

# ECP monthly water quality data report September 2024



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## 1. Overview

This report provides a synopsis of water quality in the Evenlode catchment for September 2024. Rainfall data and combined sewage overflows (CSOs) from sewage treatment works (STWs) are considered as the “inputs” or drivers of water quality in terms of contamination and available dilution. No data were available for specific pollution sources other than from STWs, but diffuse pollution for agriculture, road runoff, and outflows from septic tanks and other small sewage treatment facilities at household level also impact water quality in the Evenlode catchment.

Data from citizen science (CS) Freshwater Watch (FWW) surveys, Environment Agency (EA) water sampling, and near-continuous sonde measurements were used to develop this synopsis. Sonde data is presented for 02 September – 05 October to demonstrate the effect of high rainfall on 22 September on the sonde data. Freshwater Watch (FWW) surveying was carried out over the weekend of 13 - 16 September. All available EA data for September are presented. Riverfly results reported during September are also included. The data sources, determinands, and recording periods are summarised in **Table 1**.

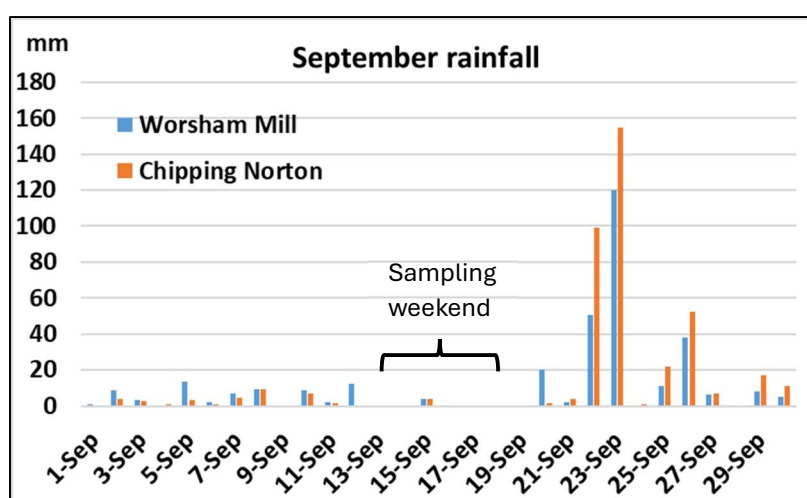
## 2. Data sources and monitoring period

**Table 1: Data types, sources, and monitoring periods**

Data type	Data source	Start	End
Rainfall	Environment Agency	01/09/2024	30/09/2024
Combined Sewage Overflows	Thames Water	01/09/2024	30/09/2024
Nutrients	ECP FWW (citizen science)	13/09/2024	16/09/2024
Nutrients	Environment Agency	1/09/2024	30/09/2024
Various	ECP Proteus sondes	02/09/2024	05/10/2024
Riverfly	ECP citizen science	September 2024	

## 3. Rainfall data

Rainfall for September recorded at Worsham Mill and Chipping Norton is shown in **Figure 1**.



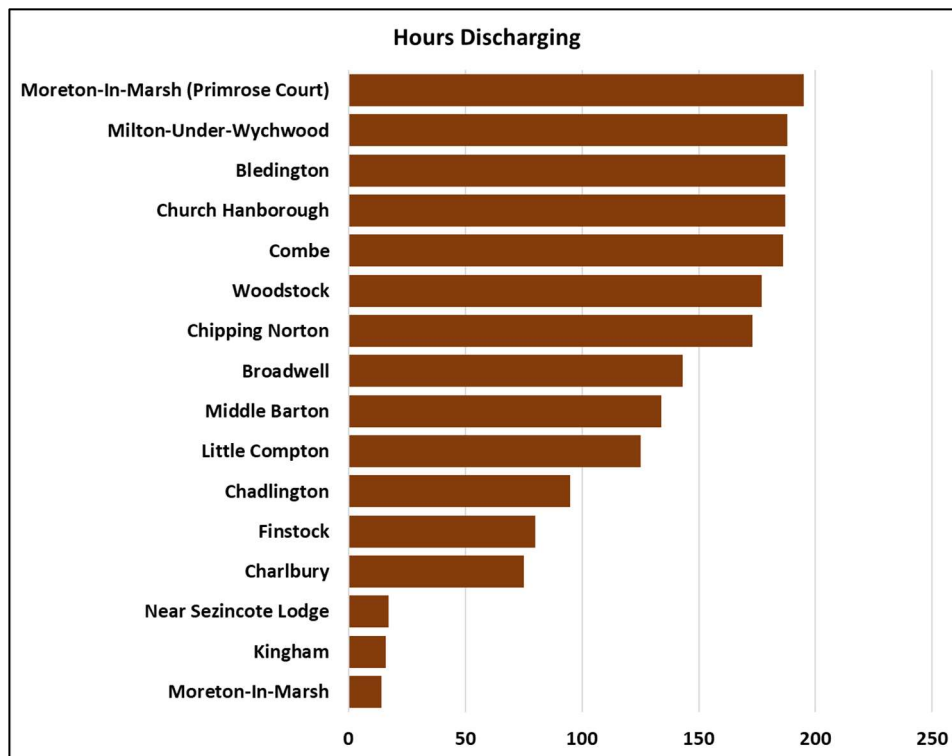
**Figure 1: Rainfall at Worsham Mill and Chipping Norton 01/08/2024 –31/08/2024**

334 mm and 406 mm of rainfall was recorded at Worsham Mill and Chipping Norton respectively for September 2024. 41 mm and 23 mm of rain fell in the week preceding FWW sampling at Worsham Mill and Chipping Norton respectively, although the sampling weekend itself was

largely dry. 64% of citizen scientists reported low flows, 33% reported average flows, and one site was dry. Very heavy rain showers were however experienced after the sampling weekend on the 22<sup>nd</sup> and 23<sup>rd</sup>.September

#### 4. Combined sewage overflow data

The hours that CSOs were discharged from STWs into the River Evenlode and its tributaries are shown in **Figure 2**.



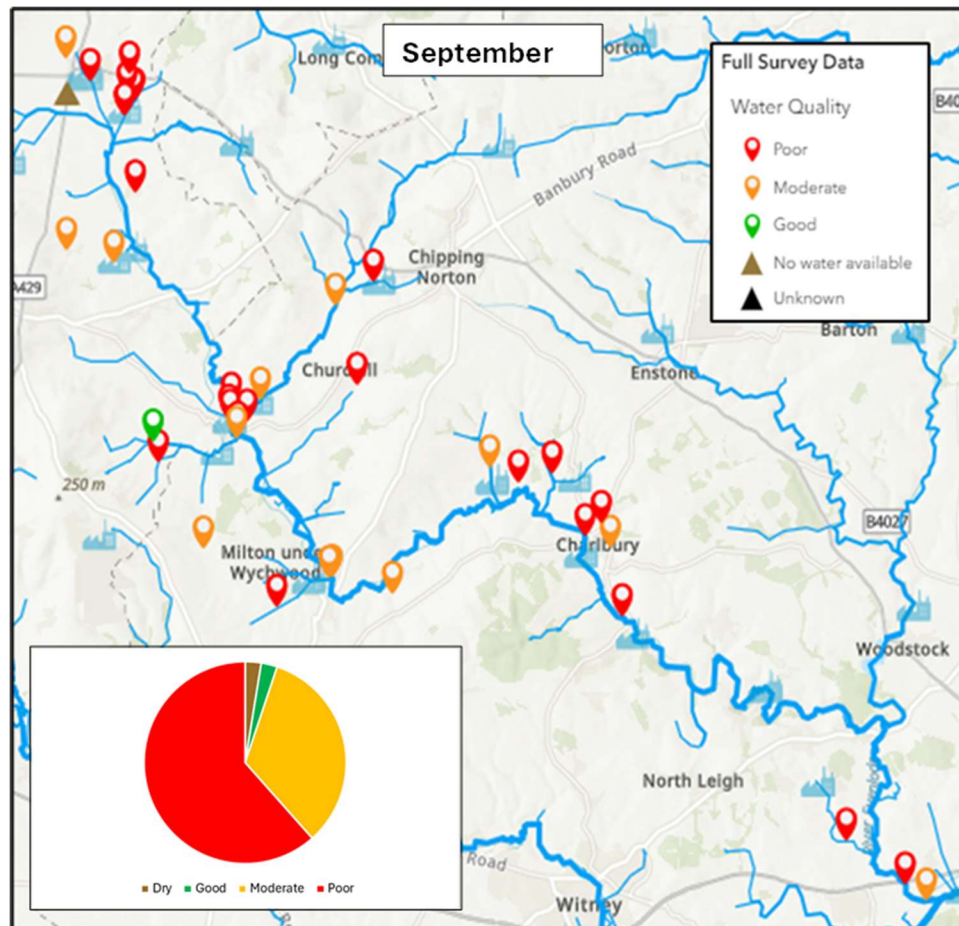
**Figure 2: Combined sewage overflows 01/07/2024 – 29/07/2024**

The relatively high number of storm discharge overflows occurred due to heavy rainfall after the sampling weekend and were not monitored by the samples collected by citizen scientists. EA data collected after 22<sup>nd</sup> September would however reflect these discharges.

#### 5. FWW and EA monitoring

39 FWW surveys were taken by 51 participants in September. The EA monitored 18 sites in the Evenlode catchment between 1 - 28 September. Nitrate as N, and orthophosphate reactive as P analysed by the EA are comparable with the N and P concentrations measured by citizen scientists using the FWW test kits, and with P monitored by the four Proteus sondes installed in the Chipping Norton Brook and Littlestock Brook.

**Figure 3** shows the spatial distribution of FWW surveys that recorded poor, moderate, and good water quality throughout the catchment for September. Water quality is derived from a combination of nitrate, phosphate, and turbidity values, as well as other observations, including of algae and of sewage fungus.



**Figure 3: FWW full survey data (19 – 22 September)**

Only one site showed good water quality (green pin) with the majority of surveys returning red pins (poor water quality).

### Nutrient concentrations

**Figure 4** shows the distribution of FWW and EA nitrate concentrations throughout the catchment. The inlay pie chart indicates the percentage of FWW surveys that showed good, moderate and poor nitrate concentrations. With very few exceptions, nitrate concentrations were moderate to high (>1 mg/L) throughout the catchment. Notably lower concentrations were recorded by coincident FWW and EA (PEVR0052) samples downstream of the Fire College near the A44 outside Moreton-in-Marsh where nitrate concentrations were <0.2 mg/L and 0.51 mg/L respectively, showing good agreement between the two data sources at the lower end of the sampling range. A second FWW sample on the same stream recorded 0.5 – 1.0 mg/L. 6 FWW sites and two EA sites recorded N concentrations >10 mg/L. The EA nitrate data support the FWW data throughout the catchment.

The graph in **Figure 5** and the pie chart inlay in **Figure 4** show that although the percentage of samples with N > 2.0 mg/L fell from August levels, less than 10% of samples had acceptable nitrate levels.

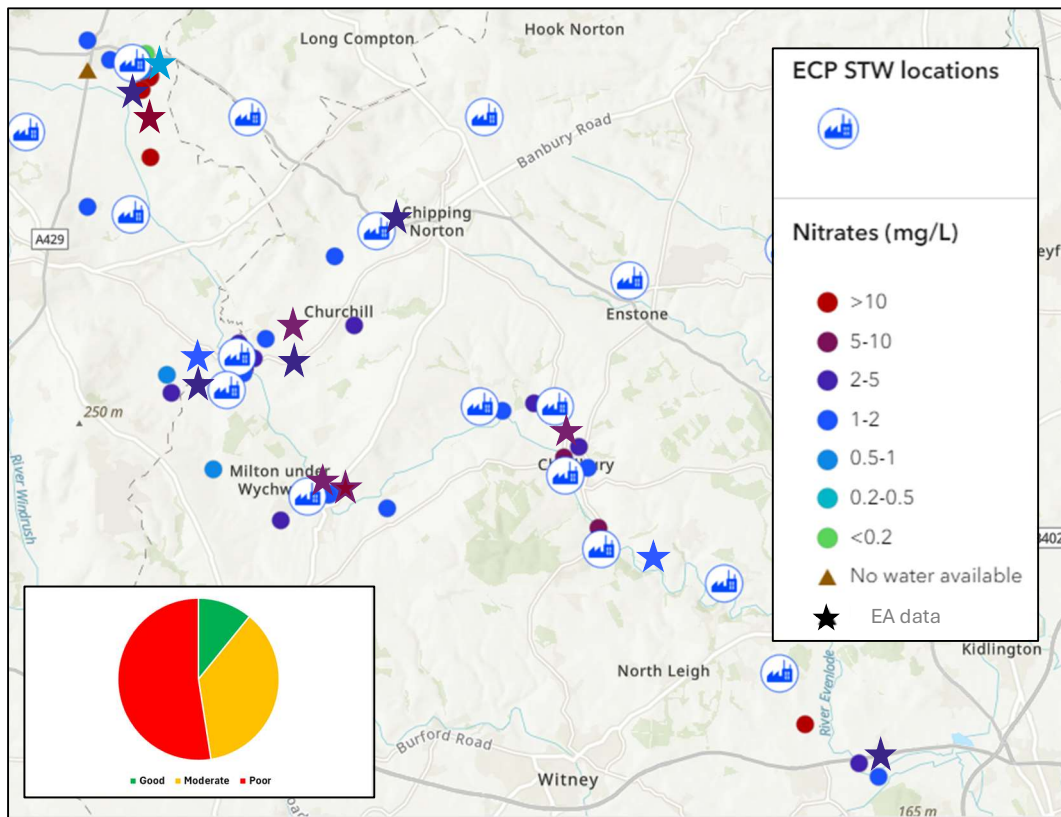


Figure 4: FWW (14 – 17 September) and EA (01 – 30 September) nitrate concentrations

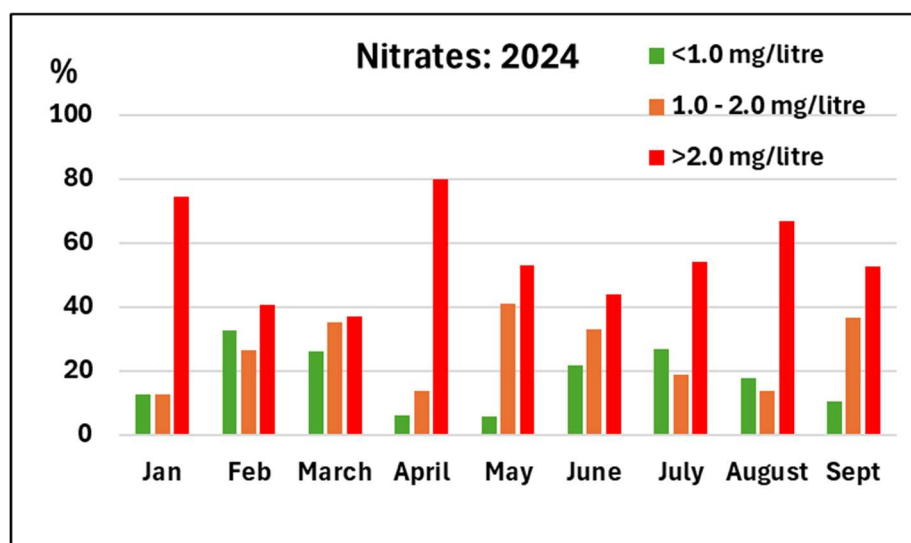


Figure 5: FWW nitrate concentrations January – September 2024

Figure 6 shows the distribution of FWW and EA phosphate concentrations. The inset pie chart indicates the percentage of FWW samples that showed low (58%), moderate (18%) and high (24%) P concentrations. The higher P concentrations were generally clustered downstream of STWs. There is good agreement between the FWW and EA P results, with most FWW and EA samples returning P concentrations <0.1 mg/L. However, the graph in Figure 7 shows that, like nitrates, phosphate concentrations increased in September.

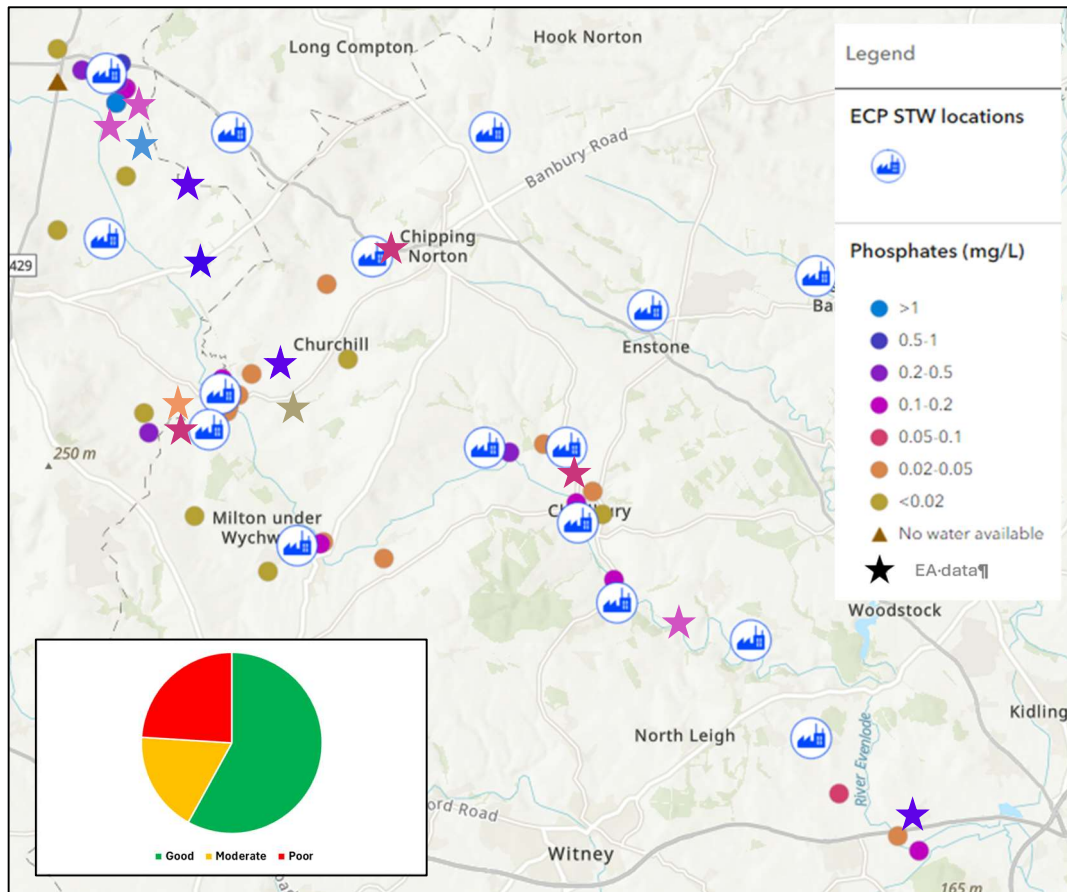


Figure 6: FWW (14 – 17 September) and EA (01 – 30 September) phosphate concentrations

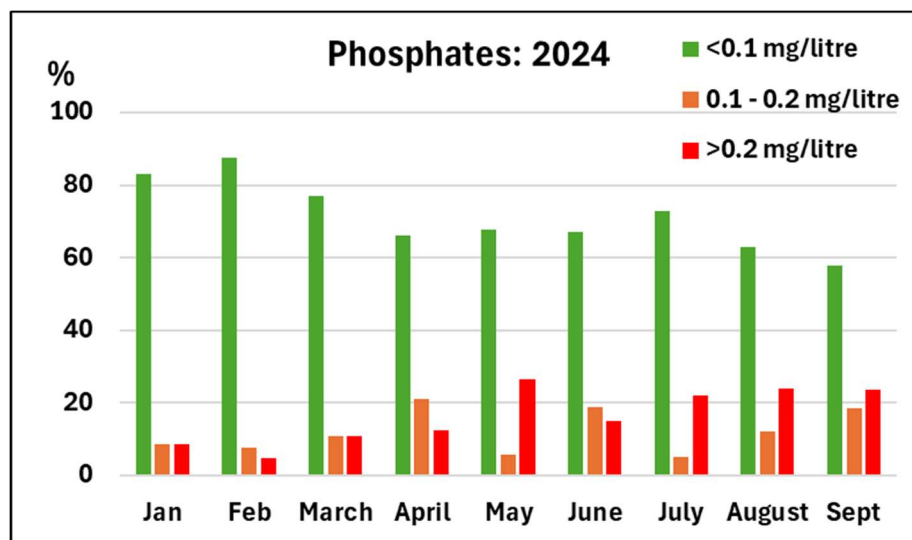
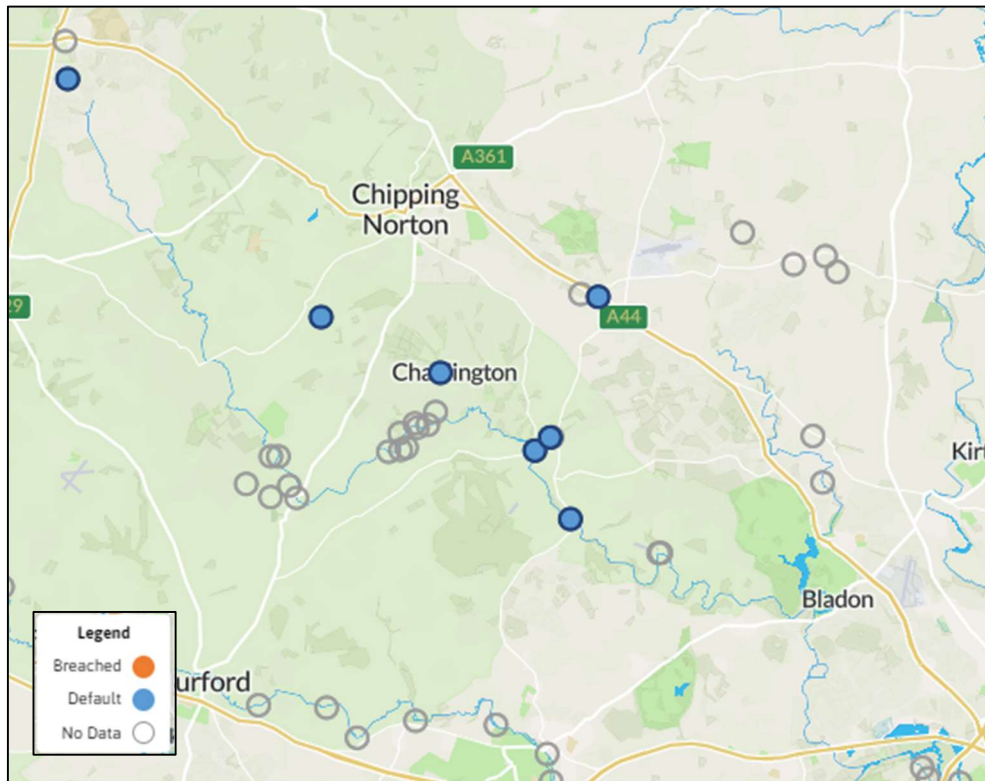


Figure 7: FWW phosphate concentrations January – September 2024

## 6. Riverfly data

Seven Riverfly sites were surveyed in September (seven on the Evenlode, and one on the Glyme). No trigger levels were breached (**Figure 8**).



**Figure 8: Riverfly surveys in the Evenlode catchment in September 2024**

## 7. The Chipping Norton Brook (Also known as the Blue Brook)

### Combined sewage outflows

No Storm Overflow Discharges were released from Chipping Norton STW prior to the September FWW sampling weekend, but the STW discharged for 173 hours during and after the rainfall event that began on September 22<sup>nd</sup>.

### FWW data

FWW data was collected for the Blue Brook between 13 - 16 September.:

- D/S of the Chipping Norton STW:
  - N = 2 – 5 mg/L, high/poor,
  - P = 0.02 – 0.05 mg/ L, low/good
- D/S of the Cornwell wetland
  - N = 1 – 2 mg/ L, moderate
  - P = 0.02 – 0.05 mg/L, low/good

As shown in **Figure 3**, in combination these nutrient concentrations indicated poor and moderate water quality, respectively.

### EA data

The EA sampled the Blue Brook above Chipping Norton STW:

- N = 2-5 mg/L (high/poor)
- P = 0.1-0.2 mg/L (moderate)

In combination these nutrient concentrations indicated poor water quality upstream of the Chipping Norton STW.

### **Sonde data**

One Proteus sonde is installed on the Blue Brook, downstream of the Chipping Norton STW. The sonde formerly located downstream of the wetland was moved to the Four Shires Brook downstream of Morton-in-Marsh STW in August.

P recorded by the Proteus sonde installed D/S of the STW for the period 12 – 17 September averaged 3.42 mg/L, i.e., >1 mg/L, high/poor, which was considerably greater than the concentrations recorded by either FWW or the EA. (Median P for the same period was 3.76 mg/L).

The sonde measures and derives several determinands including Biological Oxygen Demand (BOD), phosphorus, tryptophan, turbidity, chromophoric dissolved organic matter (CDOM), conductivity, and dissolved oxygen (DO).

**BOD** indicates the impact that decaying matter would have on dissolved oxygen levels in the water course. High BOD may indicate eutrophication, due to excess nutrients.

**Phosphorus** is comparable with the EA and FWW data, with a strong correlation to sewage discharges at the sonde locations.

**Tryptophan** is an amino acid, indicative of organic contamination and microbial activity. Sewage discharge is the dominant source at these locations.

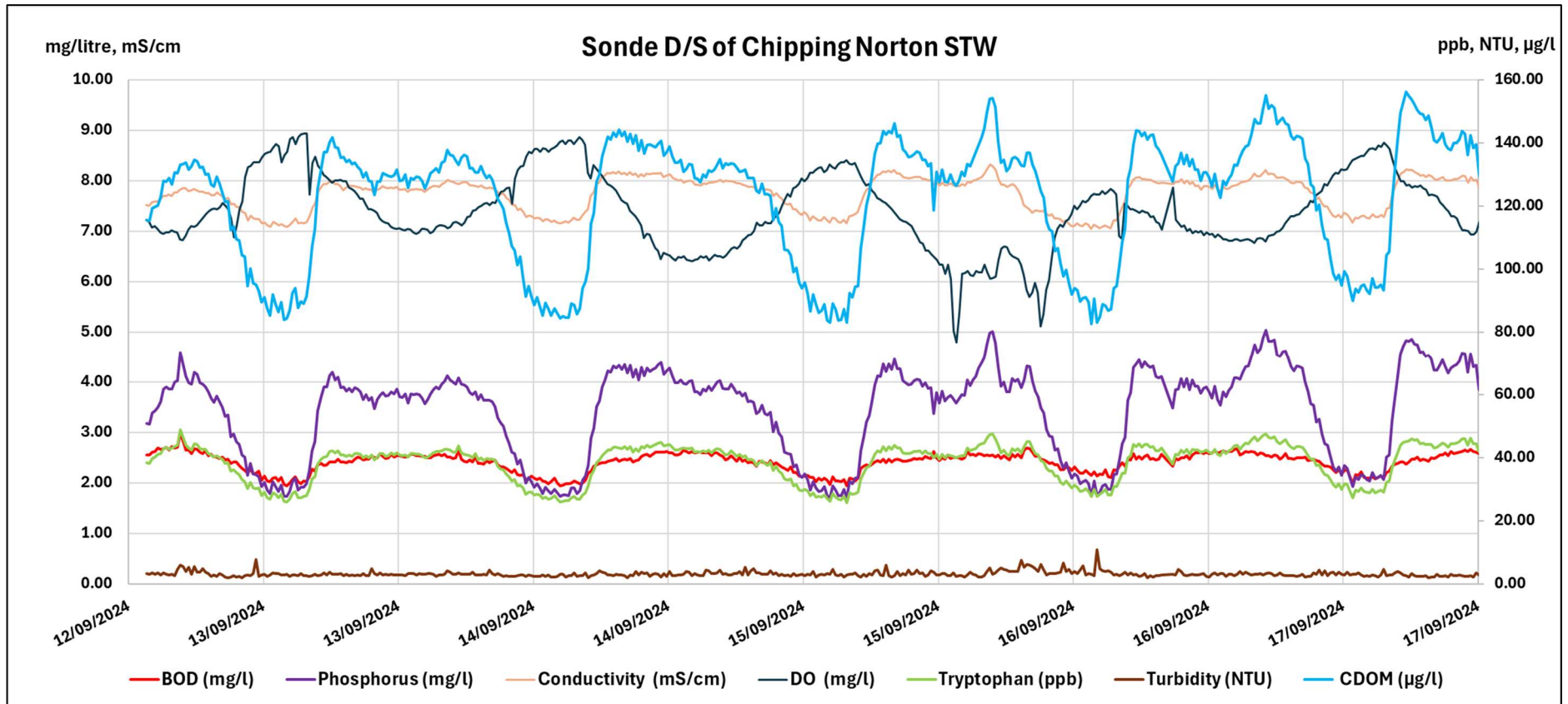
**Turbidity** indicates the total suspended solids present, which may be linked to rainfall and river flow, or to the introduction of solid matter, or to algae.

**CDOM** is the light-absorbing part of organic matter. It does not specifically measure sewage, but at the sonde locations, there is a strong correlation between CDOM and the sewage discharges.

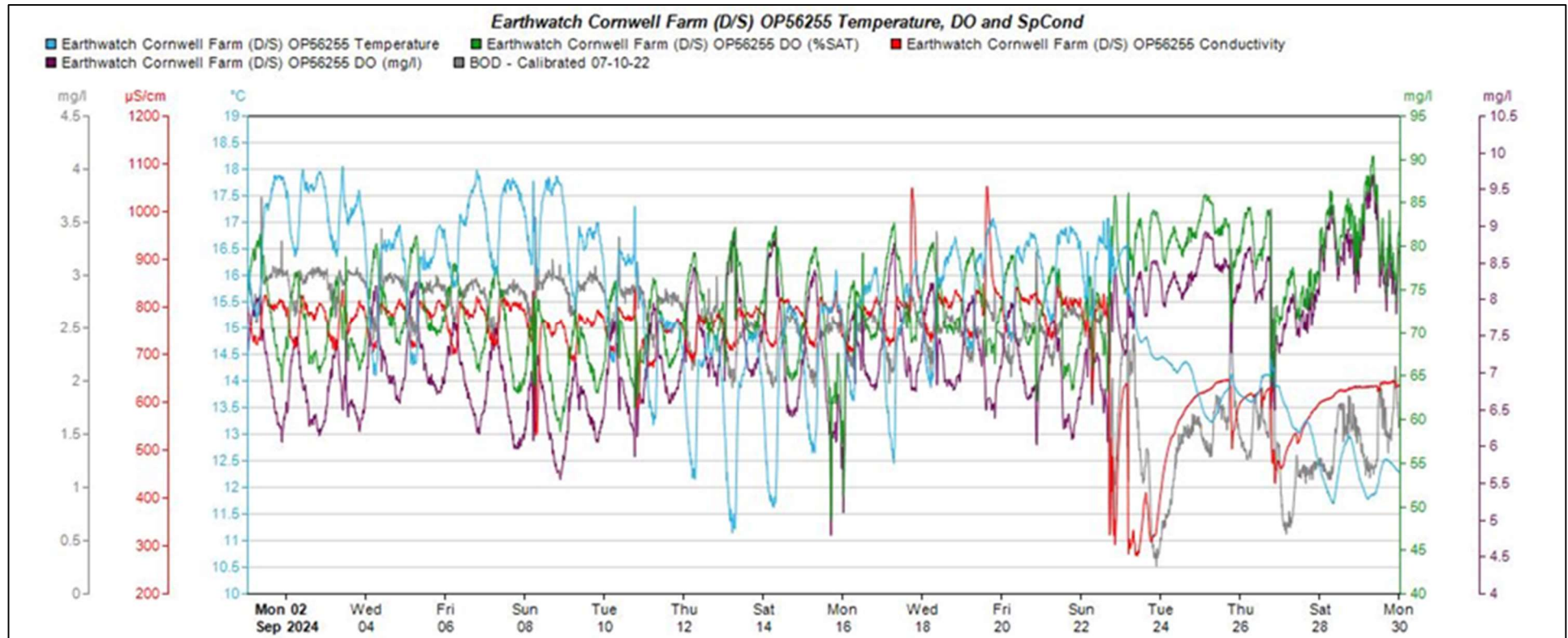
**Conductivity** indicates the amount of dissolved solids and inorganic content present. These are present naturally in freshwater bodies, due to the subsurface movement of water through rocks and soils. However, high levels of dissolved solids are indicative of pollution sources such as discharge from STWs.

**Dissolved Oxygen (DO)** is present in freshwater from atmospheric absorption and as a byproduct of photosynthesis. Low DO is (i.e. < 4 mg/L) can be lethal to fish, and is negatively impacted elevated water temperature and decaying organic matter which may be elevated downstream of STWs.

The graph in **Figure 9** shows the daily rhythm of the sewage discharge reflected in the twice daily peaks for phosphorus, conductivity, DO, tryptophan, and CDOM, and to a lesser extent BOD, whilst turbidity remained relatively steady. The graph in **Figure 10** is for the same site, but shows temperature, DO (%SAT), conductivity, DO (mg/L), and BOD for the full month, demonstrating the diluting effect of heavy rainfall and increased flow on water quality, despite the discharge of raw sewage from the STW at this time.



**Figure 9: BOD, phosphorus, conductivity, DO, tryptophan, turbidity and CDOM for the Chipping Norton Brook downstream of Chipping Norton STW 12 - 17 September 2024**



**Figure 10: Temperature, DO (%SAT), conductivity, DO (mg/L), and BOD for the Chipping Norton Brook downstream of Chipping Norton STW 01 - 30 September 2024**

Temperatures dropped around the 10<sup>th</sup> of September, leading to a corresponding increase in dissolved oxygen. The rain started on the 22<sup>nd</sup> September, leading to a change in the data signatures. The additional dilution reduced all the sanitary determinands and increased DO from that point on.

## 8. Littlestock Brook

### Combined sewage overflows

Milton-under-Wychwood STW released raw sewage into the Littlestock Brook for 188 hours in late September, i.e., after the FWW and EA sampling took place.

### FWW and EA data

**Table 2** summarises the N and P concentrations and classifications, and the resulting water quality classes for samples taken from watercourses up-and downstream of the Milton-under-Wychwood STW. The EA samples were taken on 11 September.

**Table 2: FWW and EA N and P sampling results around Milton-under-Wychwood STW**

Data source	Location	N (mg/L)	Class	P (mg/L)	Class	Water quality
FWW	The Liffs U/S of STW,	2-5	High/poor	<0.02	Low/good	Poor
FWW	Littlestock Brook D/S of STW	1-2	moderate	0.1-0.2	moderate	Moderate
FWW	Evenlode U/S of confluence	1-2	moderate	0.02-0.05	Low/good	Moderate
EA	Littlestock Brook D/S of STW	> 10	High/poor	> 1	High/poor	Poor
EA	Evenlode D/S of confluence	5-10	High/poor	0.5-0.1	High/poor	Poor

Moderate to high N concentrations were found at all the sites summarised in **Table 2**, whilst low to moderate P concentrations increased downstream of the STW. The EA concentrations for N and P were considerably greater than those recorded by FWW.

### Sonde data

Two Proteus sondes are installed on the Littlestock Brook. BOD, CDOM, phosphorus, tryptophan, turbidity, conductivity and DO data from the sondes up- and downstream of the Milton under Wychwood STW are shown in **Figure 11** and **Figure 12** respectively. The axes values and line colours are the same for both graphs.

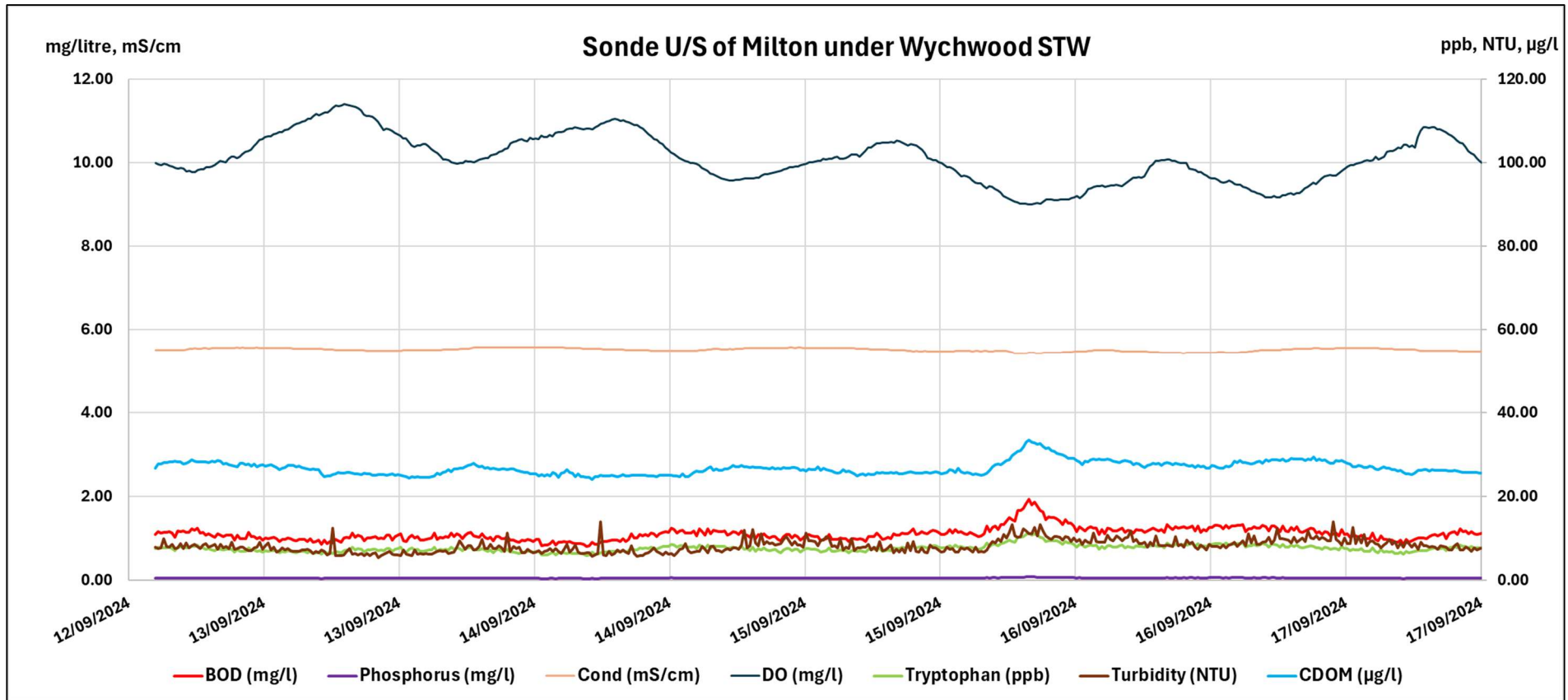


Figure 11: BOD, phosphorus, conductivity, DO, tryptophan, turbidity and CDOM for the Littlestock Brook at Heath Farm, upstream of Milton-under-Wychwood STW 12 - 17 September

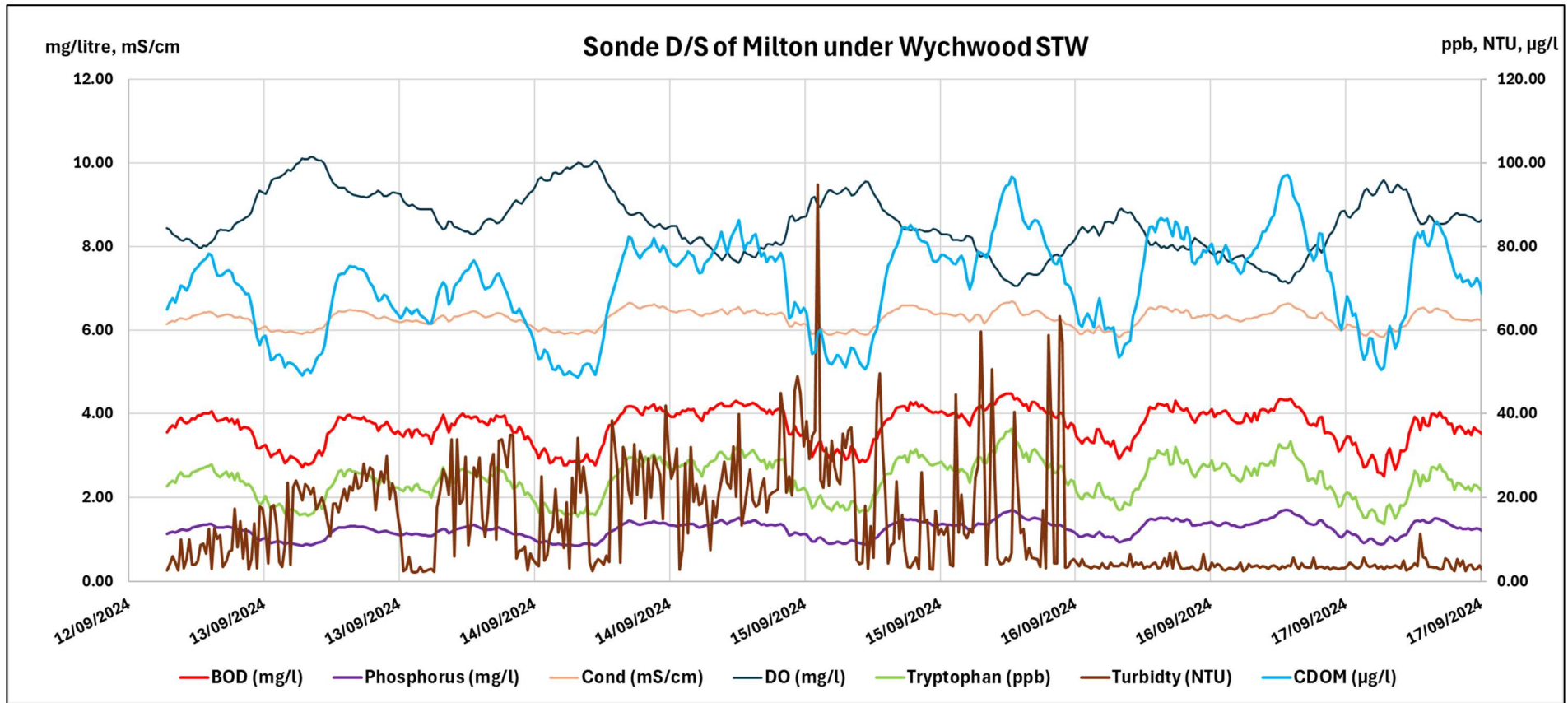


Figure 12: BOD, phosphorus, conductivity, DO, tryptophan, turbidity and CDOM for the Littlestock Brook at Littlestock House, 12 - 17 September

Upstream of the STW (**Figure 11**), all determinands were relatively constant. DO rose and fell slightly diurnally. By contrast, downstream of the STW CDOM and to a lesser extent BOD, phosphorus, tryptophan, and conductivity responded clearly to the twice daily peaks in sewage effluent due to daily domestic cycles (**Figure 12**). Turbidity was higher overall and initially far “noisier”, perhaps due to local disturbances (bioturbation) on the riverbed. **Table 3** summarises the average values from the two sondes.

**Table 3: Average values for the Littlestock Brook up- and downstream of the Milton under Wychwood STW for 18 - 23 September**

Site	BOD (mg/l)	P (mg/l)	CDOM (µg/l)	Tryptophan (ppb)	Turbidity (NTU)	Conductivity (mS/cm)	DO (mg/l)
U/S STW	1.11	0.06	26.82	7.69	8.22	5.52	10.10
D/S STW	3.69	1.25	70.96	24.31	13.38	6.28	8.58

**Table 3** shows marked increases in the average values of all determinands downstream of the STW except for DO. These differences are typical of the impact of STW outflows on receiving waterbodies. There is good agreement between the EA (1.3 mg/L) and sonde average P (1.25 mg/L) concentrations, indicating very poor water quality downstream of the STW.

## 9. The Four Shires Brook

The sonde previously located downstream of the Cornwell wetland on the Blue Brook was relocated to the Four Shires Brook downstream of the outlet of the Moreton-in-Marsh STW in mid-August.

### Combined sewage overflows

Moreton-in-Marsh STW discharged for only 14 hours, after the rainfall event of 22 – 23 September.

### FWW and EA data

**Table 4** summarises the N and P concentrations and classifications, and the resulting water quality classes for samples taken from watercourses up-and downstream of the Moreton-in-Marsh STW. The EA samples were taken on 02 and 23 September, more than a week either side of the FWW sampling weekend.

**Table 4: FWW and EA N and P sampling results around Milton-under-Wychwood STW**

Data source	Location	N (mg/L)	Class	P (mg/L)	Class	Water quality
FWW	Fire College stream, U/S	0.5-1.0	Low/good	0.2-0.5	High/poor	Poor
EA (23/09)	Fire College stream, U/S	0.5-1.0	Low/good	0.5-1	High/poor	Poor
FWW	4 Shires Brook1, U/S	> 10	High/poor	0.1-0.2	moderate	Poor
FWW	4 Shires Brook2, U/S	> 10	High/poor	0.1-0.2	moderate	Poor
FWW	4 Shires Brook1, D/S	> 10	High/poor	0.2-0.5	High/poor	Poor
FWW	4 Shires Brook2, D/S	> 10	High/poor	> 1	High/poor	Poor
EA (02/09)	4 Shires Brook, D/S	> 10	High/poor	> 1	High/poor	Poor

## Sonde data

There were problems with data recording. This was due to the sonde initially being installed to accommodate the observed day-time flows in the Four Shires Brook, which were thought to represent the typical baseline water level. It became apparent, however, that flow reduced drastically overnight, leading to the sonde drying out (evident from the zero values seen in **Figure 13**). In other words, the bulk of the daytime flow in the Four Shires Brook comprises sewage from the Moreton-in-Marsh STW, whilst the receiving watercourse has little dilution capacity to assimilate this constant impact. There did not appear to be any increase in effluent resulting from the Moreton-in-Marsh show on 7 – 8 September.

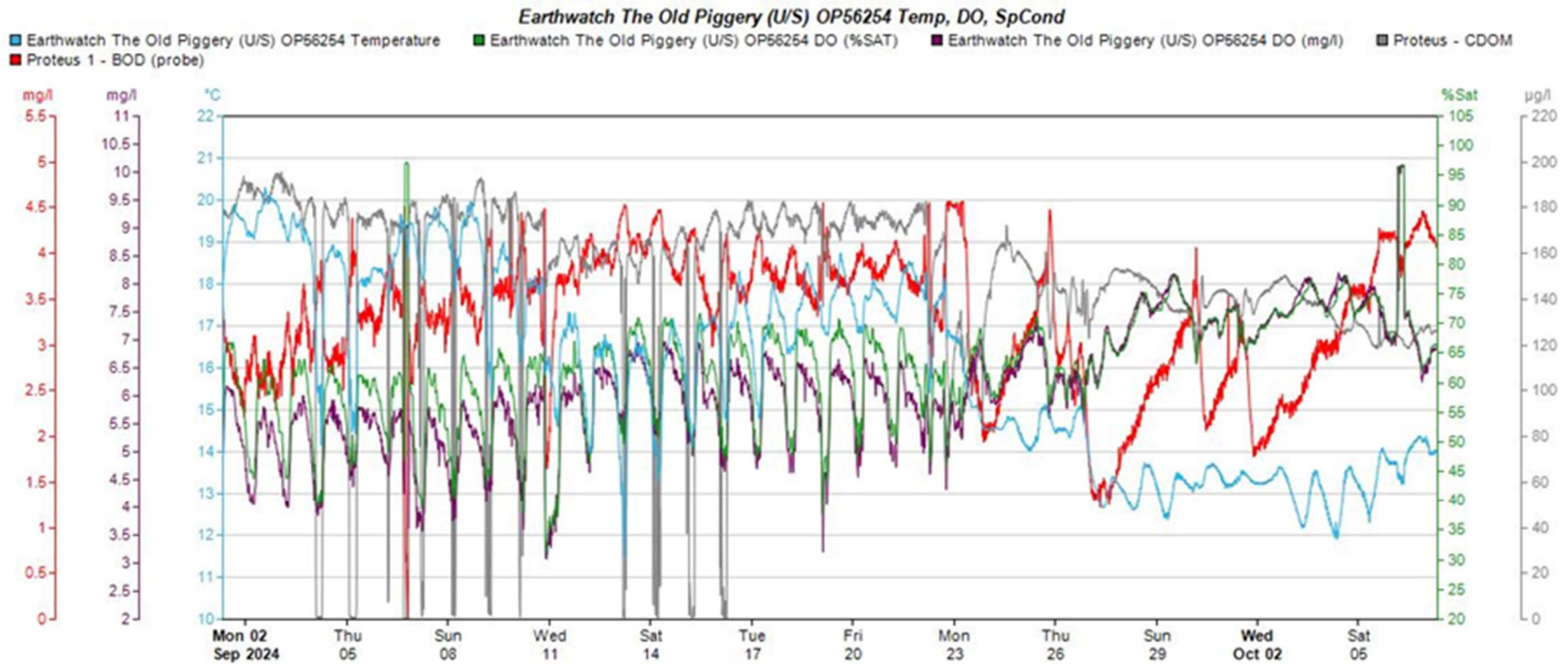


Figure 13: Temperature, DO, conductivity, and BOD for the Four Shires Brook downstream of Moreton-in-Marsh STW 02 September - 06 October 2024

The Four Shires Brook seemed to be heavily impacted by nitrates both up- and downstream of the STW outflow, in contrast to its tributary, the Fire College stream. Phosphate concentrations in the Four Shires Brook were moderate above but poor below the STW outflow. More research is needed, perhaps by deploying the YSI probe, to determine the extent of the downstream impact of the relatively high volumes of sewage on the Four Shires Brook.

## **10. Summary**

The EA and FWW data show that water quality was extremely poor in the Evenlode catchment in September with both nitrate and phosphate concentrations increasing in comparison to August, although the Riverfly surveying did not reveal any trigger level breaches. The sonde data highlighted the importance of flow levels in receiving water bodies, in terms of providing dilution to mitigate sewage outflows. Data from all sources indicates that the flow in the Blue, Littlestock and Four Shires Brooks is insufficient to mitigate the outflows from the associated STWs.