Addingham Becks Water Quality Survey

17th February 2025

Rick Battarbee, Malcolm Secrett, Judith Ellis, Jan Hindle, Ian Thurston, Sylvia Kenny, Jackie Olive, John Fontana, Jess Penrose, Maire O'Donnell & Ian Benson

Addingham Environment Group

Charlotte Simons

Yorkshire Dales Rivers Trust

and **John Boyle**

University of Liverpool

Summary

The poor ecological quality of our village becks, indicated in summer by the extent of filamentous green algae growing on stones, is due to nutrient pollution by phosphorus.

There are multiple sources of phosphorus, many are diffuse in nature and are consequently difficult to control but our survey of 56 sites from the headwaters to their confluence with the River Wharfe highlights the need to manage septic tanks correctly and the need to minimise the runoff of surface water into drains.

We strongly recommend the use of a best practice approach using a sustainable urban drainage system (SuDS) throughout the village whereby water is held, used and enabled to soak away within the boundary of individual households rather than allowed to run into drains. Our data indicate that the most beneficial effect on the water quality of Town Beck would be the introduction of SuDS in properties on the Big Meadow Drive, Moor Park and Moor Lane estates.

Introduction

The 4Becks project began in 2017 as a village community initiative designed to draw attention to our principal becks (Town Beck, Back Beck, Lumb Beck and Wine Beck) with respect to flood risk, water quality and biodiversity.

In 2018 the project was boosted by the award of a £20,000 grant, administered by the Yorkshire Dales Rivers Trust, allowing a part-time project officer to be appointed and providing funds to carry out a water quality survey of all four principal becks.

The survey, conducted on January 16th and 17th 2019 included nutrient chemistry (for nitrogen and phosphorus) and biological (diatom and macro-invertebrate) sampling and analysis. The nutrient chemistry data for the 35 sites from that survey are presented in Appendix A.

On the 17th February 2025, approximately six years later, we have repeated the survey by taking and analysing samples for pH, electrical conductivity and total phosphorus (TP) from the same sites. We have also added new sites. These were included to provide higher spatial resolution to the sampling design to identify pollution sources more precisely. We have also included samples from the River Wharfe to assess the impact of the becks on the main river.

Whereas pH and conductivity represent mainly natural conditions reflecting the concentrations of minerals such as calcium in catchment soils and geology, total phosphorus is a measure of nutrient pollution. Natural unpolluted waters in upland environments have very low phosphorus concentration with values less than 10 µg/l, close to the limit of detection for laboratory-based analytical methods. Values greater than this are likely to reflect the phosphorus contamination by human activity from septic tanks, agricultural manure, artificial fertiliser, surface water runoff and leaky drinking water pipes.

On this premise we might expect TP concentration in our Addingham becks to be low in the headwaters and increase downstream and the downstream increase to be more pronounced

in Town Beck, Back Beck and Wine Beck as they pass through the village and less pronounced in Lumb Beck and Hall Gill that flow through open countryside.

High nutrient concentrations are a cause for concern as they lead to poor ecological conditions, especially the excessive growth of filamentous algae, both in the becks and downstream in the main river.

Here we present the data for 56 sites sampled on the morning of the 17th February. We describe the data for each beck in turn focussing on changes in the concentration of TP.

Sites

Figure 1 shows the location of the 56 sites and Table 1 shows a list of the sites sampled in 2025 together with their site codes, site names, geographical locations. It also shows time of sampling and the analytical results for temperature, pH, electrical conductivity and total phosphorus. Photographs of all sites can be seen here.

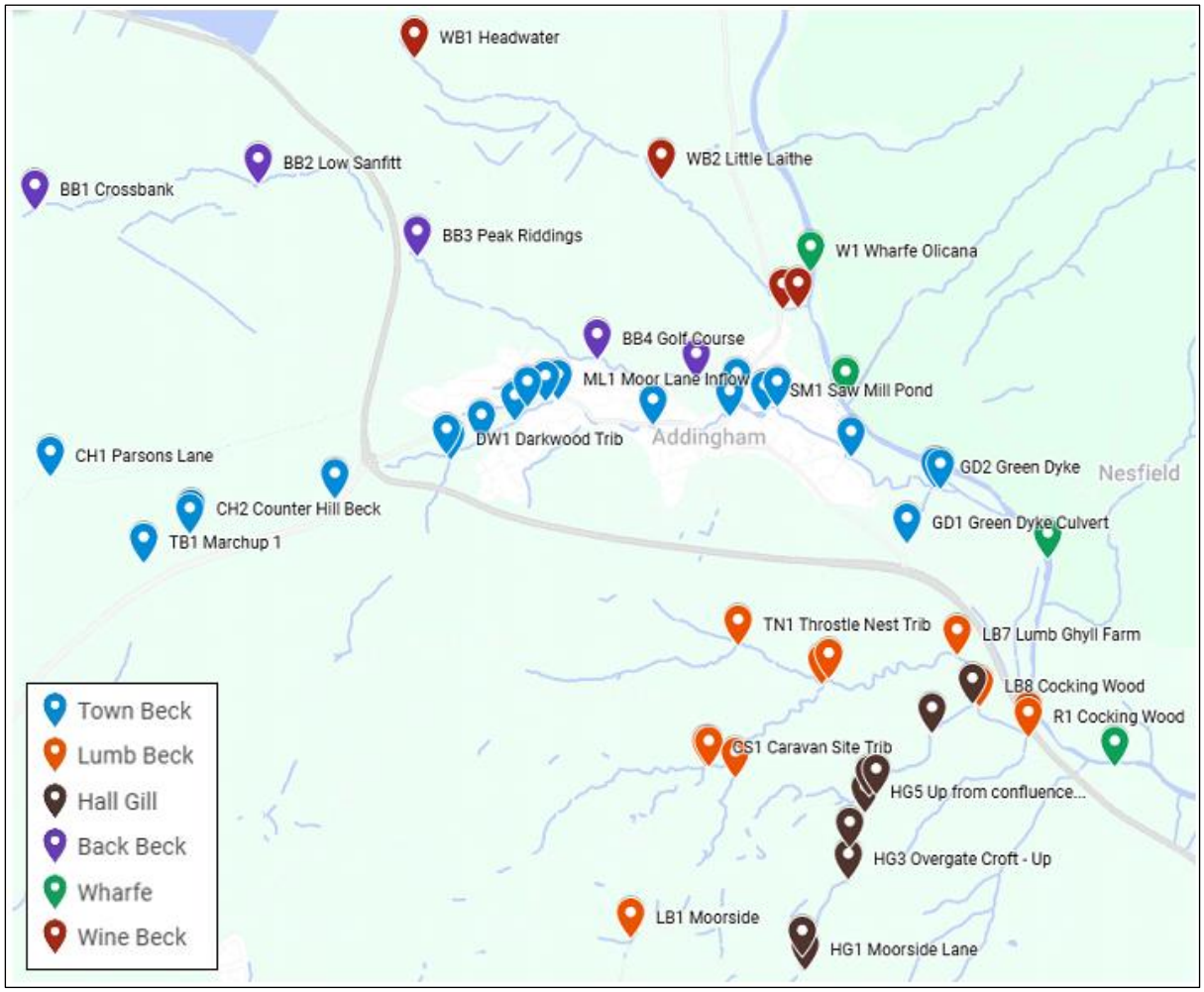


Figure 1. Location of 56 sampling sites along Addingham becks

The sites are grouped in catchments, Lumb Beck, Hall Gill (a sub-catchment of Lumb Beck), Town Beck, Back Beck (a sub-catchment of Town Beck) and Wine Beck. Within each catchment or sub-catchment we have sampled at selected points along the main becks and on their

tributaries attempting to identify pollution sources. One sample (BM1, Big Meadow Drive) was taken from a pipe (see picture below), all others were taken from naturally flowing waters.

The four sites sampled in the River Wharfe were located upstream and downstream of the respective points where Wine Beck, Town Beck and Lumb Beck enter the river.

Methods

Samples were collected in the field by four teams working simultaneously between approximately 9.00 am and 2.30 pm using sterile 100 ml bottles for pH and conductivity (EC) and sterile 15 ml test tubes for total phosphorus (TP). Duplicate samples were taken for TP. Water temperature was measured in situ. All samples were taken to the lab at 9 Main St. where pH and EC were measured. Samples for TP analysis were stored in a refrigerator at 4 ^{o}C for later delivery to the University of Liverpool.

Weather conditions were good throughout the day with partial cloud cover and no rainfall. The temperature was low and there had been a frost overnight. Flow in the becks was moderate, allowing sampling from the banks or from within the becks to be easy and safe at all sites.

pH was measured using a Hach SL1000 Portable Parallel Analyser (PPA). EC was measured using a portable Hanna Instruments low range HI-99300 meter. TP was analysed at the University of Liverpool Ecology Laboratory. Measurements were made after acidic potassium persulphate autoclave digestion using a SEAL AA3 HR Segmented Flow Analyzer.

`		Site					Temp	EC		TP
Catchment	Beck	Code	Site name	Lat/Long	masl	Time	°C	µS/cm	pH	µg/l
Lumb Beck	Lumb Beck	LB1	Moorside	53.925761,-1.887532	240	09:20	4.2	200	7.6	74
Lumb Beck	Caravan Site spg	CS1	Caravan Site Trib	53.931995,-1.882940	161	09:55	4.3	317	7.5	110
Lumb Beck	Cuckoo Nest Trib	CN1	Cuckoo Nest Trib	53.932028,-1.882902	161	10:00	3.3	236	7.6	27
Lumb Beck	Lumb Beck	CN2	Below conf. of CN1 & CS1	53.932047,-1.882707	161	10:07	3.7	245	7.5	60
Lumb Beck	Lumb Beck	LB2	Spring Gill Wood	53.931677,-1.881102	158	10:17	3.5	245	7.6	66
Lumb Beck	Throstle Nest spg	TN1	Throstle Nest Trib	53.936048,-1.881543	129	10:51	4.2	339	7.5	47
Lumb Beck	Throstle Nest spg	TN2	Throstle Nest Trib	53.935058,-1.875770	112	11:11	4.3	342	7.5	103
Lumb Beck	Lumb Beck	LB6	Lumb Gill	53.935095,-1.875612	112	11:26	4.3	283	7.6	68
Lumb Beck	Lumb Beck	LB7	Lumb Ghyll Farm	53.936078,-1.867471	87	11:48	4.6	294	7.6	69
Lumb Beck	Lumb Beck	LB8	Cocking Wood	53.933612,-1.864523	86	12:05	4.1	294	7.6	54
Lumb Beck	Reynards spg	R1	Cocking Wood	53.933201,-1.863190	82	12:14	4.6	256	7.6	128
Lumb Beck	Lumb Beck	LB9	Bypass	53.933283,-1.863160	80	12:16	4	291	7.7	53
Hall Gill	Hall Gill	HG1	Moorside Lane	53.924682,-1.876900	218	08:50	6.2[a]	139	8.2	16
Hall Gill	Hall Gill	HG2	Down from HG1	53.925173,-1.877033	214	08:55	5.7[a]	145	7.8	18
Hall Gill	Hall Gill	HG3	Overgate Croft - Up	53.927938,-1.874156	165	09:30	4.9[a]	163	7.6	24
Hall Gill	Hall Gill	HG4	Overgate Croft - Down	53.929128,-1.874072	153	09:35	4.3	165	7.5	21
Hall Gill	Hall Gill	HG5	Up from conf. with GC	53.930381,-1.873178	137	09:40	4.5	193	7.5	28
Hall Gill	Gate Croft spg	GC1	Above conf. with HG	53.930992,-1.872887	128	09:48	4.3	222	7.3	49
Hall Gill	Hall Gill	HG6	Down from conf. with GC	53.931013,-1.872514	127	09:52	4.5	210	7.3	39
Hall Gill	Hall Gill	HG7	Cocking Lane culvert	53.933234,-1.869053	105	10:10	4.6	228	7.3	35
Hall Gill	Hall Gill	HG8	Above confluence with LB	53.934442,-1.866366	92	11:59	4.3	276	7.7	37
Town Beck	Counter Hill Beck	CH1	Parsons Lane	53.942528, -1.92332	232	08:44	3	236	7.5	28
Town Beck	Counter Hill Beck	CH2	Counter Hill Beck	53.940629,-1.914656	193	09:16	2.7	265	7.5	67
Town Beck	Town Beck	TB1	Marchup 1	53.939408,-1.917507	199	09:05	4.5	269	7.5	46
Town Beck	Town Beck	TB2	Marchup 2	53.940476,-1.914732	193	09:22	4.3	307	7.4	308
Town Beck	Town Beck	TB3	Turner Lane	53.941736,-1.905787	169	09:30	4	312	7.5	39
Town Beck	Town Beck	TB4	Stepping Stones	53.943358,-1.898943	140	09:52	3.7	358	7.5	48
Town Beck	Town Beck	DW1	Darkwood Trib	53.943133,-1.898685	146	09:55	3.7	295	7.5	45
Town Beck	Town Beck	TB5	Frankie's path	53.943859,-1.896779	136	10:00	3.5	325	7.5	49
Town Beck	Town Beck	BM1	Big Meadow pipe	53.944549,-1.894751	131	10:19	6.2	476	7.4	637
Town Beck	Town Beck	TB6	Stamp Hill	53.945088,-1.893958	128	10:30	4.2	337	7.5	64
Town Beck	Moor Pk Drive I/F	MP1	Moor Pk Drive I/F	53.945285,-1.892829	125	10:39	6.3	644	7.6	103
Town Beck	Moor Lane I/F	ML1	Moor Lane I/F	53.945320,-1.892037	123	10:47	5.7	396	7.8	220
Town Beck	Town Beck	TB7	Burnside	53.944434,-1.886251	106	11:59	4.5	385	7.7	111
Town Beck	Town Beck	TB7a	Bolton Road, Rookery	53.944733,-1.881525	98	12:11	4.8	375	7.7	111
Town Beck	Town Beck	TB8	Aynholme Bridge	53.945362, -1.88105	98	12:22	4.8	399	7.8	92
Town Beck	Saw Mill Pond	SM1	Saw Mill Pond	53.944939,-1.879317	95	12:30	4.5	537	7.7	78
Town Beck	Town Beck	TB9	Sidebeck	53.945065,-1.878616	94	12:45	4.7	455	7.8	86
Town Beck	Town Beck	TB10	Church Field	53.943253,-1.874066	89	12:57	4.9	439[b]	7.8	83
Town Beck	Town Beck	TB11	Holme House	53.942070,-1.868570	83	14:41	5.2	312	7.6	86
Town Beck	Green Dyke	GD1	Green Dyke Culvert	53.940135,-1.870574	85	13:11	6	448	7.8	104
Town Beck	Green Dyke	GD2	Green Dyke	53.942151,-1.868905	83	14:32	5.5	458	8.1	138
Back Beck	Back Beck	BB1	Crossbank	53.952193,-1.924247	259	09:04	4.9	177	7.6	46
Back Beck	Back Beck	BB2	Low White Well	53.952861, -1.919254	238	09:17	c	214	7.6	34
Back Beck	Back Beck	BB3	Low Sanfitt	53.953163,-1.910501	207	10:06	c	327	7.4	30
Back Beck	Back Beck	BB4	Peak Riddings	53.950513,-1.900694	165	10:25	c	418	7.4	103
Back Beck	Back Beck	BB5	Golf Course	53.946774,-1.889672	117	11:15	c	440	7.4	88
Back Beck	Back Beck	BB6	Trout pool	53.946080, -1.88352	102	11:30	c	468	7.4	126
Wine Beck	Wine Beck	WB1	Headwater	53.958110, -1.901431	196	09:45		413	7.5	21
Wine Beck	Wine Beck	WB2	Little Laithe	53.953331,-1.885678	106	11:40	4.7	296	7.7	22
Wine Beck	Wine Beck	WB3	Bolton Road	53.948628,-1.878254	91	11:55	4.9	333	7.6	129
Wine Beck	Wine Beck	WB4	Olicana	53.948640,-1.877280	85	12:05	4.6	340	7.6	103
Wharfe	Wharfe	W1	Wharfe Olicana	53.949970,-1.876507	82	10:30	5.4	275	7.4	13
Wharfe	Wharfe	W2	Wharfe Susp Bridge	53.945404,-1.874344	81	10:50	5.4	271	7.4	14
Wharfe	Wharfe	W3	Wharfe Low Mill Weir	53.939548,-1.861964	78	11:05	5.1	255	7.5	12
Wharfe	Wharfe	W4	Wharfe Dales Way	53.932059,-1.857825	76	11:25	5.3	261	7.5	16

Table 1. Sites and sample data

Results

Lumb Beck

We sampled 12 sites on Lumb Beck and its tributaries. The location of the sites is shown in Figure 1 and data from the analysis of the samples is shown in Table 1 and Figure 2. In Figure 2 solid bars represent samples taken from the main beck whereas open bars are samples from tributaries.

Sites on the main beck are shown in downstream order ranging from LB1 at the edge of the moor on Addingham Moorside to LB9 close to the junction of Lumb Beck and the River Wharfe near Cocking Wood. We have called unnamed tributaries joining the main beck as Caravan Site (CS), Cuckoo Nest (CN), Throstle Nest (TN) and Cocking Wood (RI). Hall Gill is also a tributary of Lumb Beck, joining the Beck between Lumb Ghyll Farm (LB7) and Cocking Wood (LB8). We have treated this beck separately (see below).

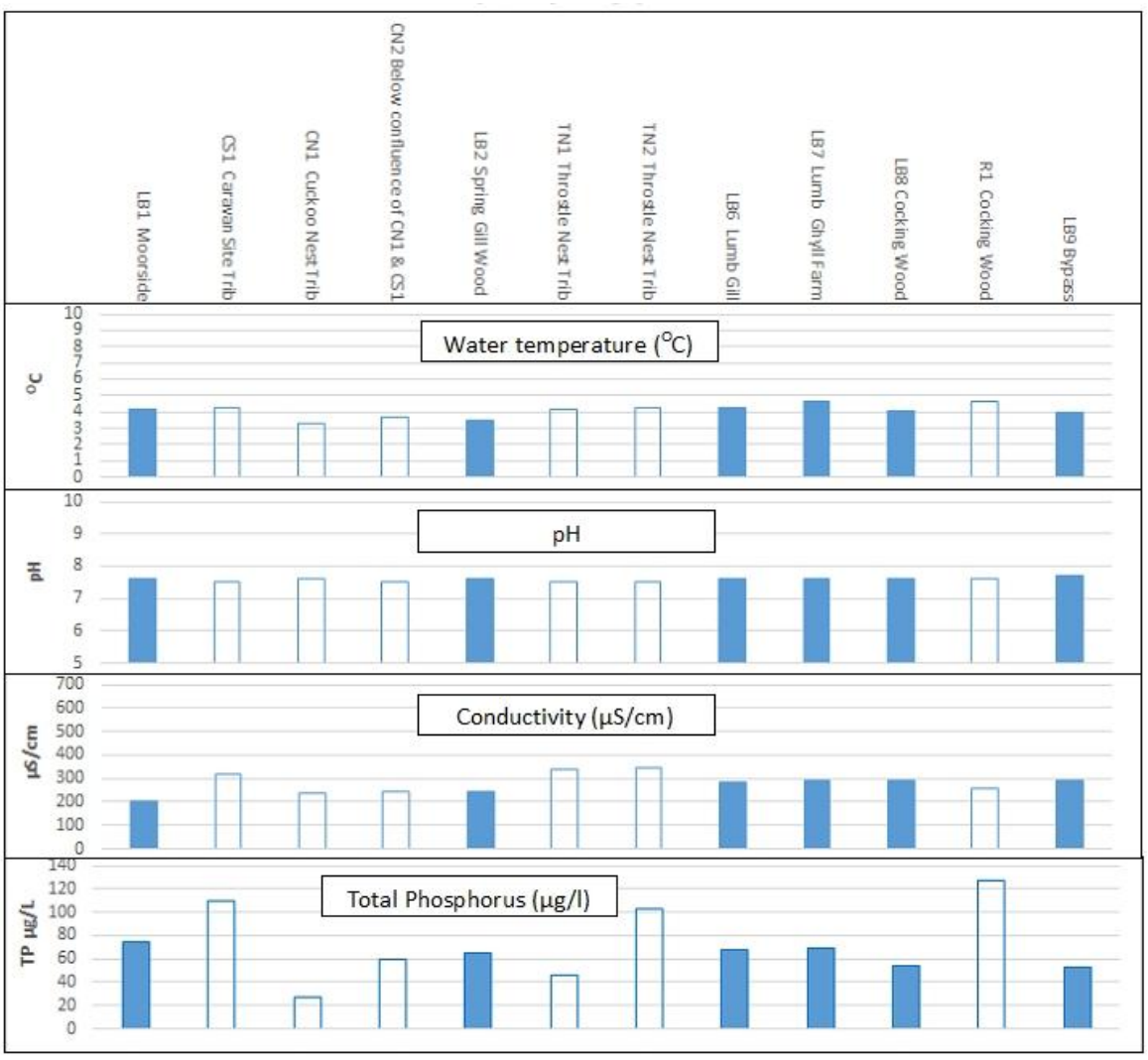


Figure 2. Temperature, pH, electrical conductivity and total phosphorus data for Lumb Beck samples

The data show that temperature at approximately 4°C and pH at approximately 7.5 did not vary significantly along the beck. Electrical conductivity was slightly more variable with values ranging from 200 to 340 µS/cm. The highest values were for the Caravan Site tributary (CS1) and the Throstle Nest tributary (TN1 and TN2).

The TP data show values varying from 27 µg/l to 128 µg/l. There is no evidence of the expected downstream increase in values. The opposite appears to be the case. The Moorside site (LB1) has quite a high value indicating a pollution source further upstream, probably from a septic tank, and the two lowest elevation sites, Cocking Wood (LB8) and Bypass (LB9), have lower values than upstream, almost certainly because of the diluting effect of the relatively low TP concentration water of Hall Gill entering the main beck between LB7 and LB8, as described below.

The samples with highest values are all from tributaries. These include the Caravan Site tributary (CS1), the Throstle Nest tributary (TN2) and the Cocking Wood tributary (R1) and may all be associated with inputs from septic tank systems. The Throstle Nest data provide the clearest evidence for septic tank input as the high value at TN2 (103 µg/l), downstream of two farmhouses, is much higher than the value at TN1 (47 µg/l) immediately upstream of the houses.

Hall Gill

Although Hall Gill is a tributary of Lumb Beck it is a relatively large beck, and almost as long as Lumb Beck itself. We have therefore treated it as a separate watercourse.

We sampled eight sites on the main Hall Gill channel and one on a tributary (Gate Croft, GC1). Locations are shown in Figure 1, data are shown in Table 1 and Figure 3.

We recorded water temperatures of 6.2 and 5.7°C respectively at the top two sites. These are higher than ambient air temperature and are most likely measurement errors. Water temperatures at other sites downstream are all in line with air temperature and in agreement with values from other sites on other becks.

pH also seems anonymously high at these two sites. Further investigation is needed to determine whether these values are correct.

EC values are low rising from 129 to 276 µS/cm from the Moorside (HG1) to the confluence with Lumb Beck (HG8). These values are lower than those for the other becks.

In contrast to Lumb Beck (above) TP values increase downstream as expected. The highest elevation site (HG1) has the lowest value (16 µg/l). Concentrations jump from HG5 to HG6 (from 28 to 39 µg/l) probably due to the inflow of the tributary joining Hall Gill between those two sample points. That inflow (GC1) has a significantly higher TP value (49 ug/l) than the receiving water, probably due to septic tanks serving the two Gate Croft households upstream. Future surveys should include sampling from a site immediately upstream of Gate Croft Barn.

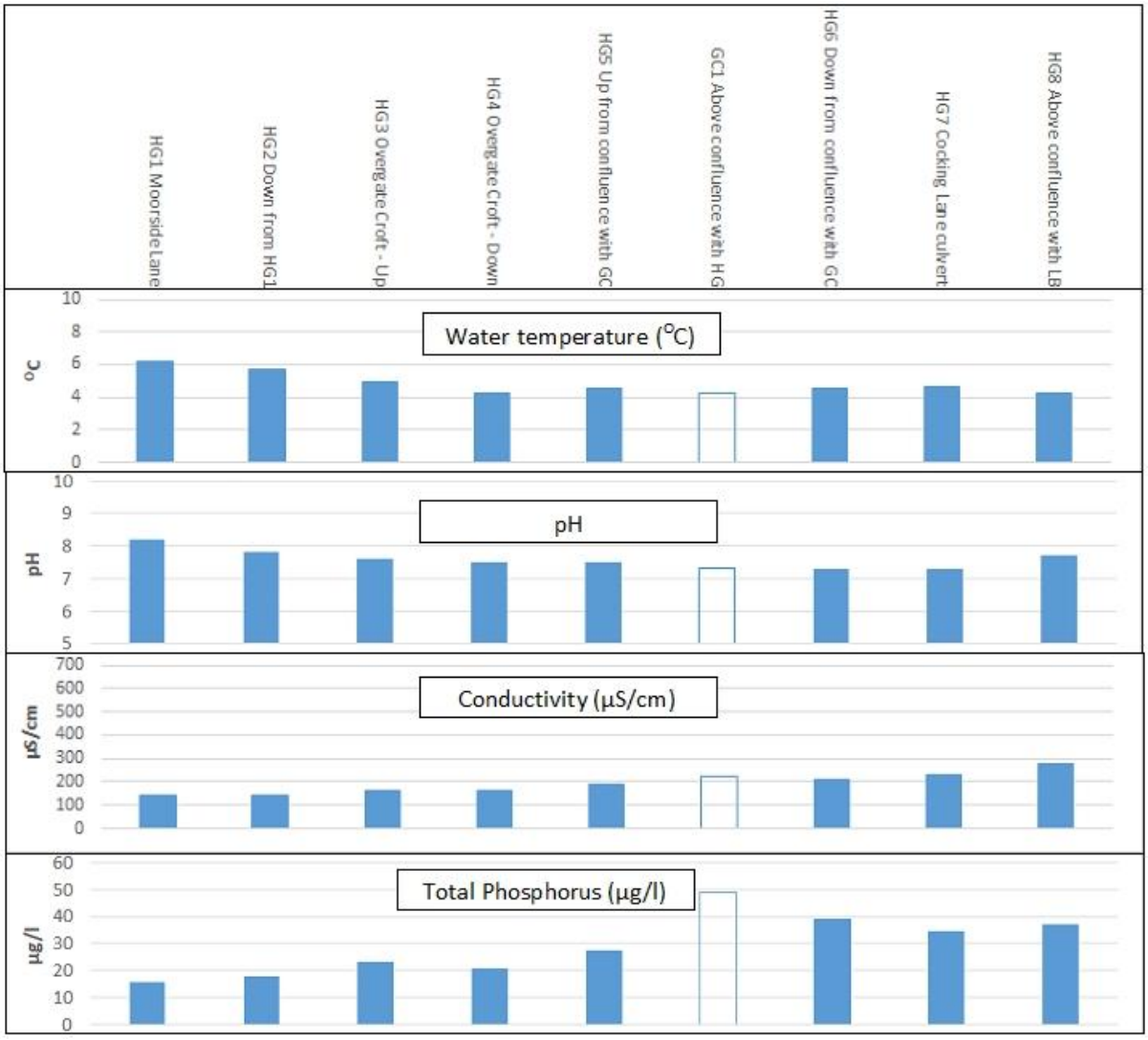


Figure 3. Temperature, pH, electrical conductivity and total phosphorus data for Hall Gill samples

Town Beck

Town Beck is the main beck running through Addingham village. Its headwaters rise near Cringles where it is called Marchup Beck. Its name changes when it reaches the village at Townhead where it becomes Town Beck. It is joined by Back Beck at Aynholme Bridge on Bolton Road and flows into the Wharfe at Low Mill.

Twenty-one sites were sampled, 12 on the main beck and nine on tributaries or inflows, including one pipe inflow (BM1). The locations of the sites are shown in Figure 1, data are shown in Table 1 and Figure 4.

The water temperature data show more variability than similar data for other becks (Table 1). There are a few samples with markedly higher values. These are all inflows with temperatures

of 6°C in comparison to the main beck (ca. 4°C). They include samples from inflows that are mainly culverted and flow through and under roads and gardens (MP1 Moor Park Drive, ML1 Moor Lane, GD1 Green Dyke) or in the case of BM1 (Big Meadow Drive) is from pipeflow (see picture).

pH values are very stable consistently falling between 7.4 and 8.1 whereas EC gradually rises downstream from 236 to 435 µS/cm. The value shown in Figure 4 for TB11 is significantly lower than the value close by upstream and thought to be an error. We analysed repeat samples from this section of the beck, from Church Field to the Green Dyke confluence, and showed the value at TB11 to be very similar to TB10 as expected indicating that the initial value was indeed probably an error.

TP values are higher in Town Beck than in the other becks (note the change in scale on the y axis in Figure 4). The data show an overall increase downstream from approximately 40 µg/l

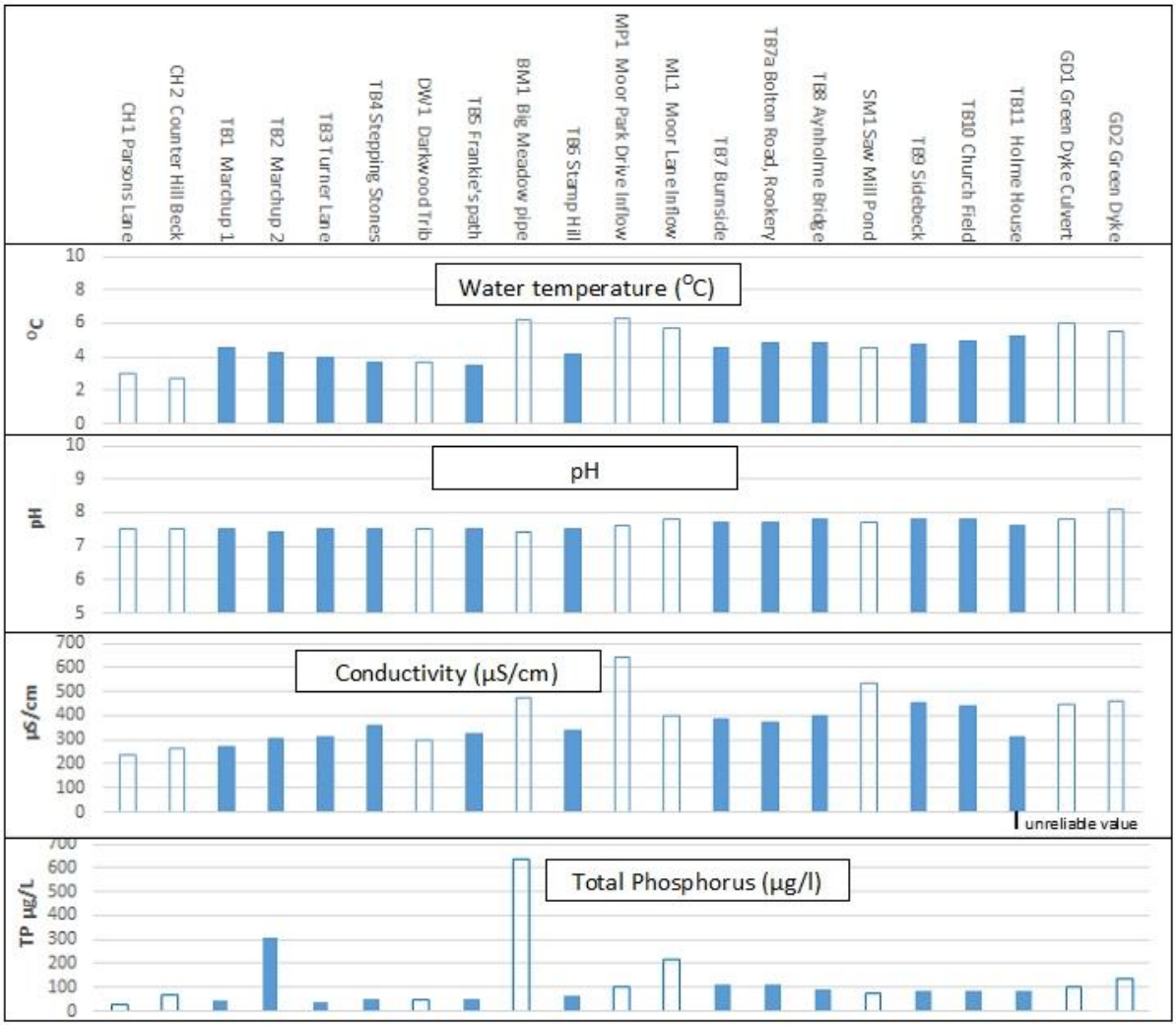


Figure 4. temperature, pH, electrical conductivity and total phosphorus data for Town Beck samples

to 100 µg/l with a step change between Frankie's Path (TB5) and Burnside (TB7). This is in accordance with data from the previous surveys along this stretch of Town Beck reflecting the influence of the Big Meadow Drive (BM1), Moor Park Drive (MP1) and Moor Lane (ML1) inflows, all of which have high or very high TP concentrations. These are shown by the open bars in Figure 4. The high values are due to these pipes and tributaries taking nutrient rich surface drainage water from the streets, homes and gardens in the Big Meadow, Moor Park and Moor Lane estates.

A very high TP value is also shown for the Marchup 2 sample (TB2). This also concurs with previous surveys and is thought to be caused by drainage from the septic tank serving the Lower Marchup hamlet. Somewhat surprisingly this high value does not persist downstream. This is in part due to the diluting effect of the Counter Hill tributary (CH2) that enters Marchup Beck immediately downstream of TB2 and probably to further input of surface water and groundwater between TB2 and TB3.

Back Beck

Back Beck rises on Addingham Low Moor to the west of Chelker Reservoir. It flows under the main road close to the junction with Skipton Road through a steep-sided valley, where it is called Heathness Gill, through the edge of the golf course, along the back of School Lane, under Bridge 55, past the Primary School and joins Town Beck at Aynholme Bridge.

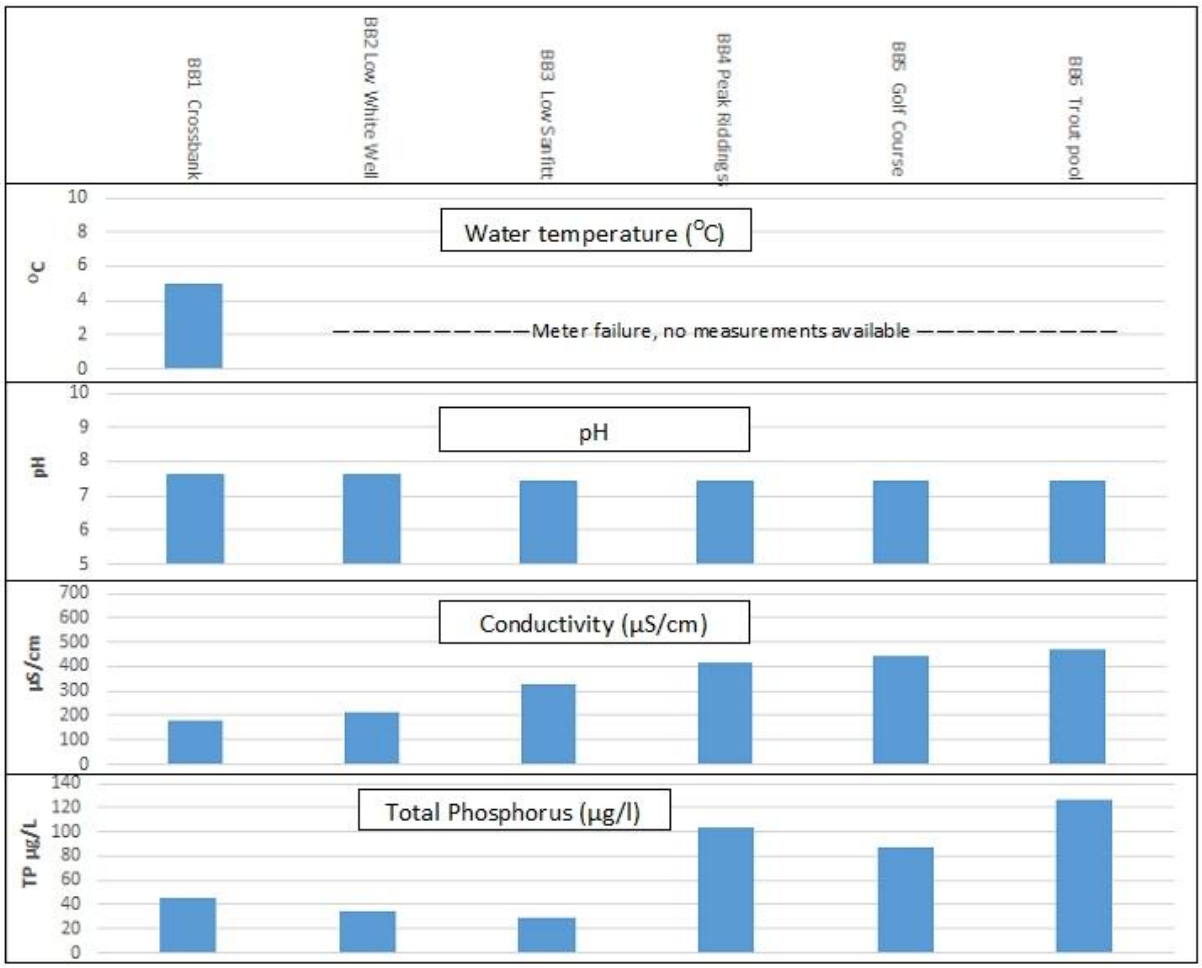


Figure 5. Temperature, pH, electrical conductivity and total phosphorus data for Back Beck samples

Unfortunately the hand held meter used to measure water temperature failed after the first measurement of approximately 5°C at the headwater site, BB1 (Figure 5). pH remained stable, between 7.4 and 7.8, along the length of the beck but EC increased from just less than 200 µS/cm to almost 500 µS/cm. The small increase in conductivity in Town Beck downstream of Aynholme Bridge (Figure 4) is probably due to the input of this somewhat more alkaline water from Back Beck.

TP is relatively low at the higher elevation sites west of the bypass, but there is a step change between sites BB3 and BB4 from ca. 30 µg/l to over 100 µg/l. The reason for this is not known, but it is likely that the source has an agricultural origin, given the location of the increase. The very high value of over 120 µg/l measured at the Bridge 55 trout pool (BB6) may be due to pollutants from the free range chicken allotments at the back of Burns Hill.

Wine Beck

Wine Beck rises close to Chelker Reservoir and flows south-eastwards through Farfield, under Bolton Road, past the Paddock and Olicana static caravan sites to reach the Wharfe at High Mill.

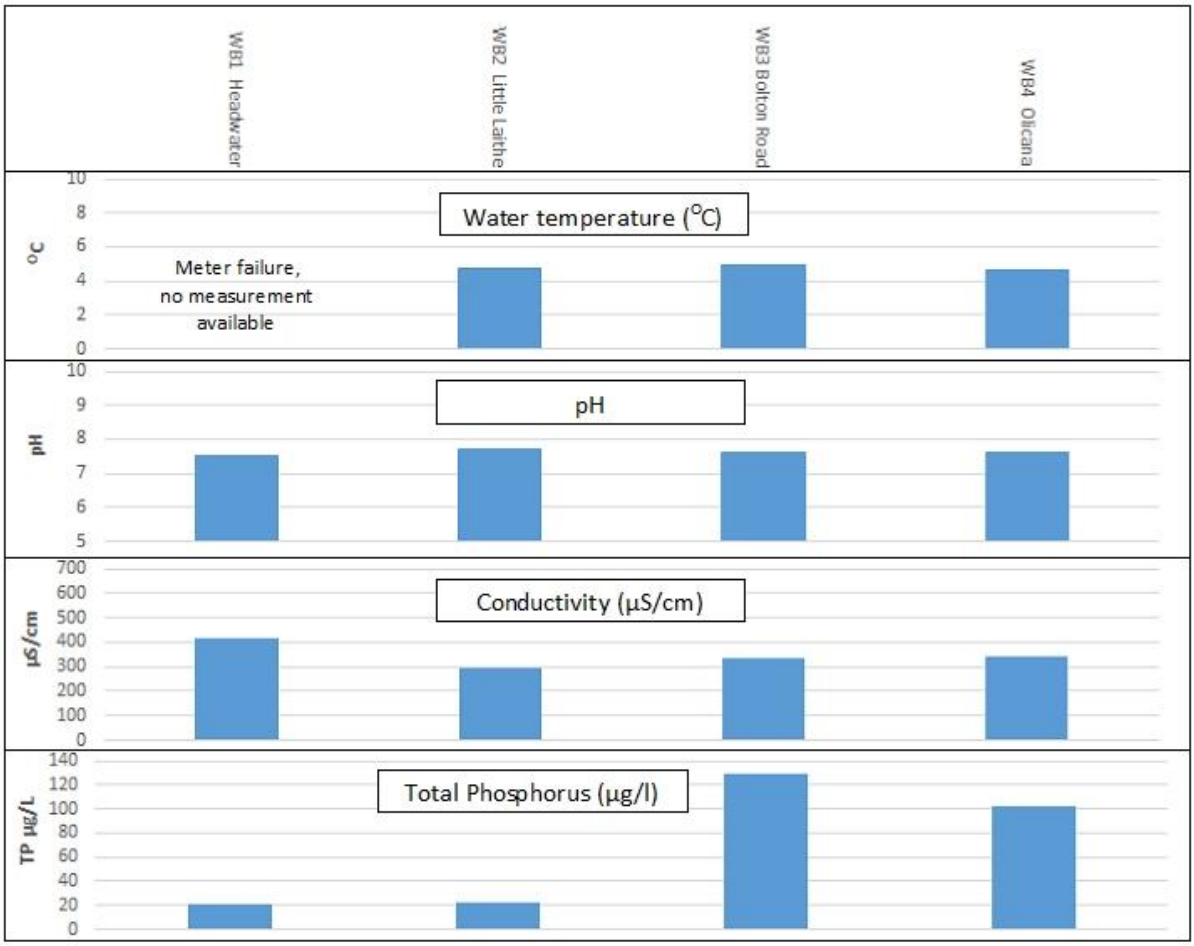


Figure 6. Temperature, pH, electrical conductivity and total phosphorus data for Wine Beck samples

Water temperature data were available for only three of the four sites sampled (Figure 6). pH and EC values were stable, between 7.4 and 7.8, and between 300 and 400 µS/cm, respectively. However, there was a strong step change in TP between WB2 and WB3, from 20 µg/l to over 120 µg/l. The cause of the increase is not known but it is more likely to be related to a source or sources within the cluster of houses to the south of Bolton Road than to agricultural land further upstream. Future surveys should include sampling from a site immediately upstream of the houses. A disused septic tank formerly used to service wastewater from the Paddock caravans occurs between sites WB3 and WB4. It is not known whether there is any ingress of surface water during rainfall events that might lead to the discharge of residual organic matter into the beck. Sewage from the Paddock caravans is now pumped into the mains sewage network.

River Wharfe

We collected samples from the River Wharfe upstream and downstream of the confluences between Wine Beck, Town Beck and Lumb Beck and the river to make direct comparison between the chemistry of the river and the chemistry of the becks close to the point of entry

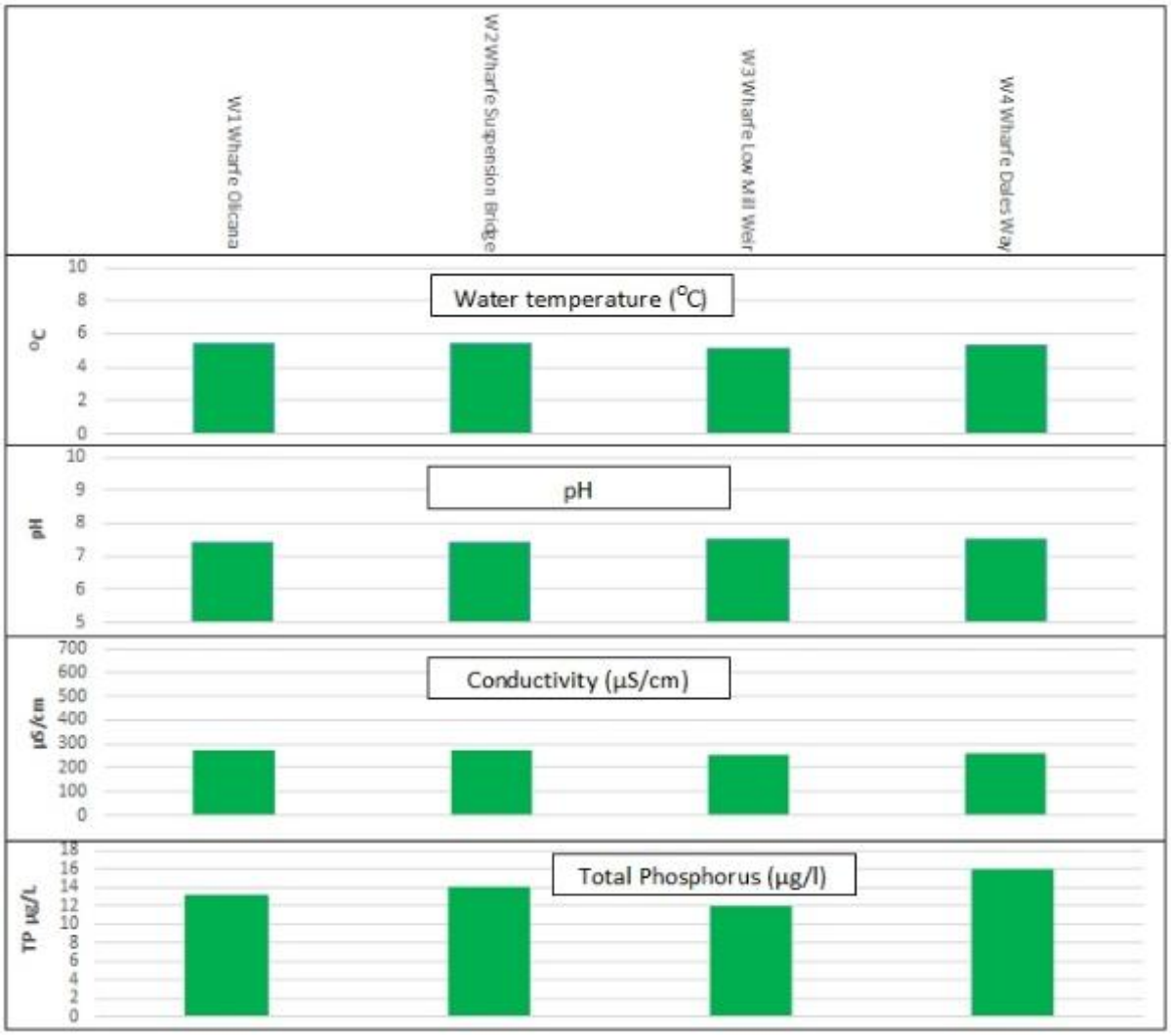


Figure 7. Temperature, pH, electrical conductivity and total phosphorus data for R. Wharfe samples

as well as to assess whether the becks were responsible for any change in the water quality of the river.

The data for the Wharfe are shown in Figure 7. The data from the four sites are very stable as might be expected for sites spaced so closely together. The temperature is about 5.5 ^{o}C, pH about 7.5, conductivity about 275 µS/cm, and TP between 13 and 16 µg/l. Whereas temperature and pH values are similar to those of the inflowing Addingham becks, conductivity and TP values are significantly lower. These differences indicate that pollutant phosphorus entering the river from the becks has little or no effect on phosphorus concentration in the main river owing to the capacity of the river to dilute the inflows. They also indicate that the becks, especially in their lower reaches, are in poorer ecological condition than the river itself.

Summary and conclusions

In a repeat of a survey carried out in 2019 we sampled 52 sites along our main village becks and their tributaries and four sites on the River Wharfe, upstream and downstream of the entry points of Wine Beck, Town Beck and Lumb Beck.

The samples were taken by four teams of volunteers working concurrently on the morning of 17th February 2025. We measured water temperature in the field and pH and conductivity in the lab in the afternoon of the 17th February. TP was analysed later in Liverpool University.

Water temperature values were similar at all sites, reflecting the air temperature at the time of sampling.

pH values were also similar and quite high at between 7.5 and 8 at most sites. Such alkaline values for becks with moorland headwaters may seem surprising, but in this survey no samples were collected from moorland sites. The highest elevation samples in each beck were taken from sites downstream of the moorland boundary bordered by fields subjected to a long history of agricultural liming.

Except for Hall Gill, conductivity values are also relatively high, between 200 and 300 µS/cm in the upper reaches and 300 to 500 µS/cm in lower reaches. Hall Gill values vary between 100 and 200 µS/cm. These data reflect the variable alkalinity of catchment soils more accurately than pH, as pH is well-buffered at these levels of alkalinity and therefore less sensitive to change. Consequently, but with the exception of Wine Beck, conductivity, which is closely correlated with alkalinity, increases downstream in all becks. Wine Beck is different because its headwaters are not influenced by acidic water from the moorland.

Total phosphorus values vary significantly along the becks, between the becks, and between the becks and the main river. Phosphorus is a key nutrient pollutant. Entirely natural, unpolluted waters would be expected to have TP concentrations below 10 µg/l. All sites sampled in this survey have greater values, indicating that they all suffer from pollution to a greater or lesser extent. Phosphorus pollution sources include agricultural runoff (manure and fertilisers), septic tank effluent, runoff from urban surfaces, discharges from plumbing misconnections and leaks from mains water supply pipes. The data across the five catchments are shown in Figure 8.

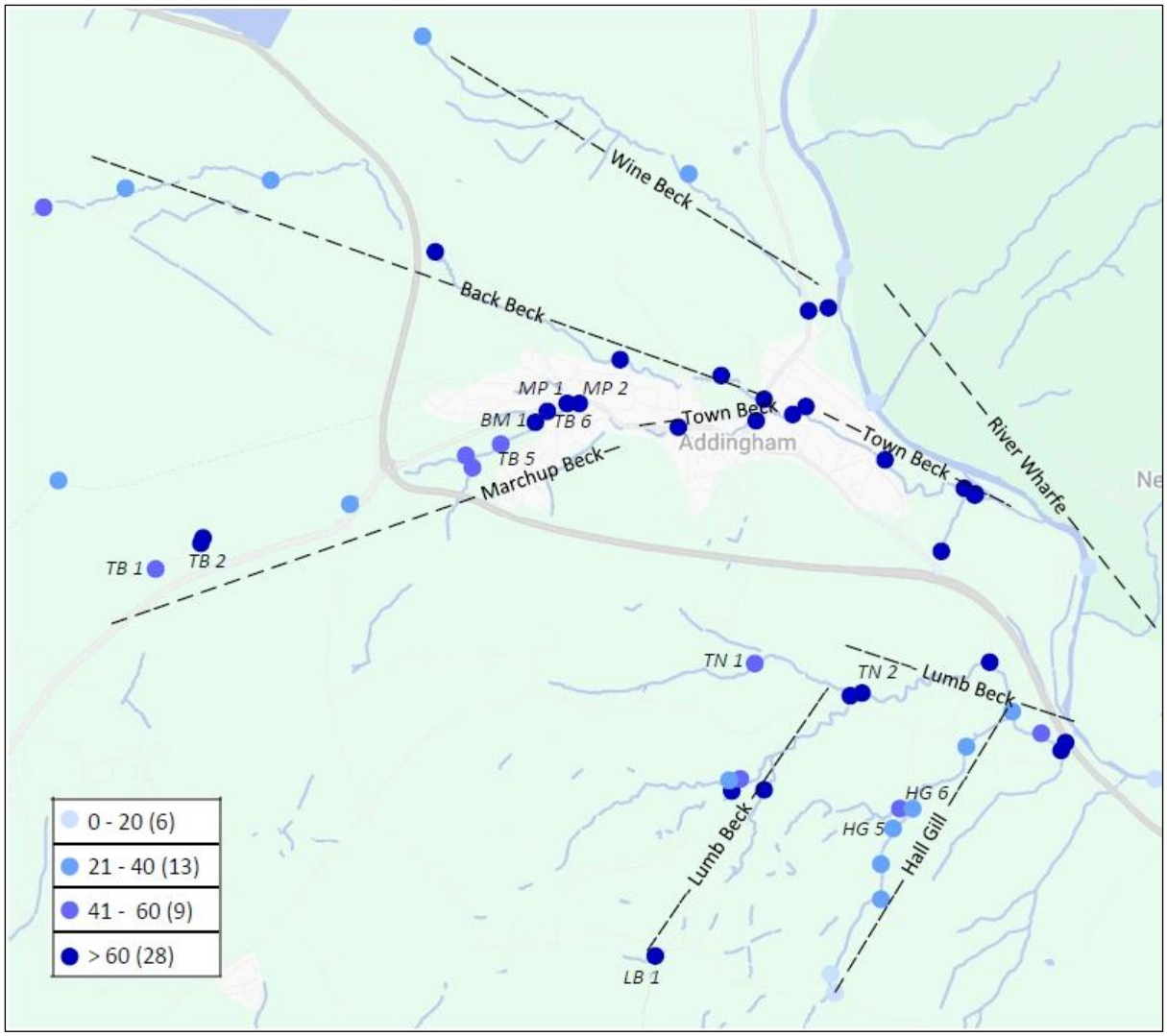


Figure 8. TP values (µg/l) across the catchments

Key features are:

- In all but one beck (Lumb Beck) concentrations are relatively low in their upper reaches and increase downstream as the becks flow through agricultural land, past septic tanks and, in the case of Back Beck and Town Beck, through the built-up area of the village;
- In Lumb Beck the highest elevation sample on the edge of the Moorside (LB1 Moorside) has a high concentration (>70 µg/l), possibly due to pollution from a septic tank further upstream;
- Differences between the upstream and downstream samples for a number of farmhouses, including Gate Croft (HG5 vs HG6), Throstle Nest (TN1 vs TN2), Low Marchup (TB1 vs TB2), indicate the probable impact of phosphorus pollution from septic tanks. Septic tanks are no longer permitted to discharge directly into streams but even permitted discharges into field drains can lead to phosphorus-rich soil water reaching watercourses;

- The sample with the highest phosphorus concentration (BM1, over 600 µg/l) was collected from the pipe taking surface water into Marchup (Town) Beck from the Big Meadow Drive Estate;

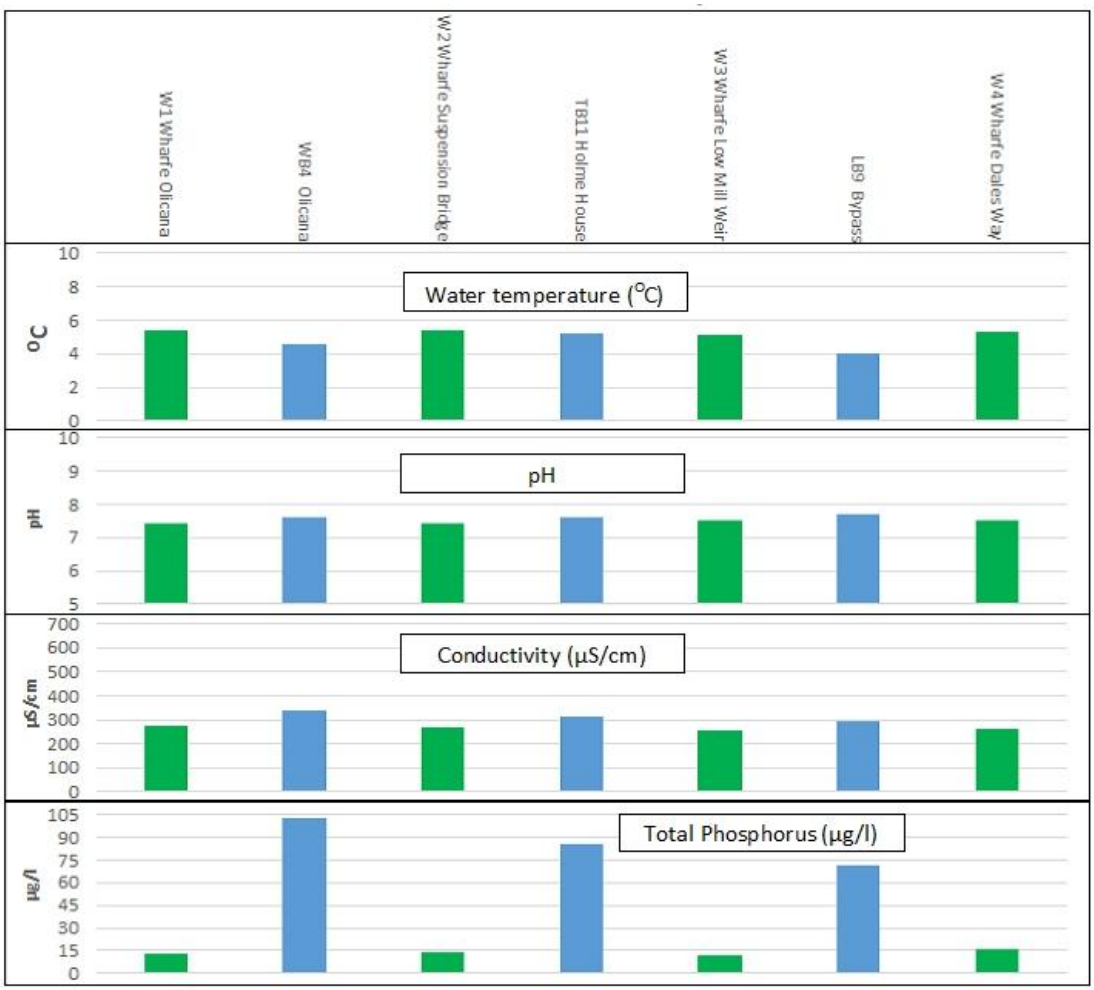


Figure 9. Comparisons between TP concentration of inflow beck (blue) and River Wharfe samples (green)

- Very high TP concentrations were also seen in the samples from the Moor Park Drive (MP1) and Moor Lane (ML1) inflows to Marchup Beck. Both of these unnamed tributaries flow through and along the back gardens of houses in Moor Park and Moor Lane and take runoff from road surfaces on the estates;
- The data for Marchup (Town) Beck are in close agreement with phosphorus data from the previous survey in 2019 (Appendix A) showing a doubling of pollutant phosphorus concentration between Frankie's Path (TB5) and Burnside (TB6), attributed to the influence of the Moor Park Drive and Moor Lane estates in particular;
- TP values for the River Wharfe flowing through Addingham are very low. They remain low downstream despite the high concentrations of phosphorus in the inflow becks (Figure 9, Wine Beck, Town Beck and Lumb Beck). This is due to the difference in volumes between the main river and the becks where the main river provides very high dilution of the inflow concentrations;

- The poor ecological quality of Town and Back Becks in the village, indicated in summer by the extent of filamentous green algae growing on stones in the becks, and most visible at Burnside, is due to nutrient pollution by phosphorus.

The high concentrations of phosphorus in the Addingham becks is the result of pollution from multiple sources. Many of these sources are diffuse in nature and are consequently difficult to control. In the countryside around the village farmers need to follow Government rules for water (https://www.gov.uk/guidance/rules-for-farmers-and-land-managers-to-prevent-water-pollution) and residents of properties not on the mains sewerage system need to ensure their septic tanks are set up and operated in accordance with Government binding rules for septic tanks (https://www.gov.uk/permits-you-need-for-septic-tanks/you-have-a-septic-tank-or-small-sewage-treatment-plant).

Within the built-up area of the village phosphorus pollution is best controlled by minimising the runoff of surface water into drains. Household and highway drainpipes either discharge into the main sewer or directly into the becks. Surface water runoff into the sewer can overload the treatment capacity of sewage works leading to spills of untreated sewage into rivers and direct runoff into the becks not only causes nutrient pollution but also can alter water flow. In either case best practice is to use a sustainable approach (or SuDS, sustainable urban drainage system) whereby water is held, used and enabled to soak away in gardens or within the boundary of individual households.

In Addingham our survey data suggest that this approach would have the most beneficial effect on the water quality of Town Beck if it were installed on the Big Meadow Drive, Moor Park and Moor Lane estates.

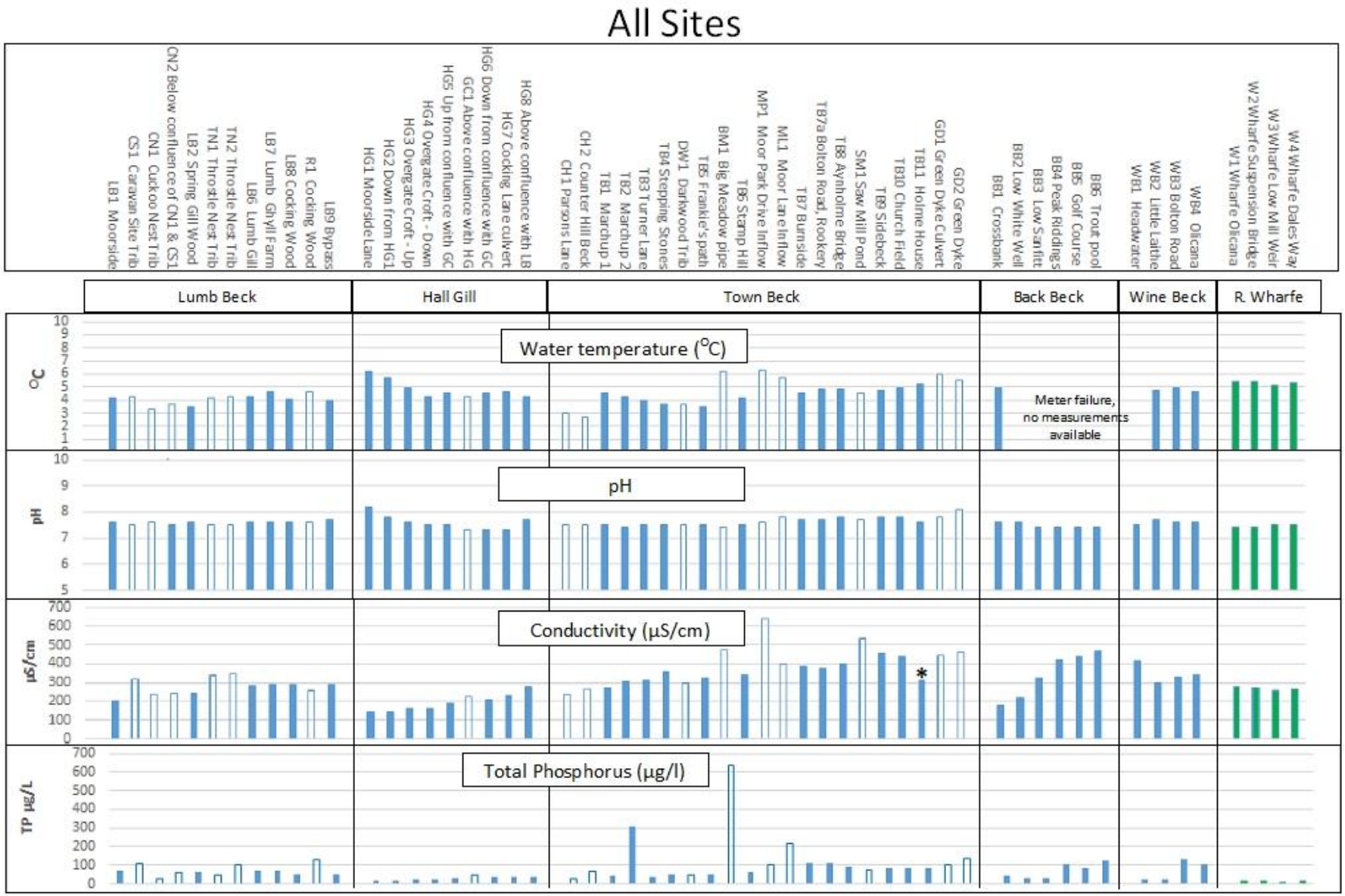
Acknowledgements

We thank all landowners for permission to cross their land and take samples from becks across the Addingham parish. We also thank Yorkshire Dales Rivers Trust for the loan of temperature and pH meters.

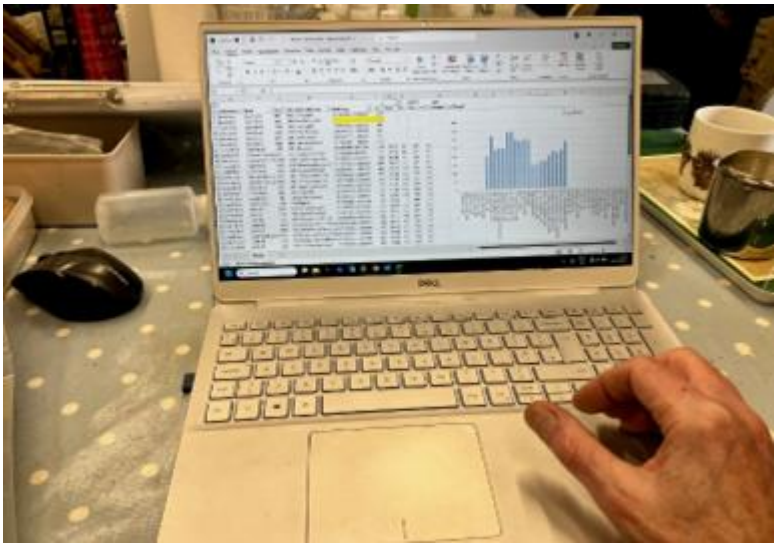
Appendix A: Water chemistry data for the 4Becks survey of January 16th and 17th 2019

Site Code	Beck	Sitename	Lat	Long	TP µg/l
LB1	Lumb Beck	Moorside	53.925839	-1.8875801	44
LB2	Lumb Beck	Spring Gill Wood	53.931657	-1.8811526	62
LB3 & LB4	Lumb Beck	Caravan Site & Cuckoo Nest	53.932027	-1.8820653	50
LB5	Lumb Beck	Throstle Nest	53.935040	-1.8758424	67
LB6	Lumb Beck	Lumb Gill	53.935220	-1.8754306	62
LB7	Lumb Beck	Lumb Ghyll Farm	53.936083	-1.8675380	62
LB8	Lumb Beck	Hall Gill	53.934267	-1.8666451	38
LB9	Lumb Beck	Cocking Wood	53.933094	-1.8631609	140
LB10	Lumb Beck	Bypass	53.933283	-1.8631603	148
BB1	Back Beck	Crossbank	53.952193	-1.9242476	55
BB2	Back Beck	Low Sanfitt	53.953163	-1.9105011	477
BB3	Back Beck	Peak Riddings	53.950513	-1.9006940	129
BB4	Back Beck	Golf Course	53.946774	-1.8896722	98
BB5	Back Beck	Primary School	53.946084	-1.8829094	74
WB1	Wine Beck	Headwater	53.958373	-1.9056436	1890
WB2	Wine Beck	Little Laithe	53.953331	-1.8856778	44
WB3	Wine Beck	Olicana	53.948640	-1.8772800	154
TB1	Town Beck	Marchup 1	53.939408	-1.9175072	41
TB2	Town Beck	Marchup 2	53.940476	-1.9147326	416
TB3	Town Beck	Marchup 3	53.940629	-1.9146561	14
TB4	Town Beck	Turner Lane	53.941736	-1.9057877	28
TB5	Town Beck	Stepping Stones	53.943358	-1.8989438	30
TB6	Town Beck	Darkwood	53.943133	-1.8986853	45
TB7	Town Beck	Frankie's path	53.943859	-1.8967792	39
TB8	Town Beck	Big Meadow pipe	53.944549	-1.8947513	599
TB9	Town Beck	Stamp Hill	53.945088	-1.8939577	47
TB10	Town Beck	Moor Park Drive Inflow	53.945285	-1.8928298	267
TB11	Town Beck	Moor Lane Inflow	53.945320	-1.8920375	150
TB12	Town Beck	Burnside	53.944434	-1.8862505	79
TB13	Town Beck	Aynholme Bridge	53.945291	-1.8805807	66
TB14	Town Beck	Saw Mill Pond	53.944939	-1.8793171	82
TB15	Town Beck	Sidebeck	53.945065	-1.8786160	79
TB16	Town Beck	Church Field	53.943253	-1.8740661	113
TB17	Town Beck	Green Dyke	53.942151	-1.8689051	196
TB18	Town Beck	Holme House	53.942070	-1.8685702	59

Appendix B: Water chemistry data for all sites for the 4Becks survey of February 17th 2025



Appendix C. Photographs



Additional photographs can be seen here:

- Lumb Beck photos
- Town Beck photos
- Back Beck photos
- Wine Beck photos
- Hall Gill photos
- R. Wharfe photos
- Laboratory photos

Note: The photos are automatically displayed in list view, to switch to thumbnails click this icon top right on the screen.