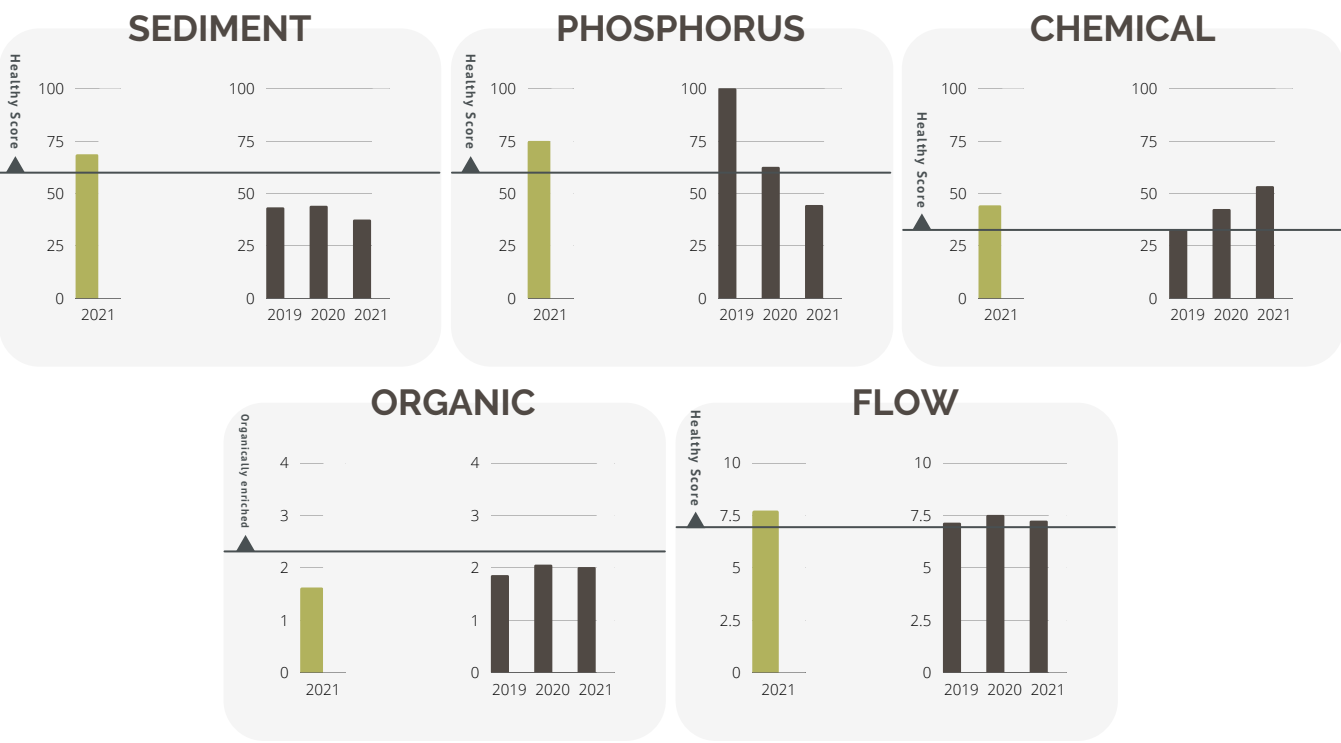
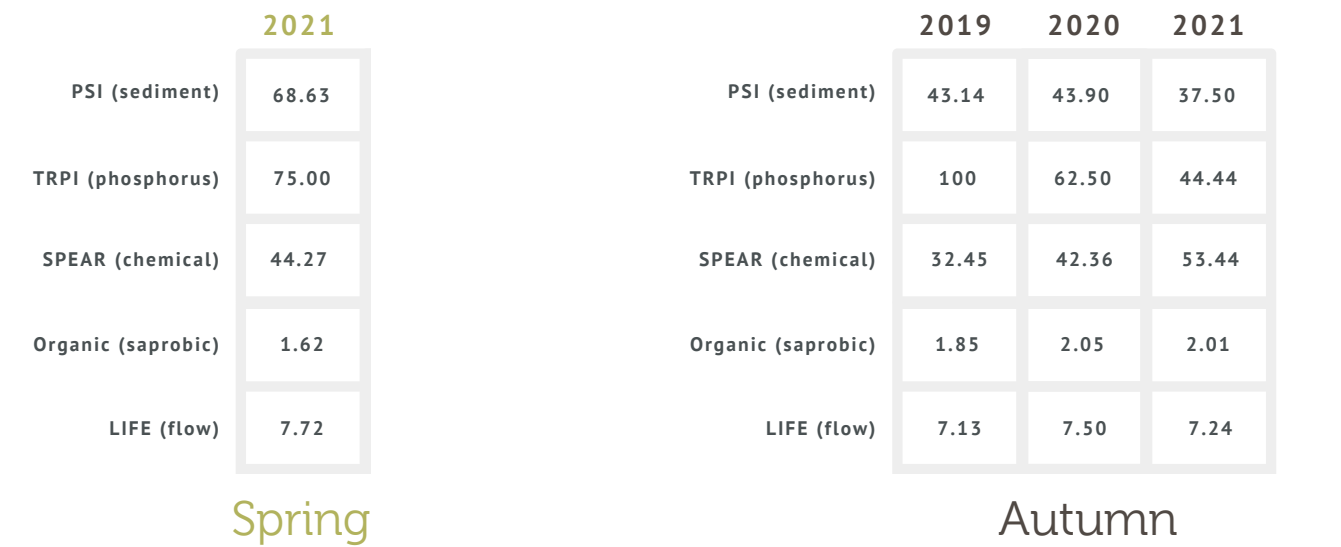
The number of scoring taxa (NTaxa) at the site ranged between 17 and 24, so was fairly consistent between samples. The macro-invertebrate assemblages present, and notes recorded at the time of sampling, show that there was a range of different habitat and flow types available at the site - including run and pool flow types and a variety of different substrate types. A small amount of in stream macrophytes (*ranunculus sp.*) and filamentous algae (*cladophora agg.*) were recorded. These features provide natural habitat variation for macro-invertebrates to live within. Slow flows were, however, also recorded at the site and overlaying silt was present on the substrate, noted as thick in some samples. These features are likely to be impacting on the in-stream ecology.

The SmartRivers pressure scores were moderate for chemicals in 2019 and good to high since then, suggesting that chemicals are not currently an issue at this site. Flow and organics ratings were either slightly impacted or unimpacted and of little concern at this site. There was concerning siltation and nutrients “P” pressure exhibited by the macro-invertebrates at the site. Both pressures were shown to be at least moderately impacting on the site in most samples, with the exception of spring 2021 when scores were improved. The pressure ratings suggest that pressure from siltation and nutrients “P” are of most concern at this site and that these impacts are potentially exacerbated in autumn.

BART’s regular ARMI riverfly monitor at Parsonage Farm, and Secretary of Chew Fly Fishing Club (CFFC), has made a number of observations in regards to the ecology at this site, and has suggested that Bristol Water’s compensation scheme has had a detrimental effect on both the fish life and the ecology of the river Chew downstream of the lake. Reports from this monitor include very low flows, a sticky brown algae (diatom) substance which smothered the bottom of the river and instream macrophytes, a decrease in brown trout in the river and a decrease in riverfly numbers.

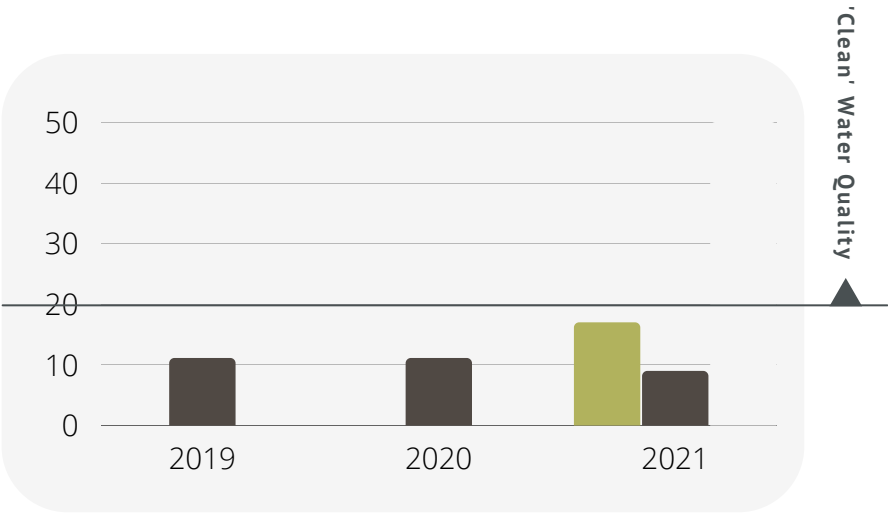
PRESSURE METRICS

Persistent sediment pressure was indicated by the invertebrate community at Parsonage Farm in autumn. Chemical and phosphorus pressure were also exhibited in autumn, although this was not consistent.



EPT (SP) - MAYFLY/STONEFLY/CADDISFLY SPECIES)

A greater number of these species indicates higher water quality.



EPT species at Parsonage Farm indicated moderate water quality, apart from autumn 2021 where it was poor (9 species).

CONSERVATION 'VALUE'

CCI can indicate exceptionally rich or regionally unusual invertebrate populations.

GENERAL WATER QUALITY (ORGANIC)

BMWP/ASPT are a general index of biological quality. Invertebrates, mostly at family-level, all have scores related to organic pollution sensitivity. **BMWP** is the sum of these scores, **ASPT** is the sum of these scores divided by how many invertebrates were assigned a tolerance score.

	CCI	BMWP	ASPT
autumn 2019	7.06	103.00	5.72
spring 2020	NA	NA	NA
autumn 2020	7.25	103.00	6.06
spring 2021	6.67	149.00	6.21
autumn 2021	3.88	99.00	5.82

≥15 = high conservation value

≥71 = good water quality

≥5 = good water quality

SITE BREAKDOWN

Dapps Bridge



The diversity of the macro-invertebrate communities found at Dapps Bridge varied considerably between samples. The BMWP scores ranged from moderate to high, with a particularly low score in autumn 2020 and the highest score in spring 2021. ASPT scores were all above 5 and in autumn 2021 the score was above 6. They were lowest in autumn 2019 and highest in autumn 2021, not following the trend of the BMWP scores. Both indices, therefore, suggest variable water quality in this location, with a possible water quality issue impacting on the macro-invertebrates in autumn 2020.

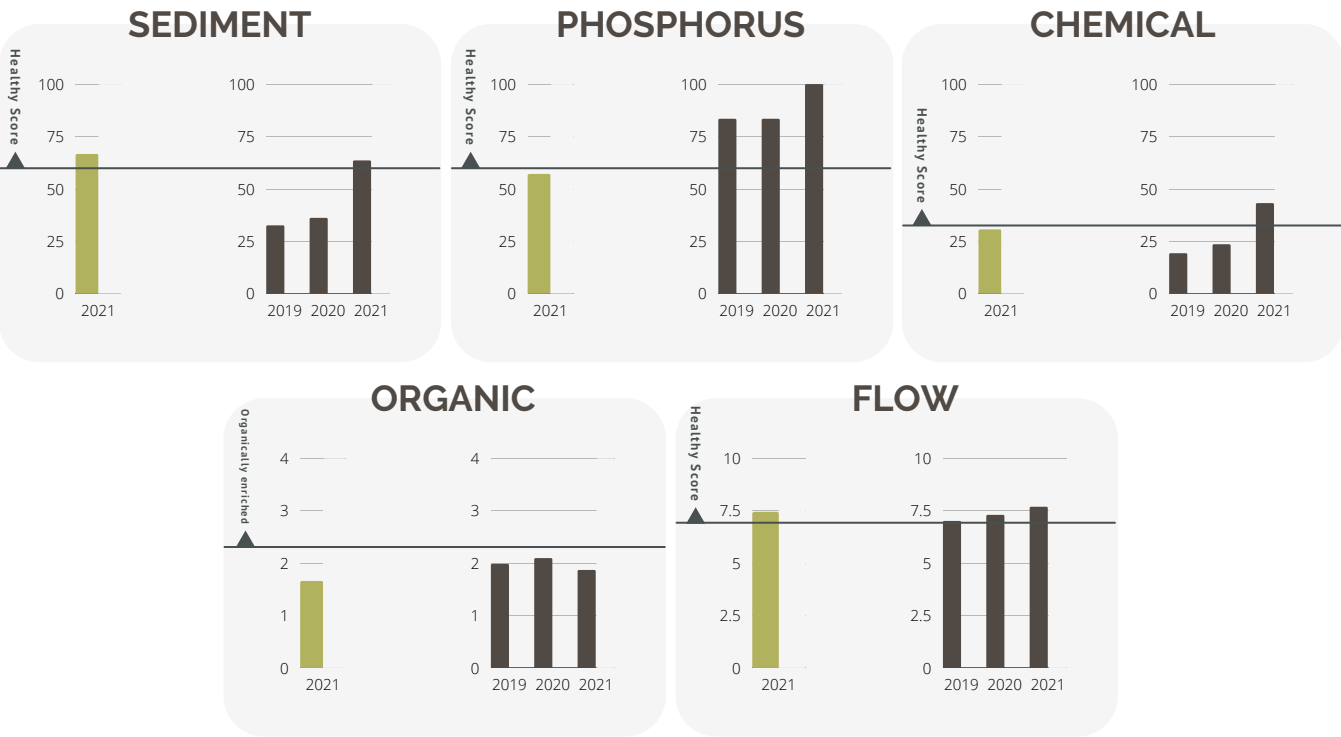
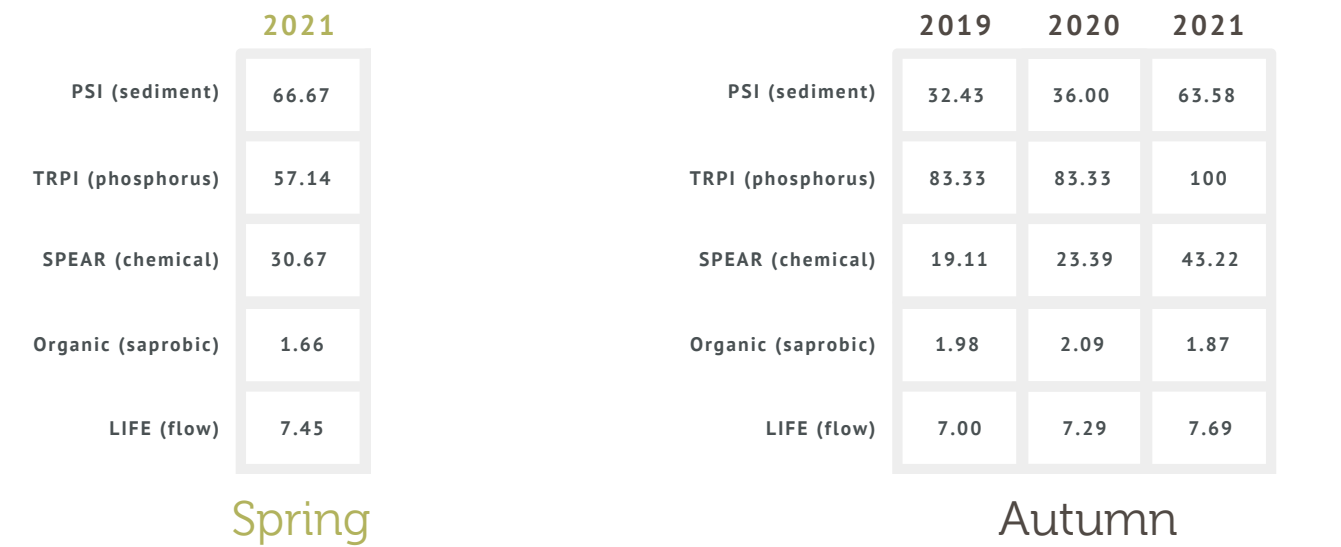
The number of scoring taxa (NTaxa) at the site ranged between 12 and 18 which is consistently low. The notes recorded at the time of sampling show that there were run and riffle flow types and a range of different substrate types available at the site. The flow was backed up slightly behind a small stone dam at the time of some surveys which was restricting the natural flow and overlaying silt was recorded in all samples. These features are likely to be impacting on the in-stream ecology.

The SmartRivers pressure scores were moderate or on the border of moderate/poor for pesticides in all samples, with the exception of autumn 2021 when there was no pressure exhibited. Nutrients, organics and flow ratings were either slightly impacted or unimpacted and of little concern for the majority of samples at this site, with a possible nutrient issue in spring 2021. There was concerning siltation pressure exhibited by the macro-invertebrates at the site in 2019 and 2020, but scores improved in 2021. The pressure ratings suggest that chemicals and siltation are likely to be having most impact on the macro-invertebrates at this site.

The Dapps Bridge site is located towards the downstream end of the river Chew approximately 500m upstream of the large weir in Keynsham Park. The weir can be seen to have a detrimental impact on the river Chew by backing up the water for a large distance and causing slow flows and sediment build up. It is likely that although the river returns to a more natural state at the Dapps Bridge site, the weir may still be having a detrimental impact on the watercourse here, including the build up of overlaying silt. It is also possible that the small stone dam/s that are regularly built by the general public at this site may be affecting the flow here and causing sediment to build up.

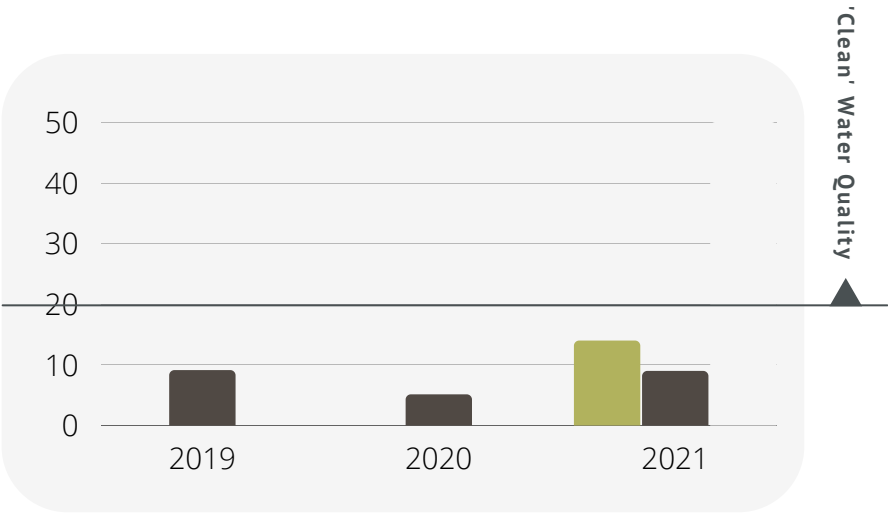
PRESSURE METRICS

High chemical and sediment pressure were exhibited by the invertebrate community in autumn 2019 and autumn 2020. Some recovery was evident in autumn 2021, although chemical stress was still indicated in spring 2021.



EPT (SP) - MAYFLY/STONEFLY/CADDISFLY SPECIES)

A greater number of these species indicates higher water quality.



EPT species in spring 2021 indicated moderate water quality, however for all autumn samples it was poor.

CONSERVATION 'VALUE'

CCI can indicate exceptionally rich or regionally unusual invertebrate populations.

GENERAL WATER QUALITY (ORGANIC)

BMWP/ASPT are a general index of biological quality. Invertebrates, mostly at family-level, all have scores related to organic pollution sensitivity. **BMWP** is the sum of these scores, **ASPT** is the sum of these scores divided by how many invertebrates were assigned a tolerance score.

	CCI	BMWP	ASPT
autumn 2019	4.88	90	5.00
spring 2020	NA	NA	NA
autumn 2020	4.13	62.00	5.17
spring 2021	6.25	109.00	5.74
autumn 2021	4.62	88.00	6.29

≥15 = high conservation value

≥71 = good water quality

≥5 = good water quality

RESULTS IN CONTEXT

Water Framework Directive

Under Water Framework Directive, waterbodies are given an overall health designation based on the assessment of two main components - ecological status and chemical status.

CHEW WATERBODIES (WITHIN THE AVON BRISTOL RURAL OPERATIONAL CATCHMENT)

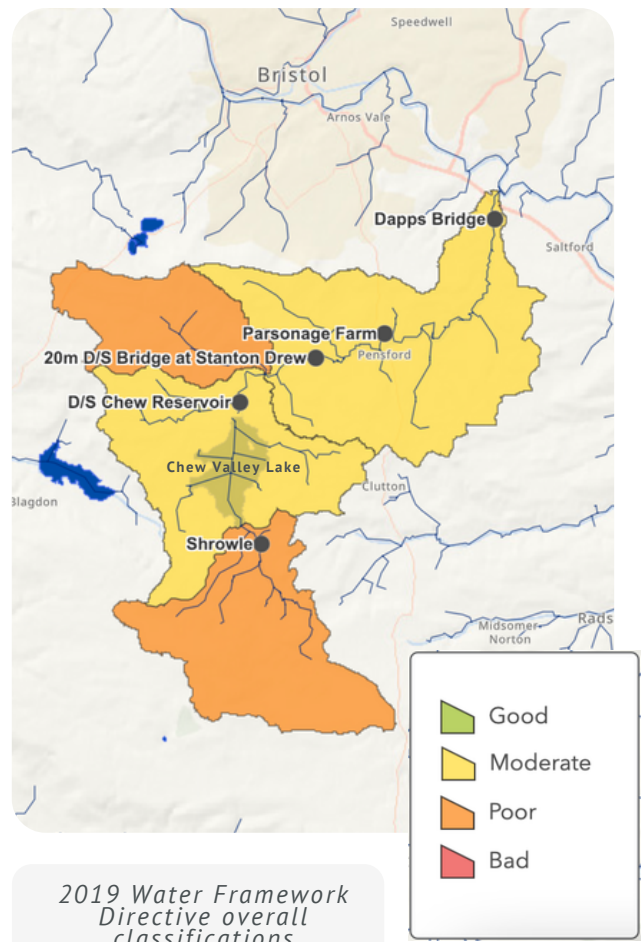
None of the three main River Chew waterbodies achieved 'good' Water Framework Directive classifications.

The furthest upstream waterbody (Chew - source to Chew Valley Lake) was designated as 'poor'. Multiple factors were identified as responsible for the failure to achieve good status. These included: chemical pollution from abandoned mines, poor soil/nutrient management from agricultural land and flow issues from physical barriers and abstraction by the water industry.

The middle waterbody (Chew Valley Lake to conf Winford Brook) and furthest downstream waterbody (Chew - conf Winford Brook to conf R Avon) were both classified as 'moderate' status. In both, point source sewage discharges were identified as reasons for not achieving good status. Diffuse nutrient pollution from agriculture and physical modifications were also key contributors the failure of the middle waterbody.

Chew Valley Lake itself was also assessed under WFD and designated as poor status. Reasons for failure were diffuse and point source pollution from the agricultural and water industry sectors. DS Chew Reservoir was the site that indicated the greatest water quality stress from SmartRivers monitoring. Loading from Chew Valley Lake could be a reason for this.

Unlike the WFD assessment, SmartRivers monitoring indicates water quality problems to be greater downstream of the lake than in the river upstream. As well as the lake, surrounding tributaries could be contributing to the issues. Winford Brook joins the River Chew upstream of the Stanton Drew monitoring site and is designated as 'poor' status.



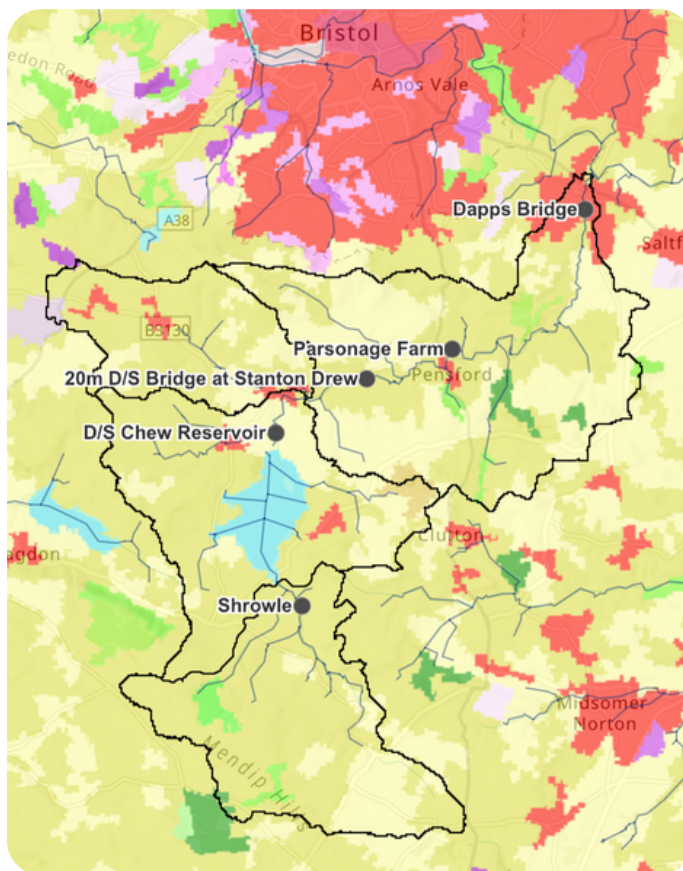
RESULTS IN CONTEXT

Catchment land use

Land cover is mainly agricultural around the River Chew. Agricultural pollution tends to be diffuse and occur over a wide geographical area. Although individually minor, the cumulative effects of separate discharges can be significant on a catchment scale. Activities such as ploughing, seedbed preparation, crop spraying, fertiliser spreading and applying slurry may all contribute. Run-off from farm roads and yards, the surface of fields and dusty roofs after rainfall are also all potential sources of pollution.

Parsonage Farm exhibited seasonal stress from sediment pollution. Seasonal stress from organic enrichment was also present at DS Chew Reservoir. Rainfall in autumn can increase loading in rivers, especially when combined with compacted bare soil or poor crop cover.

Land use around the Dapps Bridge site is urban. Urban areas are also present upstream of the Parsonage Farm site and at the Winford Brook/Chew confluence upstream of the Stanton Drew site. The Chew may be receiving pollution such as residential/commercial wastewater and stormwater runoff from these urban environments, causing nutrient, sediment and chemical stress.



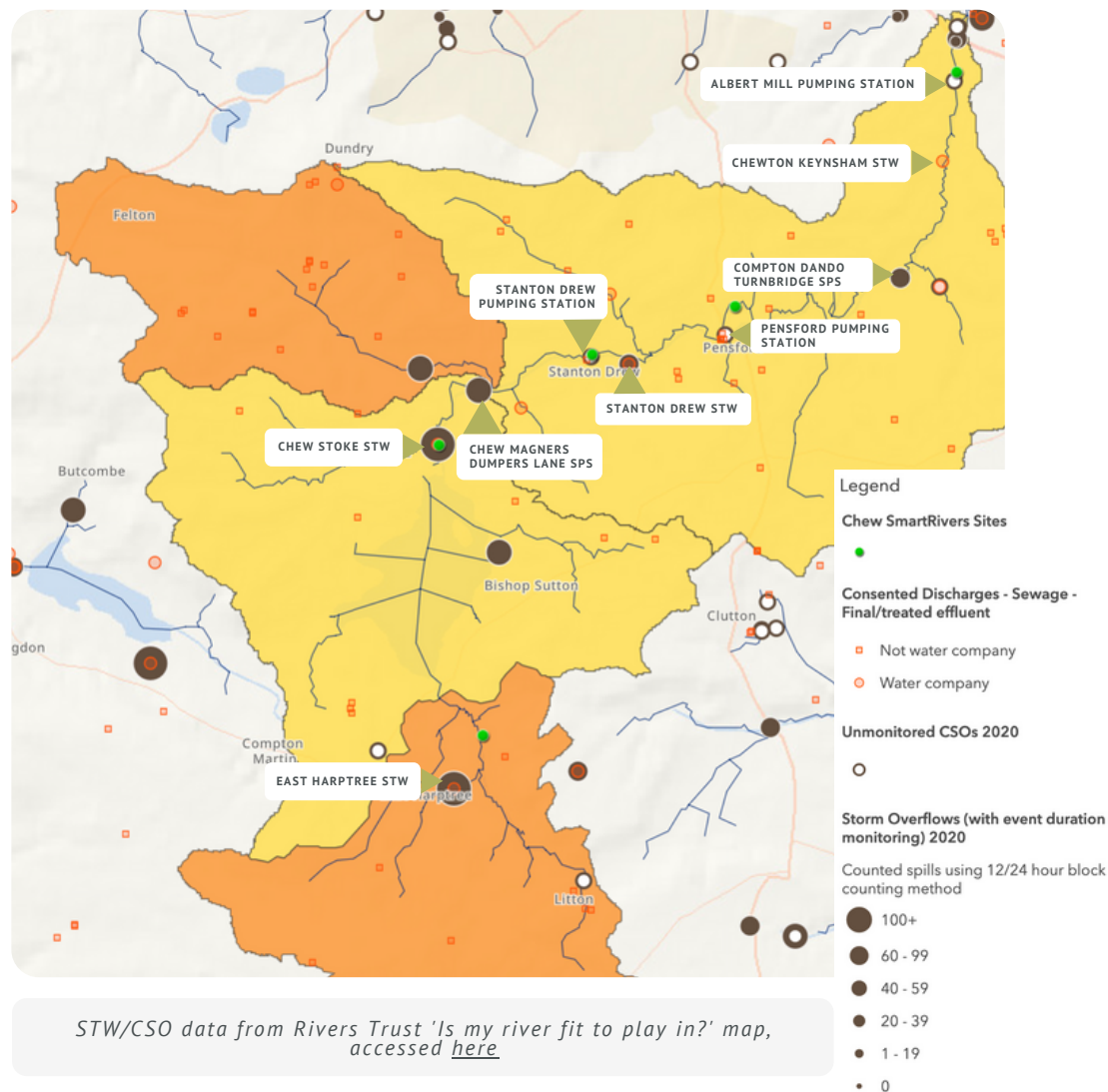
Chew waterbodies (within the Avon Bristol Rural Operational Catchment) Corine land cover EEA (2018)

LAND USE CATEGORIES KEY:

111: Continuous urban fabric	222: Fruit trees & berry plantations	331: Beaches, dunes, sands
112: Discontinuous urban fabric	223: Olive groves	332: Bare rocks
113: Diffuse constructions	224: Lavender	333: Sparsely vegetated areas
121: Industrial or commercial units	231: Pastures	334: Burnt areas
122: Road & rail networks	241: Ann. crops assoc. with peren.	335: Glaciers & perpetual snow
123: Port areas	242: Complex cultivation patterns	400: Undifferentiated wet areas
124: Airports	243: Agriculture + natural veg.	411: Inland marshes
131: Mineral extraction sites	244: Agro-forestry areas	412: Peat bogs
132: Dump sites	311: Broad-leaved forest	421: Salt marshes
133: Construction sites	312: Coniferous forest	422: Salines
141: Green urban sites	313: Mixed forest	423: Intertidal flats
142: Sport & leisure facilities	321: Natural grassland	511: Water courses
211/212: Arable land	322: Moors & heathland	512: Water bodies
213: Rice fields	323: Sclerophyllous vegetation	521: Coastal lagoons
214: Greenhouses	324: Transitional woodland-scrub	522: Estuaries
221: Vineyards	325: Moors	523: Sea & ocean

RESULTS IN CONTEXT

Sewage works and CSO's



Over 100 CSO spills occurred at East Harptree STW, which discharges to a tributary that joins the River Chew upstream of the Shrowle SmartRivers site. Despite this, the invertebrate community indicated minimal pressure here.

In 2020 Chew Stoke STW sewer storm overflow spilled 202 times for 3872 hours. This could be contributing to the persistent water quality pressures indicated by the SmartRivers monitoring.

Between the DS Chew Reservoir and Stanton Drew sites, Chew Magna Dumpers Lane SPS storm overflow spilled 76 times for 462 hours. Stanton Drew pumping station is next to the Stanton Drew site, this has a sewer storm overflow without event duration monitoring. Just downstream of this is Stanton Drew STW, where the storm overflow spilled 45 times for a total of 831 hours. Between Stanton Drew and Parsonage Farm, Pensford pumping station is also present (with an unmonitored CSO).

Between Parsonage Farm and Dapps bridge, Compton Dando Turnbridge sewer storm overflow spilled 41 times for 560 hours. Chewton Keynsham STW and Albert Mill pumping station are also situated between these two sites. Albert Mill has a sewer storm overflow without event duration monitoring.

Phosphate generation

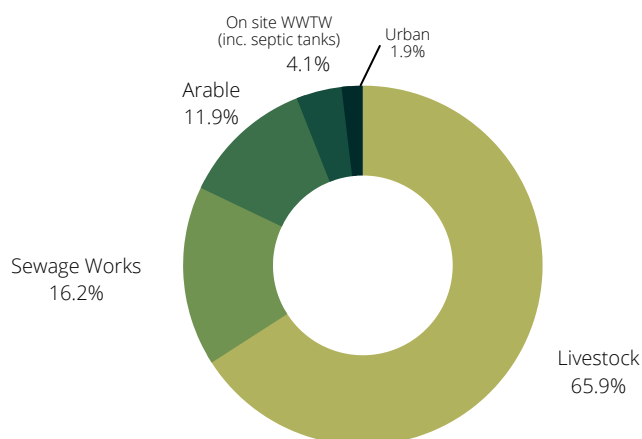
AVAILABLE SAGIS OUTPUTS FOR RIVER CHEW

*SAGIS percentage data from Rivers Trust SAGIS phosphorus ArcGIS layer.
© Environment Agency copyright and/or database rights 2018.*

CHEW - CONF WINFORD BROOK TO CONF R. AVON

Phosphate concentration (mg/L): **0.3**

Diffuse percentage to be removed for good target compliance: **85.6%**



SAGIS modelling (available for the Chew - conf Winford Brook to conf R. Avon, which contains 3 out of 5 of the SmartRivers monitoring sites) indicates considerable phosphate issues from diffuse sources, mostly livestock agriculture (65.9%). The percentage improvement required to meet WFD standards is very high.

SmartRivers monitoring did indicate some phosphorus stress at Stanton Drew and Dapps Bridge. This was exhibited in spring 2021. As only a single year of spring monitoring data is available, it will be interesting to see if the same is true in spring 2022. Persistent phosphorus stress was indicated at the DS Chew Reservoir site, but this falls within a different waterbody without SAGIS modelling.