

WESTCOUNTRY RIVERS TRUST CITIZEN SCIENCE



MONITORING OF THE PAR RIVER AND ITS TRIBUTARIES

The monitoring group operates under the citizen science scheme run by the Westcountry Rivers Trust. The Friends of Luxulyan Valley, The Friends of Par Beach, and the G7 Legacy Project for Nature Recovery have helped. Comments and opinions in this report are not necessarily shared by these organisations.

NOVEMBER 2022

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A. KEY POINTS FROM WRT CSI MONITORING IN NOVEMBER 2022

1. River levels were very high following heavy rain.
2. Lisa Goodall and Peter Scobie of the Environment Agency conducted tests at 4 of our monitoring sites. EA testing is to a far higher standard than can be conducted by volunteers and covers a far wider range of tests. Not only has this given more authoritative data, it has also provided an essential test of the usefulness of the CSI monitoring. Full consideration of their findings will be in a future report although their bacteria sampling is featured in sections I and M.
3. It was not possible to carry out an otter survey.

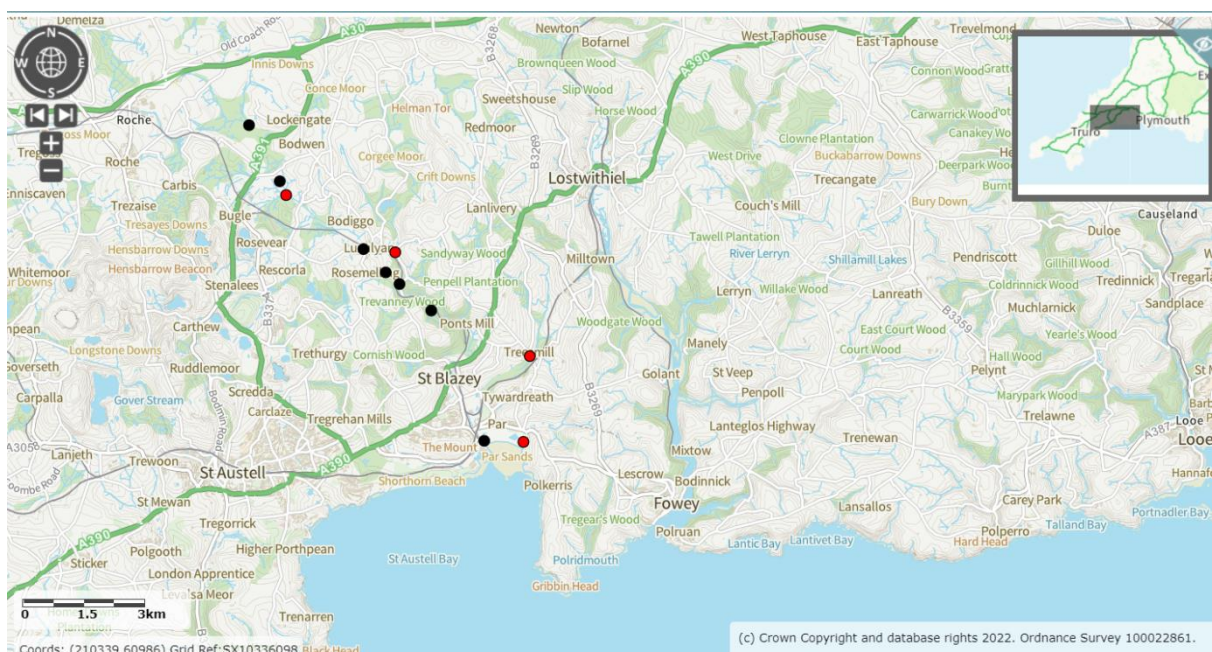
B. OUR GROUP

Monitoring is part of the Citizen Science programme run by the West Country Rivers Trust (WCRT) and is carried out monthly by volunteers, including Dave Burrell; Joan Farmer; Veronica Jones; Sue Perry; Roger Smith; Simon Tagney; Maggie Tagney; and Brian Harrison. They have received training from Lydia Ashworth, Junior Evidence and Engagement Officer of the West Country Rivers Trust (<https://wrt.org.uk/project/become-a-citizen-scientist/>). Results are logged on the Cartographer website. The support and advice given by Ross Tonkin, Chloe Lake, David Edwards, Claire and Gary Phillips, Jenny Heskett, Nick Taylor, Jeremy Roberts, Mat Bateman, Colin Pringle, Matt Healey, Simon Browning and Lydia Deacon is greatly appreciated. The interest and encouragement offered by Environment Agency officers, especially Lisa Best, Lisa Goodall and Peter Scobie, have been invaluable.

C. NOVEMBER 2022 MONITORING POINTS

This month monitoring occurred at 11 locations. Monitoring points along the main Par River are shown in black. Those in red are on tributaries.

Source: <https://magic.defra.gov.uk/MagicMap.aspx>



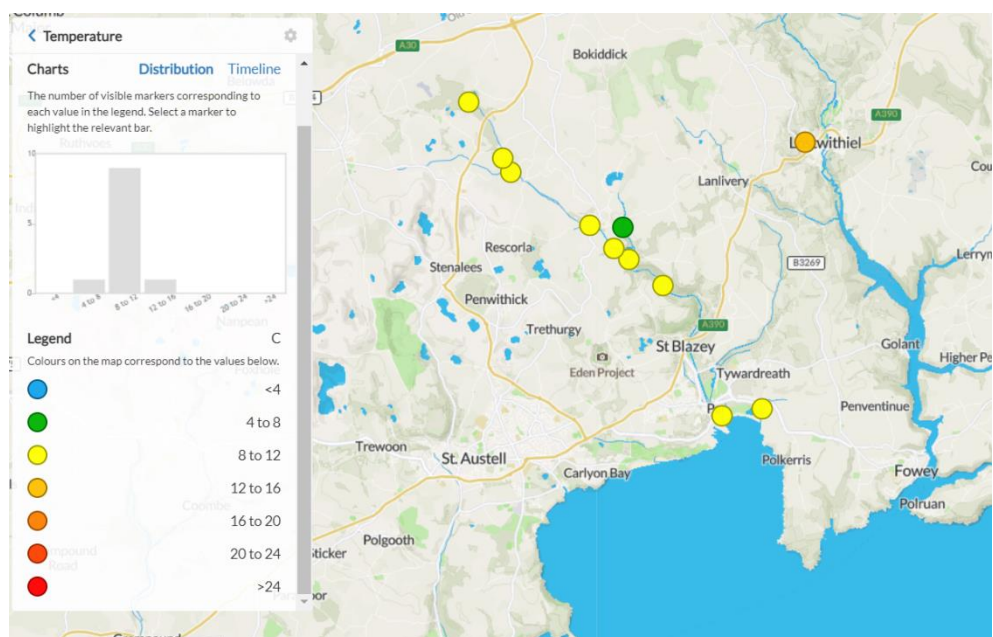
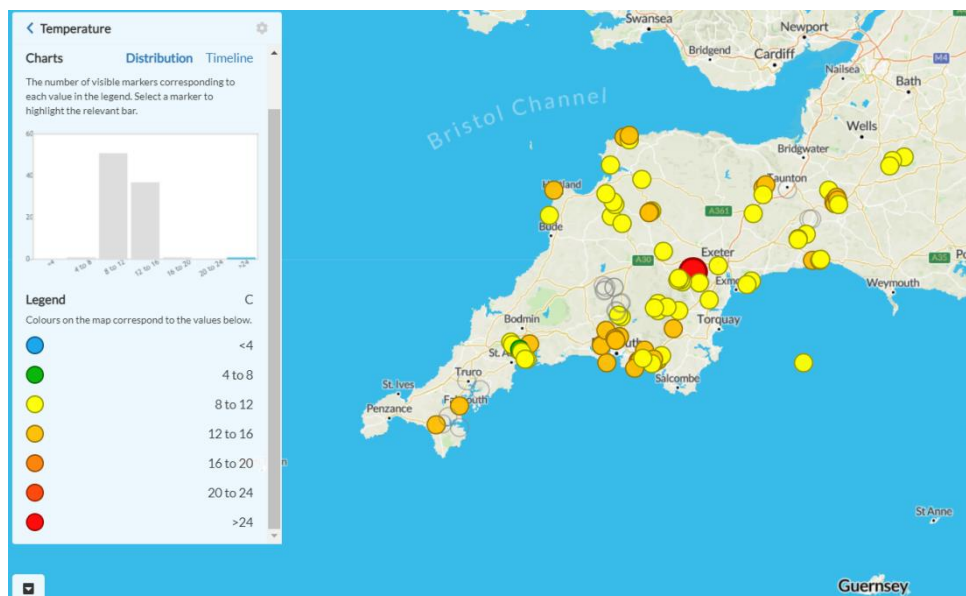
LOCATION	DATE	TYPE OF CHECK	MONITORED BY
Criggan Moors, Par River, SX 01882 61133	18/11/2022	CSI sample & Cartographer record. Water sample for bacteria testing.	Roger Smith
South of Minorca Lane, Par River, SX 02657 59788 (same site but recorded more precisely as SX02668 59747)	16/11/2022	CSI sampling. Cartographer record. Water sample for bacteria testing.	Joan Farmer, Lisa Goodall, Peter Scobie
Carbis Stream SX 02834 59401	16/11/2022	Water sample for bacteria testing.	Joan Farmer, Lisa Goodall, Peter Scobie
	18/11/2022	CSI sampling. Cartographer record.	Roger Smith
Luxulyan allotments, Par River, SX 04732 58045	16/11/2022	CSI sampling. Cartographer record. Water sample for bacteria testing.	Joan Farmer, Lisa Goodall, Peter Scobie
Cam Bridges, Par River, SX 05292 57454	18/11/2022	CSI sampling. Cartographer record.	Roger Smith.
Gatty's Bridge, Bokiddick Stream SX 05531 57953	19/11/2022	CSI sampling. Cartographer record.	Joan Farmer
Treffry Viaduct, Par River, SX 05650 57179	18/11/2022	CSI sampling. Cartographer record.	Roger Smith.
Lady Rashleigh Mine, Par River, SX 06451 56509	16/11/2022	CSI sampling. Cartographer record. Water sample for bacteria testing.	Joan Farmer, Lisa Goodall, Peter Scobie
Treemill, Tywardreath Stream, SX 08873 55385	23/11/2022	CSI sampling. Cartographer record.	Maggie Tagney
Par Beach slipway, SX 0776 53261	21/11/2022	CSI sampling. Cartographer record.	Brian Harrisson
Polmear Stream, Ship Inn SX 08749 53417	21/11/2022	CSI sampling. Cartographer record.	Simon Tagney

D. TEMPERATURE

1. This is the WRT's explanation of why this is monitored:

Temperature is a vital parameter within the river ecosystem. It controls many of the aquatic species life cycles. Temperature fluctuates with the seasons; however, you do get variation within that, particularly in small rivers and streams. Another important reason to measure temperature is to track the impact of our warming climate on our waterbodies.

2. **Geographical comparison.** Source: Cartographer.



3. Results November 2022

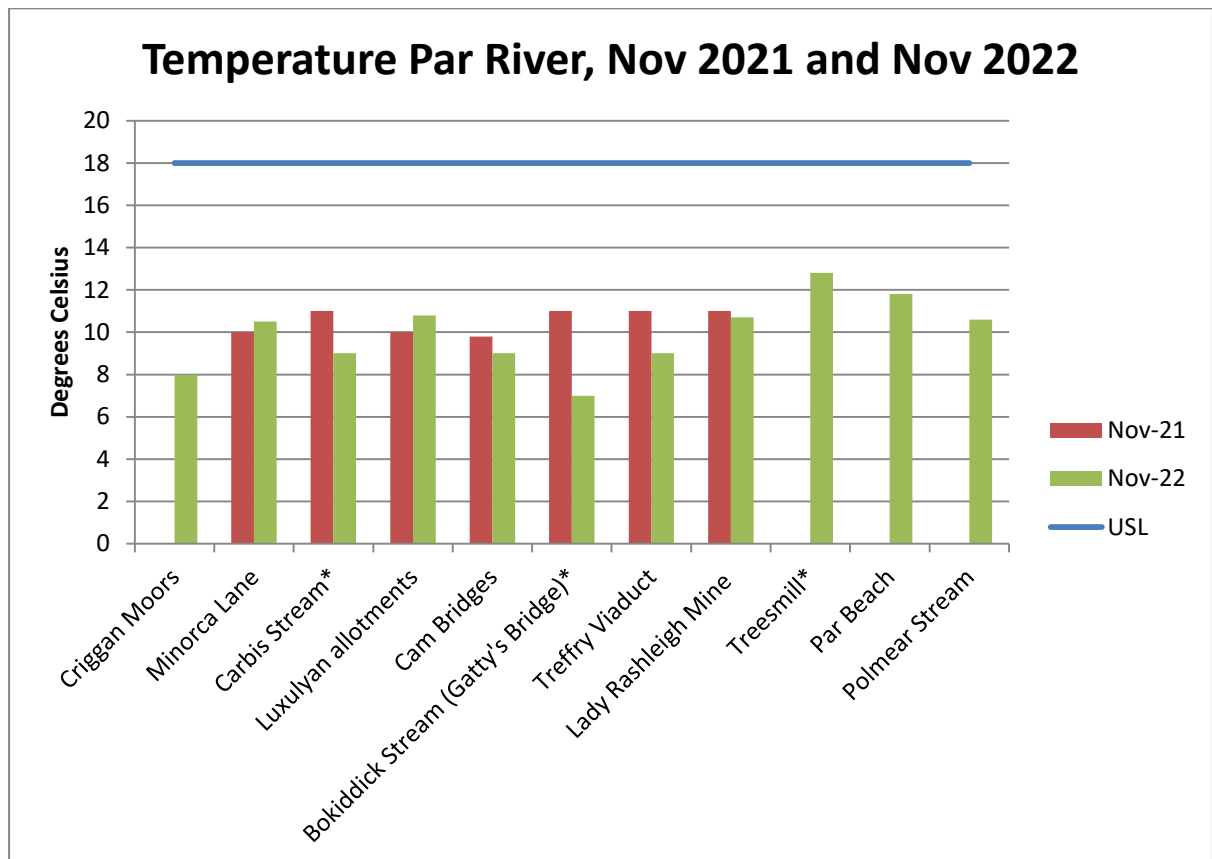
PAR RIVER/TRIBUTARY	LOCATION	Temperature °Celsius
Par	Criggan Moors, SX 01882 61133	8
Par	South of Minorca Lane, Par River, SX 02657 59788	10.5 (EA 10.15°)
Tributary	Carbis Stream SX 02834 59401	9
Par	Luxulyan allotments, Par River, SX 04732 58045	10.8 (EA 11°)
Par	Cam Bridges, Par River, SX 05292 57454	9
Tributary	Gatty's Bridge, Bokiddick Stream SX 05531 57953	7
Par	Treffry Viaduct, Par River, SX 05650 57179	9
Par	Lady Rashleigh Mine, Par River, SX 06451 56509	10.7 (EA 11°)
Tributary	Treesmill, Tywardreath Stream, SX 08873 55385	12.8
Par	Par Beach slipway, SX 0776 53261	11.8
Tributary	Polmear Stream, Ship Inn, SX 08749 53417	10.6

There were no significant differences in the temperatures recorded by the EA and the WRT thermometers.

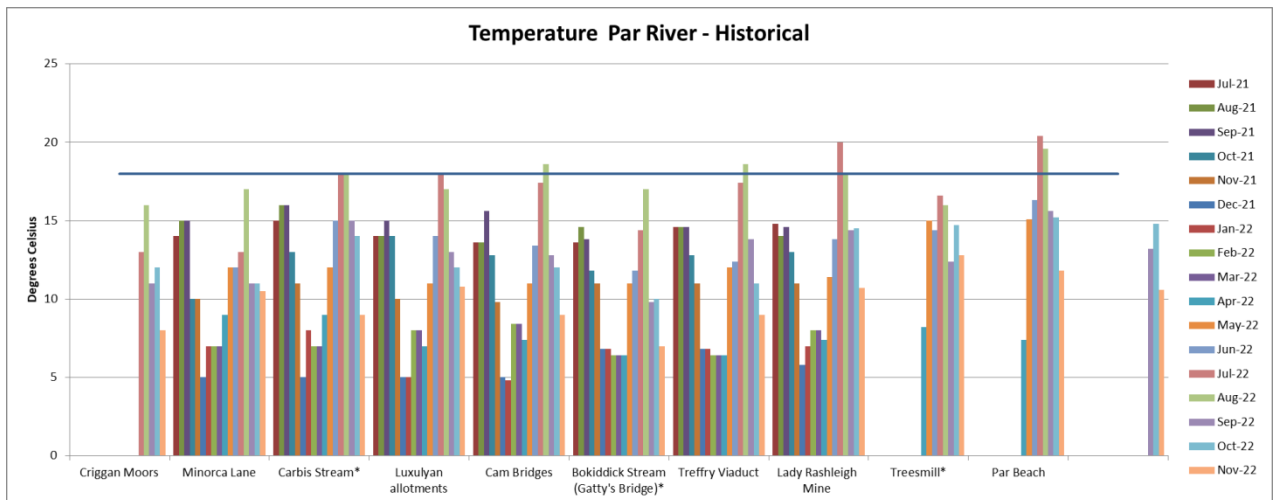
4. Graph November 2022 (and November 2021 for comparison)

*indicates a tributary of the Par River.

USL – Upper Safe Limit Our assumption is that 18° Celsius is the upper safe limit for fish. This simplification is a useful rule of thumb.



5. Historical data on temperature:

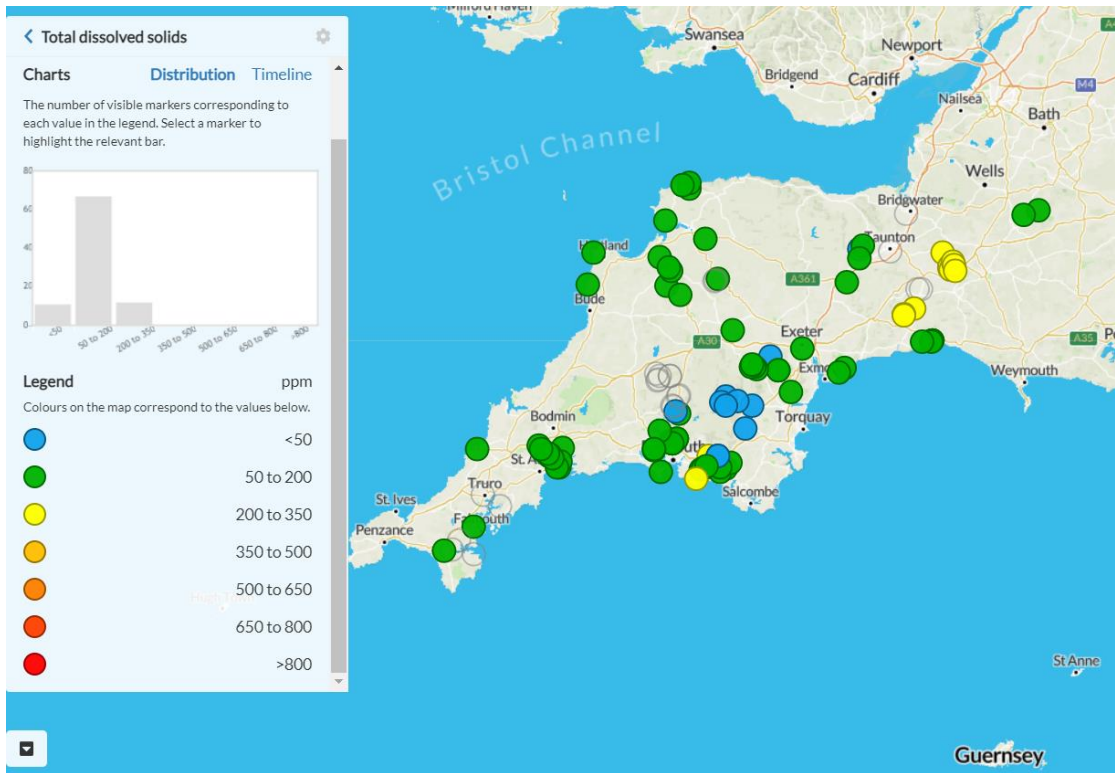
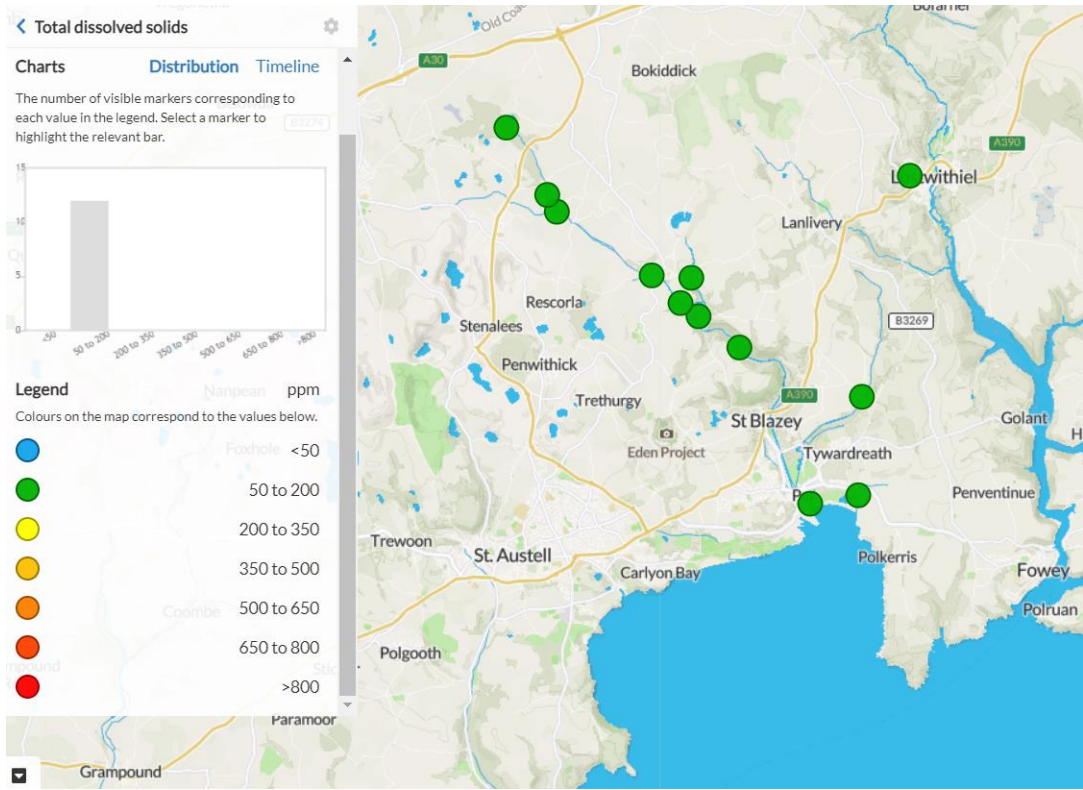


E. TOTAL DISSOLVED SOLIDS

1. We measure these in ppm (parts per million). This is the WRT's explanation:

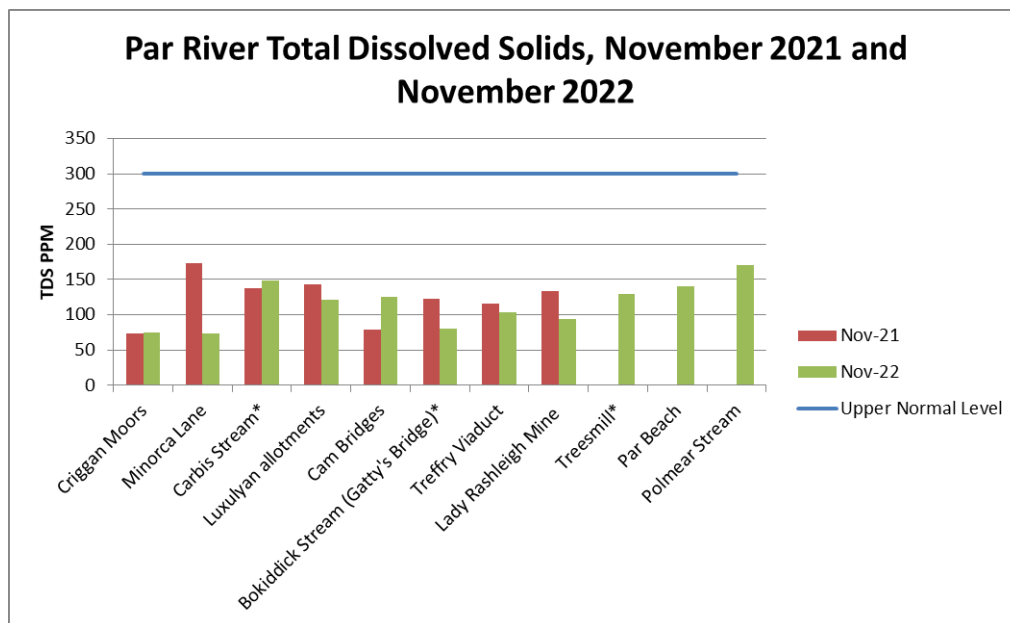
Total Dissolved Solids (TDS) is directly related to the conductivity of the water. The more minerals, salts and metals that are dissolved in the water the more conductive it gets. Low levels of dissolved solids in waters such as those on Dartmoor near to the source of the river are a result of very low levels of input from the surrounding landscape. As the river runs down to the sea it collects material from many different inputs, some natural and some man-made such as farms, sewage plants, factories and residential areas. This typically increases the amount of solids dissolved in the water leading to a higher reading. Harmful pollution from things like sewage, slurry and factory discharge will usually elevate your TDS reading. However, some pollutants such as oil can lower conductivity; therefore it should be used as a general indicator of water quality not a specific measure of toxicity. Geology will influence the normal level of conductivity in a watercourse (e.g. Areas dominated by granite generally give a lower conductivity than those with limestone). Regular monitoring will allow the detection of changes in conductivity which can indicate pollution.

2. Geographical comparison. Source: Cartographer.



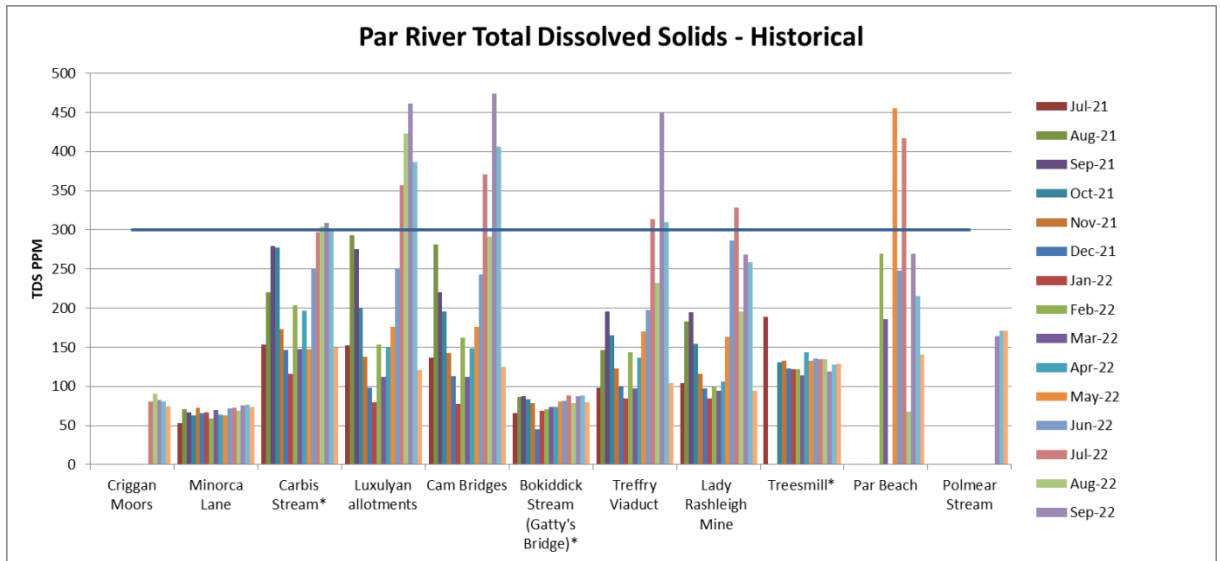
3. Results November 2022

PAR RIVER/TRIBUTARY	LOCATION	Total Dissolved Solids PPM
Par	Criggan Moors, SX 01882 61133	75
Par	South of Minorca Lane, Par River, SX 02657 59788	74
Tributary	Carbis Stream SX 02834 59401	149
Par	Luxulyan allotments, Par River, SX 04732 58045	121
Par	Cam Bridges, Par River, SX 05292 57454	125
Tributary	Gatty's Bridge, Bokiddick Stream SX 05531 57953	80
Par	Treffry Viaduct, Par River, SX 05650 57179	104
Par	Lady Rashleigh Mine, Par River, SX 06451 56509	94
Tributary	Treesmill, Tywardreath Stream, SX 08873 55385	129
Par	Par Beach slipway, SX 0776 53261	141
Tributary	Polmear Stream, Ship Inn, SX 08749 53417	171

**Upper Normal Level**

The WRT advice is: 'TDS levels vary between catchments due to natural geology etc. We generally say that after 6 months of sampling you should have an idea of what is 'normal' for your river. Looking at the scorecards for the Lower Par for 2020 and 2021 I would say that anything above 300 ppm is too high.'

4. Historical data on total dissolved solids:

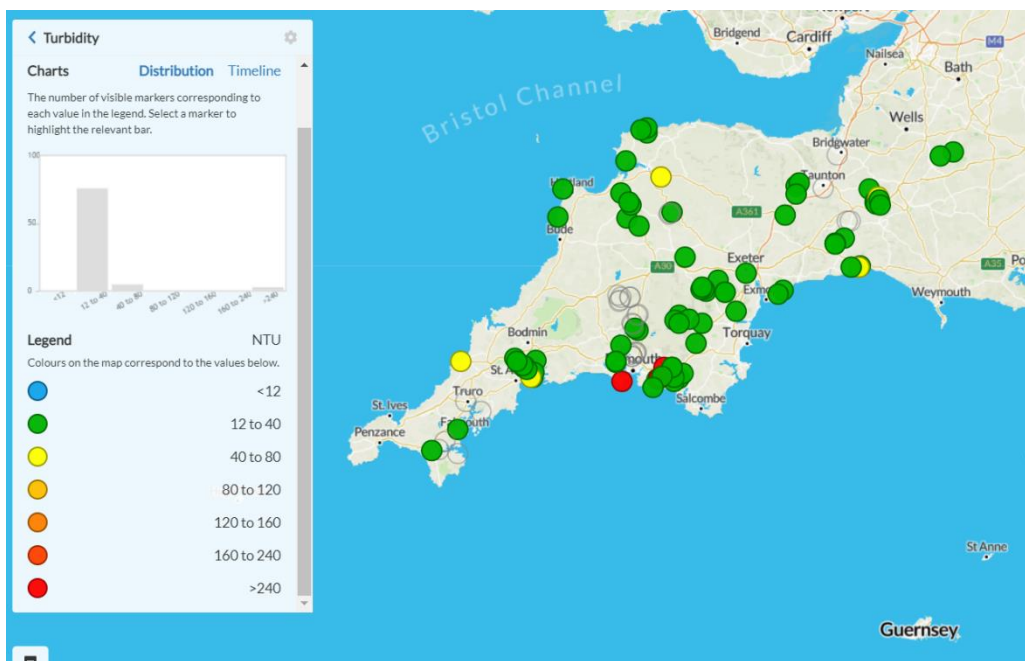


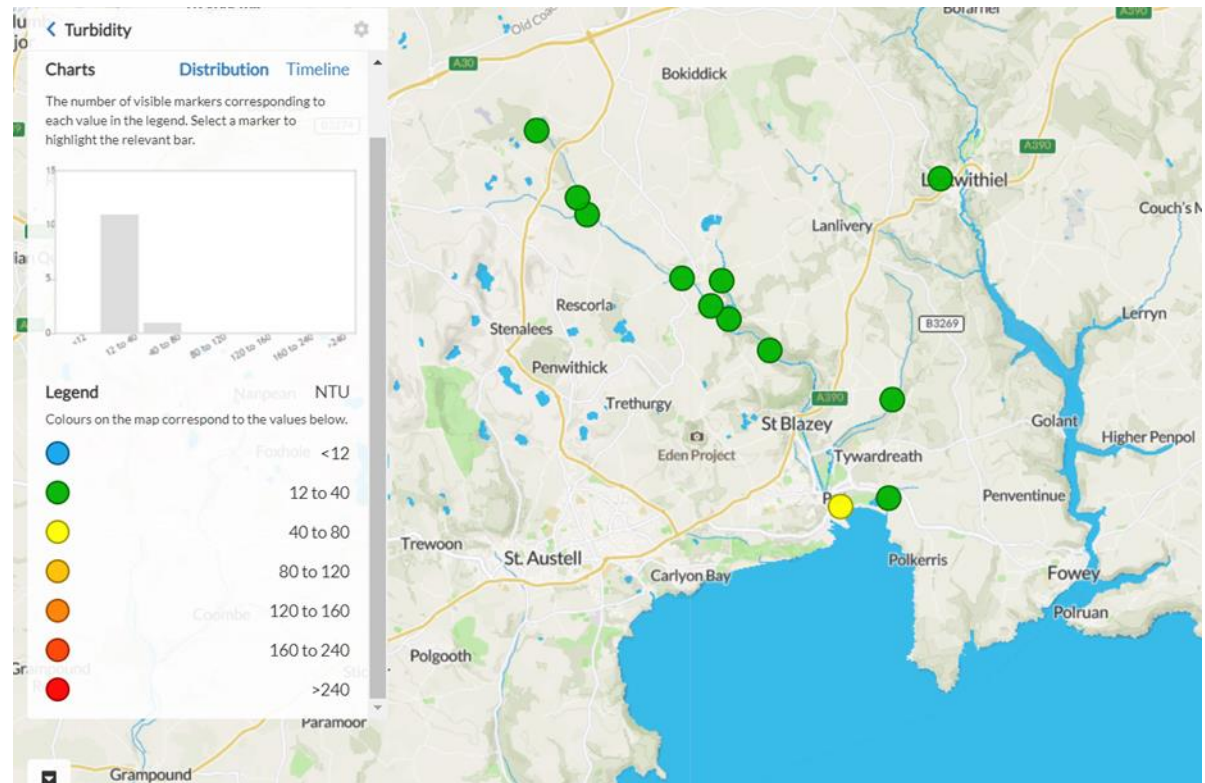
F. TURBIDITY

1. This is the WRT explanation of this measure:

Turbidity tube is a measure of the optical clarity of the water. The more suspended particles in the water the lower the clarity and the higher the turbidity. You will often find your waterbody gets more turbid after heavy rainfall due to soil running off the fields and sediment being mixed into the water column. This loss of topsoil is both a problem for farmer and river. It can often contain chemicals from the fertiliser and pesticides used on the land. An increase in sediment level on the substrate of the river can cause smothering of habitat by removing light and oxygen. Aquatic wildlife such as the less mobile invertebrates and fish eggs struggle to survive in low oxygen conditions and without light, plants are unable to grow. It is a good idea to sample your river after different weather conditions to understand how it responds to rainfall or drought.

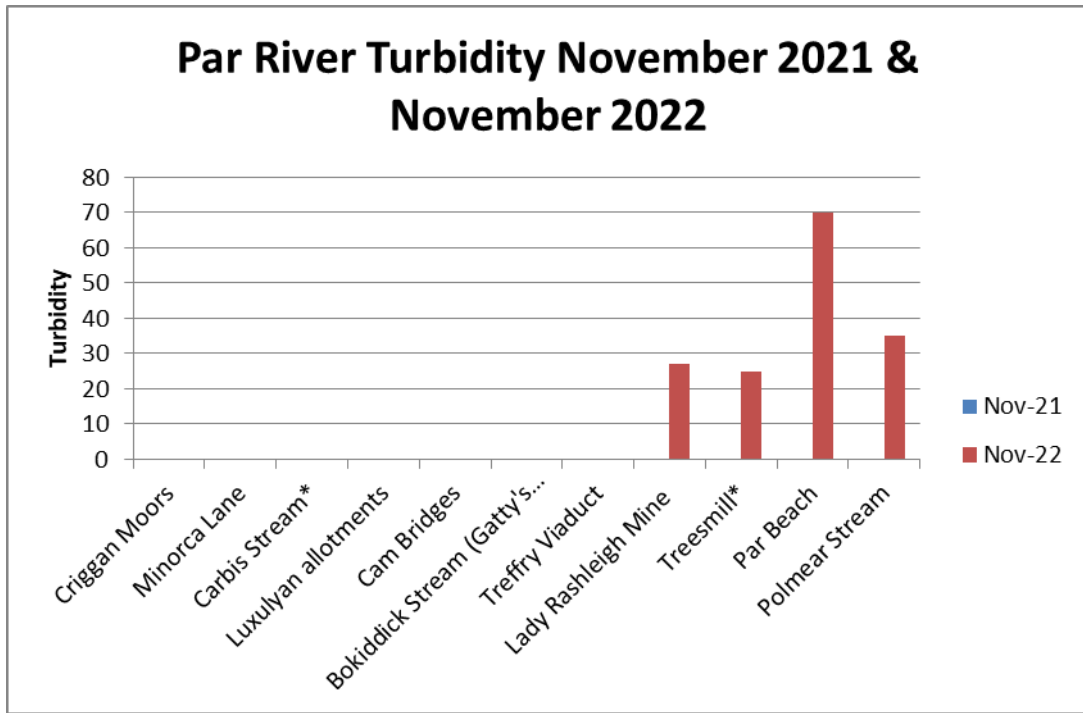
2. **Geographical comparison.** Where scores are shown as 0, it means that the reading using the Secchi tube was <12. Source: Cartographer.



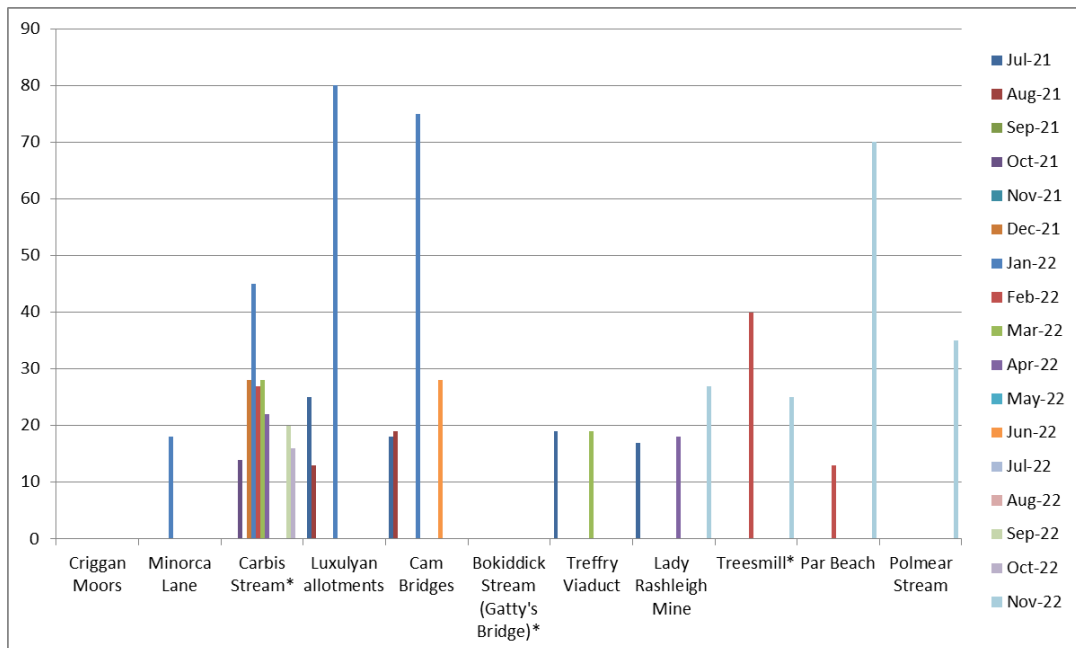


PAR RIVER/TRIBUTARY	LOCATION	Turbidity
Par	Criggan Moors, SX 01882 61133	0
Par	South of Minorca Lane, Par River, SX 02657 59788	0
Tributary	Carbis Stream SX 02834 59401	0
Par	Luxulyan allotments, Par River, SX 04732 58045	0
Par	Cam Bridges, Par River, SX 05292 57454	0
Tributary	Gatty's Bridge, Bokiddick Stream SX 05531 57953	0
Par	Treffry Viaduct, Par River, SX 05650 57179	0
Par	Lady Rashleigh Mine, Par River, SX 06451 56509	27
Tributary	Treesmill, Tywardreath Stream, SX 08873 55385	25
Par	Par Beach slipway, SX 0776 53261	70
Tributary	Polmear Stream, Ship Inn, SX 08749 53417	35

3. Results November 2022



3. Historical data on turbidity:



G. PHOSPHATES

1. This is the WRT's explanation of this measure.

Phosphate occurs naturally within the river ecosystem, but in very low levels under 0.05 mg/l. Therefore, higher levels may indicate anthropogenic input. Phosphate is found in animal and human

waste, cleaning chemicals, industrial runoff and fertiliser so this can be a good indicator of pollution. Having raised levels of phosphate can lead to increases in plant growth within the watercourse. This leads to a depletion of oxygen due to the plant's aerobic respiration during the night. Without oxygen aquatic species cannot survive and the river ecosystem collapses. (It is important to note that phosphate is taken up by plants. You may get a low reading but high plant growth, indicating eutrophication.)

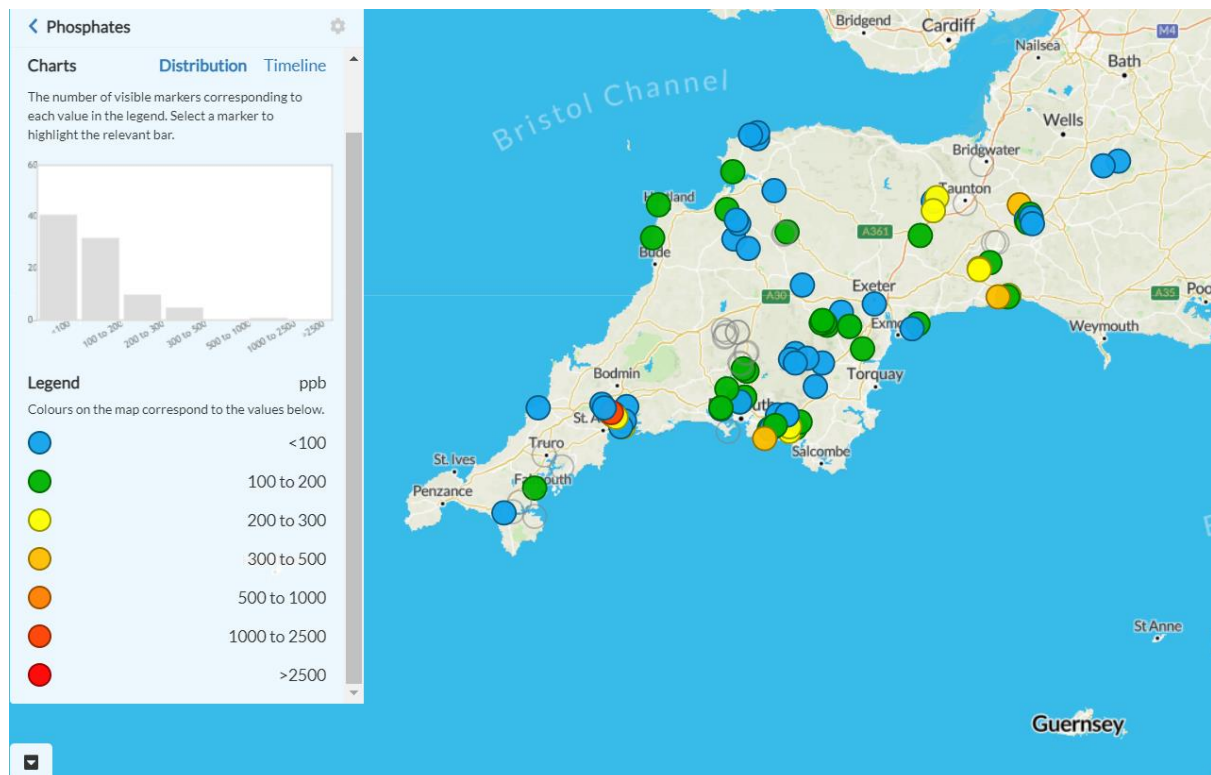
Ranges on phosphate diagnostic colour chart:

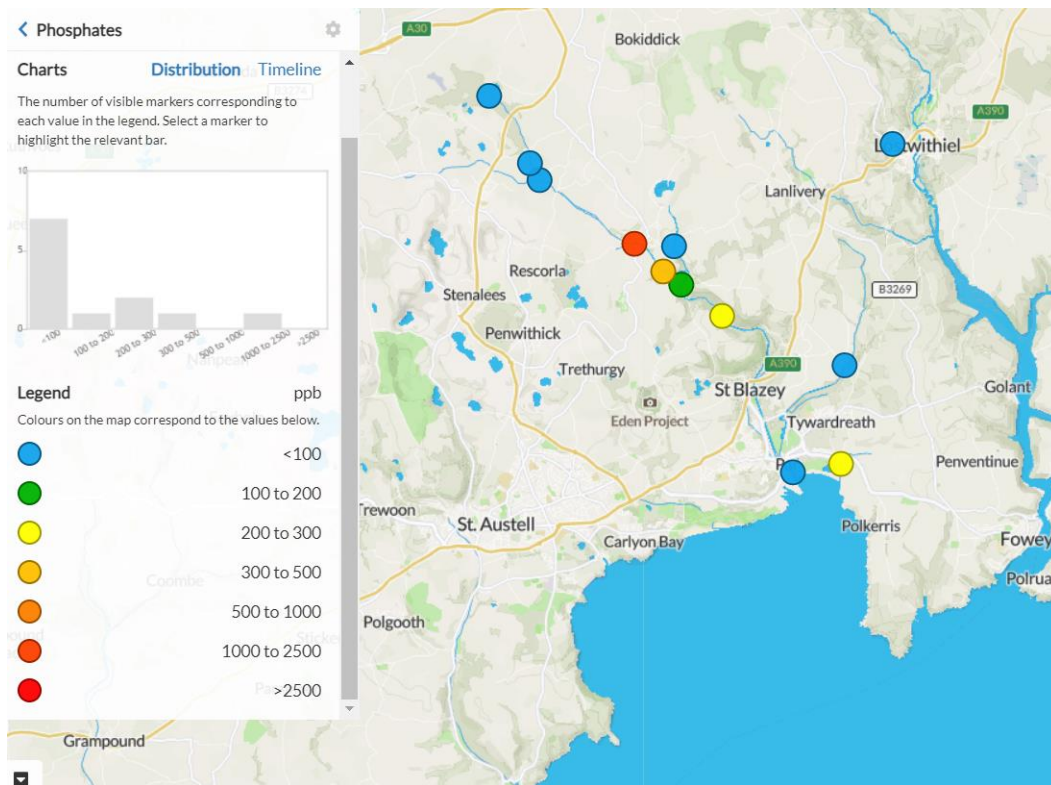
0 – 100 OK

200 – 300 HIGH

500 – 2500 – TOO HIGH

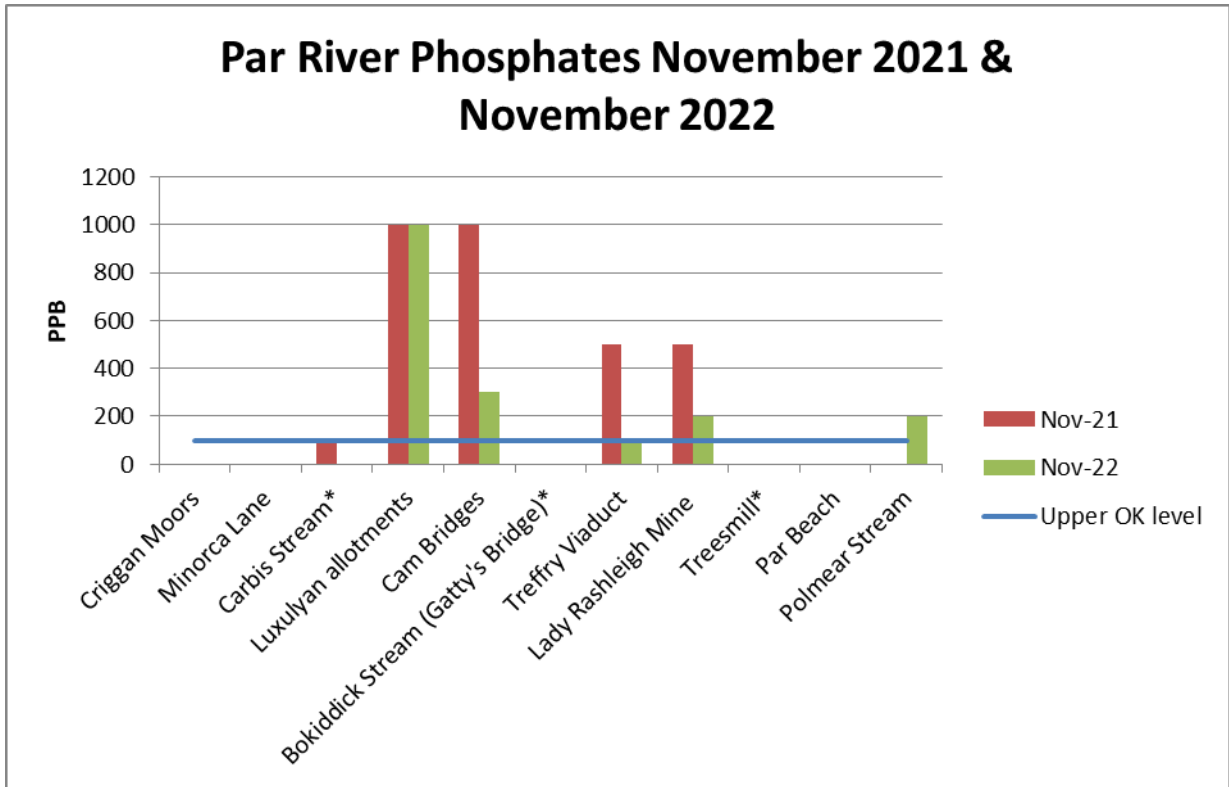
2. Geographical comparison. Source: Cartographer





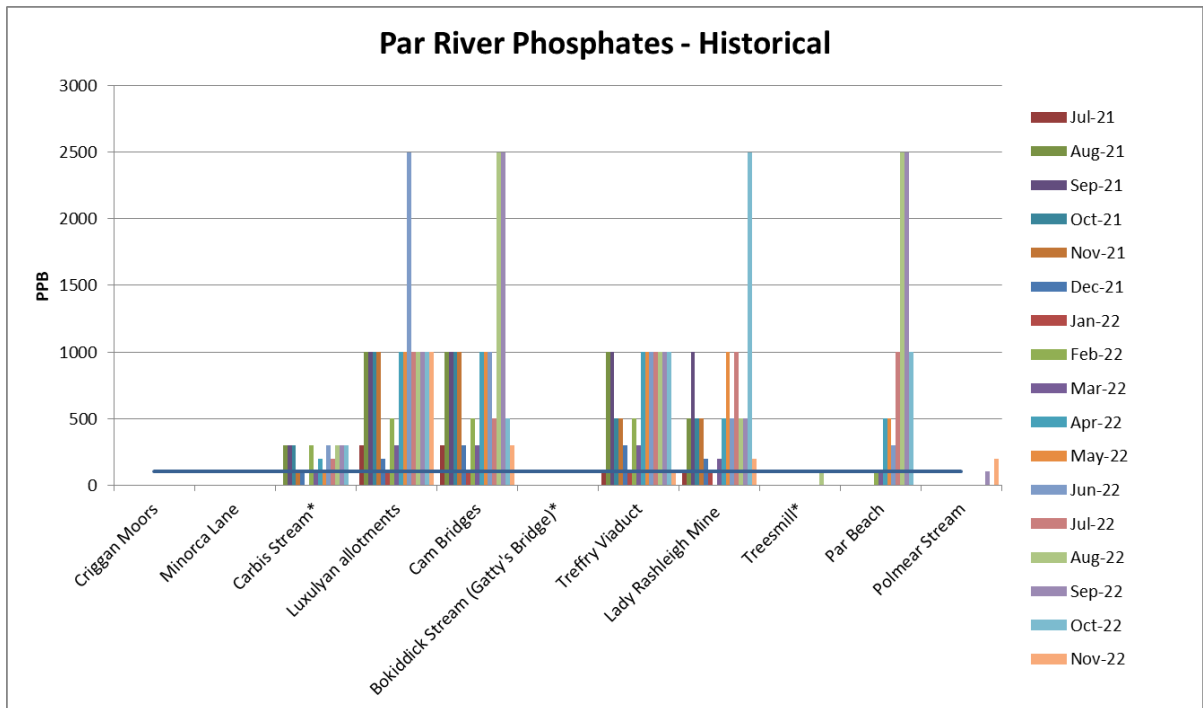
PAR RIVER/TRIBUTARY	LOCATION	Phosphates PPB
Par	Criggan Moors, SX 01882 61133	0
Par	South of Minorca Lane, Par River, SX 02657 59788	0
Tributary	Carbis Stream SX 02834 59401	0
Par	Luxulyan allotments, Par River, SX 04732 58045	1000*
Par	Cam Bridges, Par River, SX 05292 57454	300
Tributary	Gatty's Bridge, Bokiddick Stream SX 05531 57953	0
Par	Treffry Viaduct, Par River, SX 05650 57179	100
Par	Lady Rashleigh Mine, Par River, SX 06451 56509	200
Tributary	Treesmill, Tywardreath Stream, SX 08873 55385	0
Par	Par Beach slipway, SX 0776 53261	0
Tributary	Polmear Stream, Ship Inn, SX 08749 53417	200

*There is some uncertainty about this reading. It may have been closer to 500 ppb.



*indicates a tributary of the Par River. USL is 100 Parts Per Billion which, according to WRT, is the Upper Safe Level.

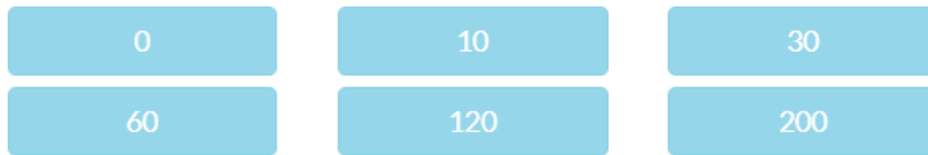
5. Historical data on phosphates:



H. NITRATES

1. The WRT kit has these ranges for nitrates:

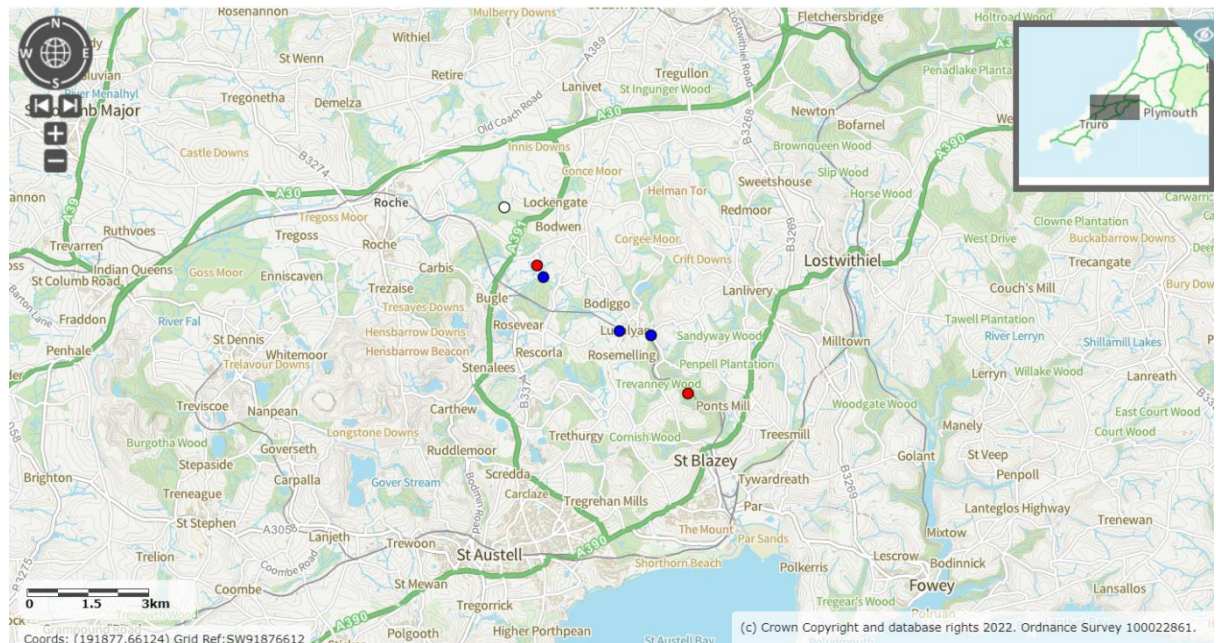
Nitrate (ppm NO₃)



2. We have concerns about the sensitivity of the testing strips so did not carry out any tests this month.

I. BACTERIA (E.COLI (EC), TOTAL COLIFORM (TC) & INTESTINAL ENTEROCOCCI)

1. This month Lisa Goodall and Peter Scobie accompanied Joan Farmer and took their own samples from two of the usual locations (Minorca Lane and Lady Rashleigh Mine) and also from Luxulyan allotments. Additionally, Joan took a sample from Gatty's Bridge. Unfortunately, it was not possible to get a sample from Criggan Moors. The EA samples were sent to the laboratories at Starcross Laboratory. Once again, Joan incubated the river group's samples at home. The EA also tests for Intestinal Enterococci.



2. Key information:

(a) What is the difference between total coliform and E. coli?

Total coliform is a large collection of different kinds of bacteria. Faecal coliform are types of total coliform that exist in faeces. E. coli is a subgroup of faecal coliform.

<https://doh.wa.gov/sites/default/files/legacy/Documents/Pubs//331-181.pdf>

(b) Why is E. coli in river water a concern?

The presence of E. coli indicates faecal contamination of the drinking water and as a result, there is an increased risk that enteric pathogens may be present. <https://www.canada.ca/en/health-canada/programs/consultation-e-coli-drinking-water/document.html>

Particular thanks are due to Joan Farmer for allowing the use of her home for the unpleasant process of incubating the samples and also for contacting the manufacturers of the kit in North Carolina, USA, for guidance on the results. Thanks too to Ross Tonkin for sharing his professional expertise.

(c) What is Intestinal Enterococci (EA testing only)?

The *Enterococcus* genus comprises over 50 species that live as commensal bacteria in the gastrointestinal (GI) tracts of insects, birds, reptiles, and mammals. Named “entero” to emphasize their intestinal habitat, *Enterococcus faecalis* and *Enterococcus faecium* were first isolated in the early 1900s and are the most abundant species of this genus found in the human fecal microbiota. In the past 3 decades, enterococci have developed increased resistance to several classes of antibiotics and emerged as a prevalent causative agent of health care-related infections.

(d) Interpreting the river group results:

Aquagenx CBT EC+TC MPN Kit gives a guide to help interpret the results of the incubated samples. This is an attempt at a simple guide linked to the **United States Environmental Protection Agency Recreational Water Health Risk Category Based on Minimum Probable Number and Upper 95% Confidence Level**. However, this simplification should be used with caution until it has been checked by someone with relevant expertise.

MPN/100mL	Health Risk Category
0	Low Risk/Safe
10 - 40	Low Risk/Probably Safe
47 – 84	Low Risk/Possibly Safe
91 - 96	Intermediate Risk/Possibly Safe
136 - 171	High Risk/Probably Unsafe
326 - 483	Very High Risk/Unsafe
>1000	Very Unsafe

(e) Interpreting the bacteria results using the revised bathing water directive (rBWD; Directive 2006/7/EC) (which was adopted by the European parliament and the Council of the European Union in 2006, for full implementation by 2014).

There are **no designated bathing spots on the Par River** (although Par Beach presumably is) but the standards applied to these places may give a useful rule of thumb in understanding the bacteria results:

Table 1. Inland waters.

Parameter	Excellent quality	Good quality	Sufficient	Reference methods of analysis
Intestinal enterococci (cfu/100 ml)	200 (*)	400 (*)	330 (**)	ISO 7899-1 or ISO 7899-2
<i>Escherichia coli</i> (cfu/100 ml)	500 (*)	1000 (*)	900 (**)	ISO 9308-3 or ISO 9308-1

(*) Based upon a 95th percentile evaluation.

(**) Based upon a 90th percentile evaluation.

Table 2. coastal waters and transitional waters

Parameter	Excellent quality	Good quality	Sufficient	Reference methods of analysis
Intestinal enterococci (cfu/100 ml)	100 (*)	200 (*)	185 (**)	ISO 7899-1 or ISO 7899-2
<i>Escherichia coli</i> (cfu/100 ml)	250 (*)	500 (*)	500 (**)	ISO 9308-3 or ISO 9308-1

(*) Based upon a 95th percentile evaluation.

(**) Based upon a 90th percentile evaluation.

Source: Rapid Test method for *Escherichia coli* and Intestinal Enterococci (SC070054) Final report (draft 3) August 2009 Jonathan Porter National Laboratory Service, Starcross Laboratory, Staplake Mount, Starcross, Devon. EX6 8PE, https://www.sepa.org.uk/media/163217/escherichia_coli_intestinal_enterococci.pdf

Bathing Waters Directive classification

There are four classifications of water quality:

- "excellent" – the highest, cleanest class
- "good" – generally good water quality
- "sufficient" – the water meets minimum standards
- "poor" – the water has not met the new minimum standards. Work is planned to improve bathing waters not yet reaching sufficient.

3. Bacteria results. Report and data from Joan Farmer:

Water results. Sampling 16/11/22 Heavy Rain

Minorca Lane SX02668 59747 * Par river; Time 12.00

Bacteria readings: e coli 483 mpn total coliforms >1000 mpn

Temperature :10.5 C

Dissolved Solids : 74 ppm

Turbidity : <12 ntu

Phosphates : 0

Carbis Stream SX 02834 59412* Tributary of Par River; Time 12.30

Bacteria readings: e coli >1000 mpn (final reading 19/11/22

total coliforms > 1000 mpn

Temperature: 11.4 C

Dissolved solids: 144 ppm

Turbidity: <12 ntu

Phosphates: 0

Luxulyan Allotment SX 04732 58045* Par River; Time: 13.15

Bacteria Readings: e coli 483 mpn total coliforms >1000

Temperature: 10.8 C

Dissolved Solids: 121ppm

Turbidity <12ntu

Phosphates 1000 (500??) ppb

Lady Rashleigh Mine SX 06451 56509* Par River; Time: 14.30

Bacteria Readings: e coli 483 mpn total coliforms >1000

Temperature: 10.8 C

Dissolved Solids 94ppm

Turbidity: 27ntu

Phosphates: 200ppb

Sampling 19/11/22 at 12.25 rain

Gatty's Bridge, Bokiddick Stream, Tributary of Par River SX05331 57953

Bacteria readings: e coli 136mpn total coliforms >1000

Temperature: 7C

Dissolved solids: 80ppm

Turbidity: < 12

Phosphates 0

4. Monthly results from the river group's 3 regular monitoring sites:

MONTH & TEST	Criggan Moor (Upper Par) SX01882 61133 Sample & Result Dates, Score & Health Risk	Minorca Lane (Upper Par) SX02657 59788 Sample & Result Dates, Score & Health Risk	Lady Rashleigh Mine (Lower Par) SX06451 56509 Sample & Result Dates, Score & Health Risk	NOTES ON WEATHER, TEST ETC
FEBRUARY 2022				
E.coli	n/a	n/a	21/02/2022 (23/02/2022; 24/02/2022) 483¹ Very High/ Unsafe 483² Very High Risk /Unsafe	Rain prev. 24 hrs
Total Coliform	n/a	n/a	21/02/2022 (23/02/2022; 24/02/2022) >1000 Very Unsafe >1000 Very Unsafe	Rain prev. 24 hrs

MARCH 2022				
E.coli	n/a	n/a	21/03/2022; 24/02/2022 136 High Risk. Probably unsafe.	Dry
Total Coliform	n/a	n/a	21/03/2022; 24/02/2022 >1000³ Very Unsafe	Dry
APRIL 2022				
Criggan	Minorca Lane	Lady Rashleigh		
E.coli	n/a	n/a	16/04/2022; 18/04/2022 326 Very High Risk /Unsafe	Dry and sunny following rain. Temp over 30° C.
Total Coliform	n/a	n/a	16/04/2022; 18/04/2022 >1000 Very Unsafe	Dry and sunny following rain. Temp over 30° C. Definitely blue in compartments 4 & 5.
MAY 2022				
E.coli	n/a	n/a	9/05/2022; 11/05/2022 136 High Risk. Prob. Unsafe	Dry
Total Coliform	n/a	n/a	9/05/2022; 11/05/2022 >1000 Very Unsafe	Dry Def. blue
JUNE 2022				
E.coli	n/a	n/a	27/06/2022; 29/06/2022 483 Very High Risk/ Unsafe	Rain in prev. 24 hours
Total Coliform	n/a	n/a	27/06/2022; 29/06/2022 >1000 Very Unsafe	Rain in prev. 24 hours Def. blue

JULY 2022				
E.coli	n/a	n/a	18/07/2022; 20/07/2022 47 Low Risk/Possibly Safe⁴	Dry
Total Coliform 18/07/2022; 20/07/2022	n/a	n/a	18/07/2022; 20/07/2022 483 Very High Risk/ Unsafe	Dry
AUGUST 2022	Criggan	Minorca Lane	Lady Rashleigh	
E.coli	19/08/2022 483 Very High Risk/ Unsafe	19/08/2022 483 Very High Risk/ Unsafe	21/08/2022; 23/08/2022 483 Very High Risk/ Unsafe	
Total Coliform	19/08/2022 >1000 Very Unsafe	19/08/2022 >1000 Very Unsafe	21/08/2022; 23/08/2022 >1000 Very Unsafe	Light rain
SEPTEMBER 2022	Criggan	Minorca Lane	Lady Rashleigh	
E.coli	16/09/2022 483 Very High Risk/ Unsafe	16/09/2022 136 High Risk/Probably Unsafe	17/09/2022; 19/09/2022 483 Very High Risk/ Unsafe	No rain
Total Coliform	16/09/2022 >1000 Very Unsafe	16/09/2022 >1000 Very Unsafe	17/09/2022; 19/09/2022 >1000 Very Unsafe	No rain
OCTOBER 2022	Criggan	Minorca Lane	Lady Rashleigh	
E.coli	17/10/2022 483 Very High Risk/ Unsafe	17/10/2022 47 Low Risk/Possibly Safe	15/10/2022 483 Very High Risk/ Unsafe	Dry. Light rain in previous 24 hours. River low.
Total Coliform	17/10/2022 >1000 Very Unsafe	17/10/2022 >1000 Very Unsafe	15/10/2022 >1000 Very Unsafe	Dry. Light rain in previous 24 hours. River low.

NOVEMBER 2022	Criggan	Minorca Lane	Lady Rashleigh	
E.coli	No sample	16/11/2022 483 Very High Risk/ Unsafe	16/11/2022 483 Very High Risk/ Unsafe	Heavy rain
Total Coliform	No sample	16/11/2022 >1000 Very Unsafe	16/11/2022 >1000 Very Unsafe	Heavy rain

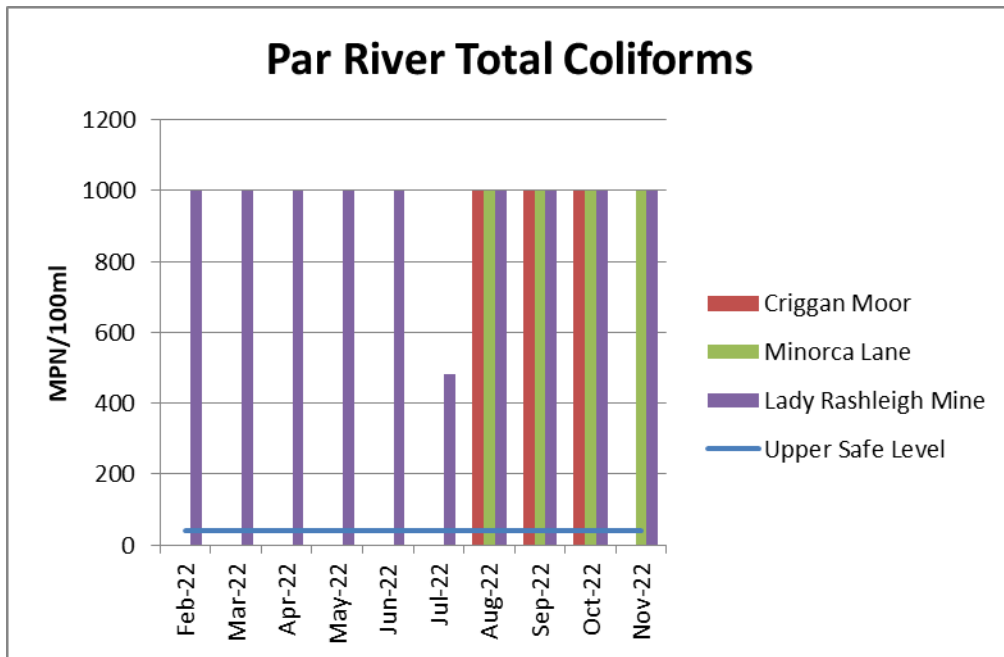
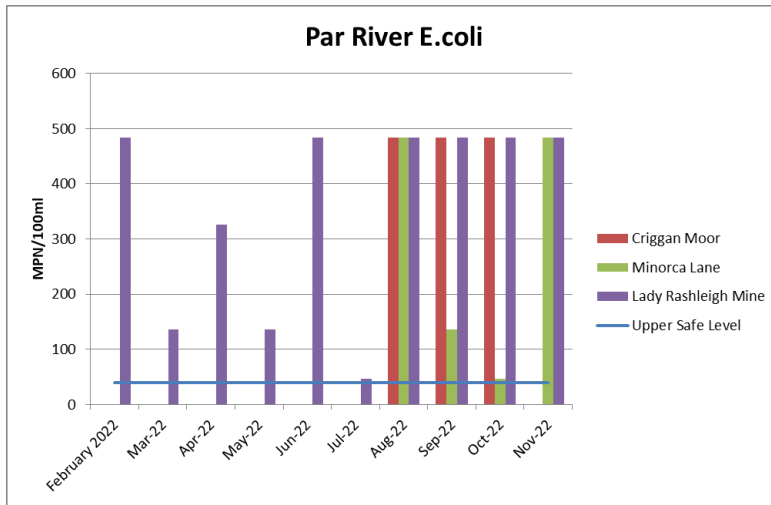
1. Readings taken twice on the 1st sample as it took 12 hours to reach the minimum temperature of 25 degrees.
2. Originally >1000 but I now believe this reading should be 483 and the traces of blue in compartment 5 had leaked out of one of the other compartments as the clip was not positioned exactly along the maximum fill line.
3. Compartments 4 and 5 had only very pale blue fluorescence in UV light, but definitely glowed with no trace of yellow. Aquagenx company confirmed that fluorescence under UV light indicates positive for total coliforms.
4. Due to hot weather, limited additional heat was added. The temperature for most of the time was between 25 and 30 so should have been left for 40-48 hours. Insufficient time given (36 hrs) so results may be wrong.

5. Combined data on bacteria from the Environment Agency and the river group:

LOCATION	E.coli (river group)	E.coli (EA)	Total Coliforms (river group)	Enterococci: Intestinal (EA)*
Par River, south of Minorca Lane, SX02668 59747	483 MPN/100ml	2200 NO/100ml	>1000 MPN/100 ml	700 CFU/0.1l
Carbis Stream, tributary of Par River, SX 02834 59412	>1000 MPN/100 ml	n/a	>1000 MPN/100 ml	n/a
Luxulyan allotments, Par River, SX 04732 58045	483 MPN/100ml	1500 NO/100ml	>1000 MPN/100 ml	410 CFU/0.1l
Bokiddick Stream, tributary of Par River, Gatty's Bridge, SX05331 57953	136 MPN/100ml	n/a	>1000 MPN/100 ml	n/a
Lady Rashleigh Mine, Par River, SX06451 56509	483 MPN/100ml	860 NO/100ml	>1000 MPN/100 ml	420 CFU/0.1l

* Enterococci are bacteria that **live in the intestinal tracts of warm-blooded animals, including humans**, and therefore indicate possible contamination of streams and rivers by faecal waste.

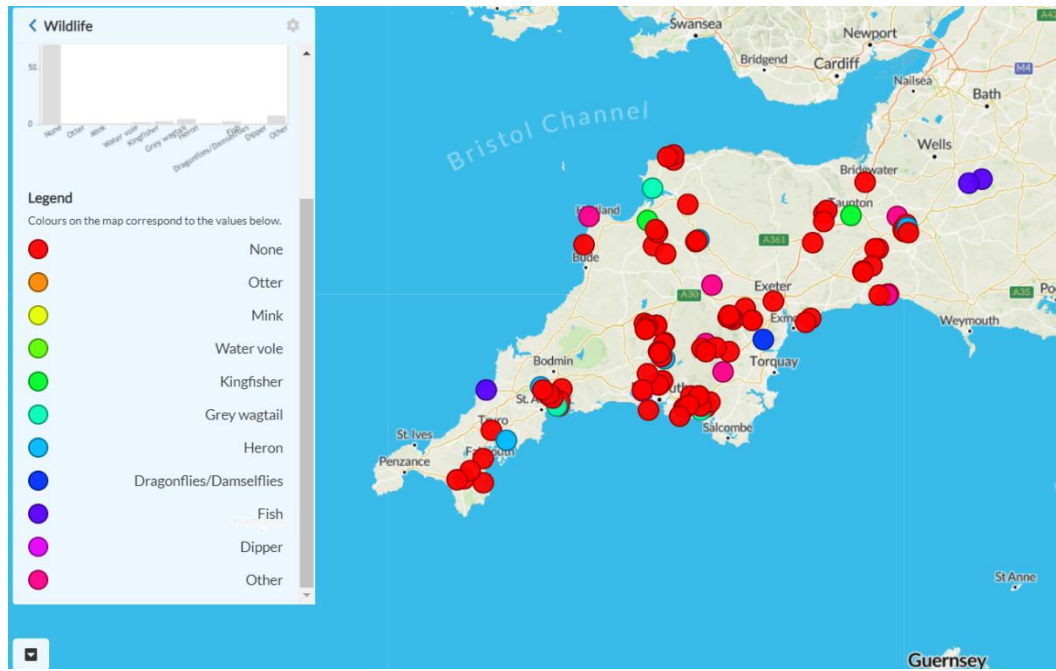
6. Graphs



Note: readings in excess of 1000 MPN/100 ml are represented as 1001 on the graph.

J. WILDLIFE (FOR OTTER REPORT SEE SECTION K)

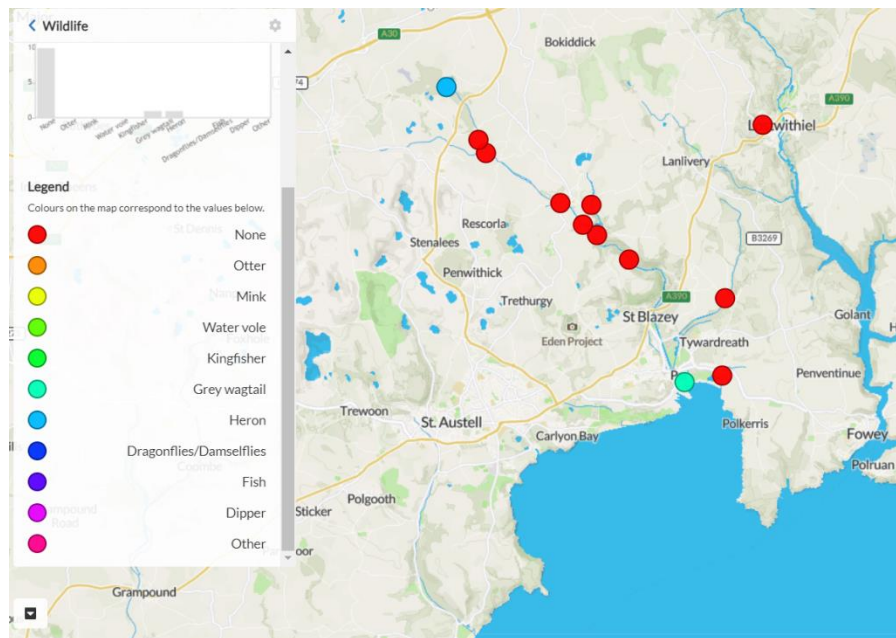
(a) Maps



Source: Cartographer.

Otter spraint is included, as usual, under 'Other'.

(b)



Source: Cartographer

Wildlife sightings at the monitoring points included:

PAR RIVER/TRIBUTARY	LOCATION	WILDLIFE NOTED
Par	Criggan Moors, SX 01882 61133	Heron
Par	South of Minorca Lane, Par River, SX 02657 59788	None
Tributary	Carbis Stream SX 02834 59401	None
Par	Luxulyan allotments, Par River, SX 04732 58045	None
Par	Cam Bridges, Par River, SX 05292 57454	None
Tributary	Gatty's Bridge, Bokiddick Stream SX 05531 57953	None
Par	Treffry Viaduct, Par River, SX 05650 57179	None
Par	Lady Rashleigh Mine, Par River, SX 06451 56509	None
Tributary	Treesmill, Tywardreath Stream, SX 08873 55385	None
Par	Par Beach slipway, SX 0776 53261	Swan, cormorant, mallard duck
Tributary	Polmear Stream, Ship Inn, SX 08749 53417	None

K. OTTER SURVEY

Owing to illness it was not possible to carry out an otter survey other than to look for spraint while carrying out the water testing. Unsurprisingly, the higher river levels meant that no spraint could be seen on accessible boulders at these locations.

L. ARMI RIVERFLY SURVEY

Three of the group (Joan Farmer, Veronica Jones and Roger Smith) have undertaken the training to carry out Riverfly Surveys under the Anglers' Riverfly Monitoring Initiative (<https://www.riverflies.org/rp-riverfly-monitoring-initiative>). In short, sampling for 8 riverfly groups is carried out using standardised methods with scores calculated for their abundance. Information is passed to ARMI and the ORKS database. If the score does not reach a trigger level (in our case trigger level was raised from 5 to 6 in May 2022), the Environment Agency must be informed immediately since it is highly likely to indicate that the water is polluted. Our group received approval to sample at two sites: Luxulyan allotments (SX 04743 58054) and Lady Rashleigh Mine (SX 06453 56500). We have decided, for the time being, to concentrate on the latter.

It is impossible to count every invertebrate so this counting method is used:

Abundance	Score	Estimated Number
1-9	1	Quick count
10-99	2	Nearest 10
100-999	3	Nearest 100
>1000	4	Nearest 1000

Riverfly monitoring has been suspended until Spring 2023 to avoid disturbing fish spawning.

M. DISCUSSION

1. Positive observations.

(a) Huge thanks are due to Lisa Goodall and Peter Scobie of the Environment Agency for spending a day visiting and testing at some of our regular monitoring sites. All this was in addition to their usual duties so was greatly appreciated. The results of their more sophisticated tests will be invaluable as a means of assessing the validity of our own citizen science methodology and in giving a more precise idea about the state of the river at key points.

(b) Phosphate levels were lower than usual. Even the 1000 ppb result at Luxulyan allotments is now considered to be more like 500 ppb, although that is still 'Too High' according to WRT guidelines.

2. Points of concern.

(a) Even with the dilution resulting from higher river levels, the CSI measures of phosphates indicate that they were 'High' at 3 of the 11 sites according to WRT guidelines and 'Too High' at another (even assuming a lower reading than was recorded on Cartographer).

(b) Bacteria levels recorded using the Aquagenx test are concerning, although with no obvious UK benchmark for undesignated inland waters it is difficult to be certain. Samples were only taken at 2 of the group's 3 regular sampling spots this time (south of Minorca Lane and Lady Rashleigh Mine) but according to US standards for recreational bathing waters E.coli levels were 'Very High/Unsafe' and Total Coliforms 'Very Unsafe' at both. The same was true at Luxulyan allotments. Samples from two tributaries were tested. On the Carbis Stream near Higher Menadue, levels of E.coli and Total Coliforms were 'Very Unsafe'. On the Bokiddick Stream at Gatty's Bridge, E.coli was 'High Risk/Probably Unsafe' and Total Coliforms 'Very Unsafe'. It must be stressed that these judgements are for US recreational waters and may not be considered appropriate for these locations.

(c) Bacteria levels (E.coli and Intestinal Enterococci) recorded by the EA tests and analysed at the Starcross Laboratory may be concerning but we don't have the necessary expertise to be sure, so comments are in the next section, **Areas of Doubt**.

3. Areas of doubt

(a) While it is of huge benefit to have the EA's data to compare with our own, it will take us a while to understand their results for pH, Conductivity, Ammoniacal Nitrogen, Orthophosphates etc but it will definitely be worth the effort.

(b) As stated in **Points of concern**, it is hard to find what standards are applied to rivers that lack designations, such as bathing waters. It might be argued that applying judgements appropriate to bathing waters to rivers that are not used for that purpose, and are unlikely to be, is inappropriate. However, it is not unreasonable for members of the public to have some criteria to allow judgements to be made, so in the absence of anything else the Bathing Waters Directive may as well be utilised.

LOCATION	E.coli (EA sampling)	Revised Bathing Waters Directive standards for E.coli in inland waters cfu/100 ml	Enterococci: Intestinal (EA sampling)*	Revised Bathing Waters Directive standards for Intestinal Enterococci in inland waters cfu/100 ml
Par River, south of Minorca Lane, SX02668 59747	2200 NO/100ml	Excellent: 500 Good: 1000 Sufficient: 900	700 CFU/0.1l	Excellent: 200 Good: 400 Sufficient: 330
Luxulyan allotments, Par River, SX 04732 58045	1500 NO/100ml	Excellent: 500 Good: 1000 Sufficient: 900	410 CFU/0.1l	Excellent: 200 Good: 400 Sufficient: 330
Lady Rashleigh Mine, Par River, SX06451 56509	860 NO/100ml	Excellent: 500 Good: 1000 Sufficient: 900	420 CFU/0.1l	Excellent: 200 Good: 400 Sufficient: 330

*0.1 litre is 100 millilitres.

A possible interpretation of the EA data might be:

LOCATION	Possible meaning for E.coli	Possible meaning for Intestinal Enterococci
Par River, south of Minorca Lane, SX02668 59747	Poor – does not meet BWD standards	Poor – does not meet BWD standards
Luxulyan allotments, Par River, SX 04732 58045	Poor – does not meet BWD standards	Poor – does not meet BWD standards
Lady Rashleigh Mine, Par River, SX06451 56509	Sufficient – does meet BWD standards	Poor – does not meet BWD standards

These judgements may be completely inaccurate and even if they are not it must be remembered that they are being applied to sites that are not Designated Bathing Waters (although a case might be made for Lady Rashleigh Mine being given this status because people and animals often go in the water there). In the absence of any standard applicable to rivers in general, it was thought useful to see how the results matched the DBW standard.

(c) Once we can find common measures for all the tests carried out by the EA and CSI groups it will be possible to provide more readily understood data for the public.

Report compiled by Dave Burrell, Joan Farmer & Roger Smith for the Par River Monitoring Group, 8th December 2022