WESTCOUNTRY RIVERS TRUST CITIZEN SCIENCE

The monitoring group has been helped by the Westcountry Rivers Trust, the Friends of Luxulyan Valley and the G7 Legacy Project for Nature Recovery. Comments and opinions in this report are not necessarily shared by these organisations.

MONITORING OF THE PAR RIVER AND ITS TRIBUTARIES

JULY 2022

CONTENTS & PAGES

The weir at Cam Bridges: hindrance, historic asset – or both?
Photo: Joan Farmer

A. KEY POINTS FROM WRT CSI MONITORING IN JULY 2022

1. River levels were exceptionally low due to the lack of rainfall. Water temperatures were high and in places exceeded 18˚ Celsius.
2. Phosphate levels from Luxulyan allotments downstream to the sea were High or Too High.
3. No clear pattern about bacteria levels has yet emerged. At Lady Rashleigh Mine the situation was better than in previous months but upstream from the two outflows at St Austell North Sewage Treatment Works they were worryingly high.
4. There was good evidence (direct and indirect) for the presence of fish from near the St Austell North STW downstream to Luxulyan Valley. Otter spraint was found at various places between the allotments and the canal bridge at Ponts Mill.
5. The Friends of Par Beach are keen to undertake river monitoring and it is hoped that the two groups will be able to work in tandem.

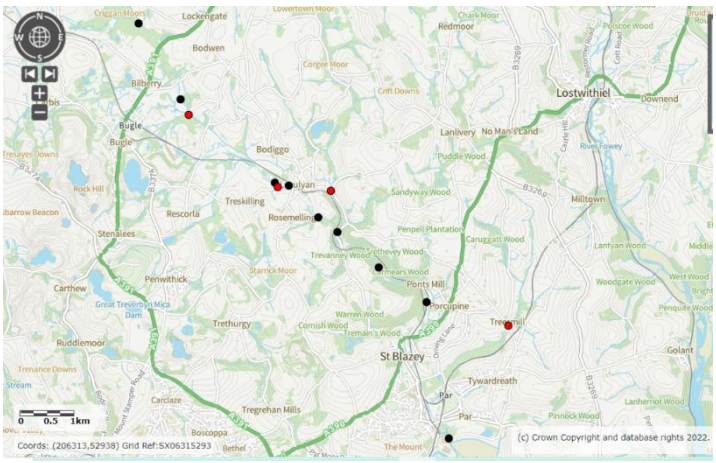
B. OUR GROUP

Monitoring is part of the Citizen Science programme run by the West Country Rivers Trust (WCRT) and is carried out monthly by volunteers from the Friends of Luxulyan Valley. The team comprises: Dave Burrell; Joan Farmer; Veronica Jones; Sue Perry; Roger Smith. They have received training from Lydia Deacon, 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, Simon Tagney and Brian Harrisson (Friends of Par Beach), 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, has been invaluable.

C. JULY 2022 MONITORING POINTS

This month we monitored at 13 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



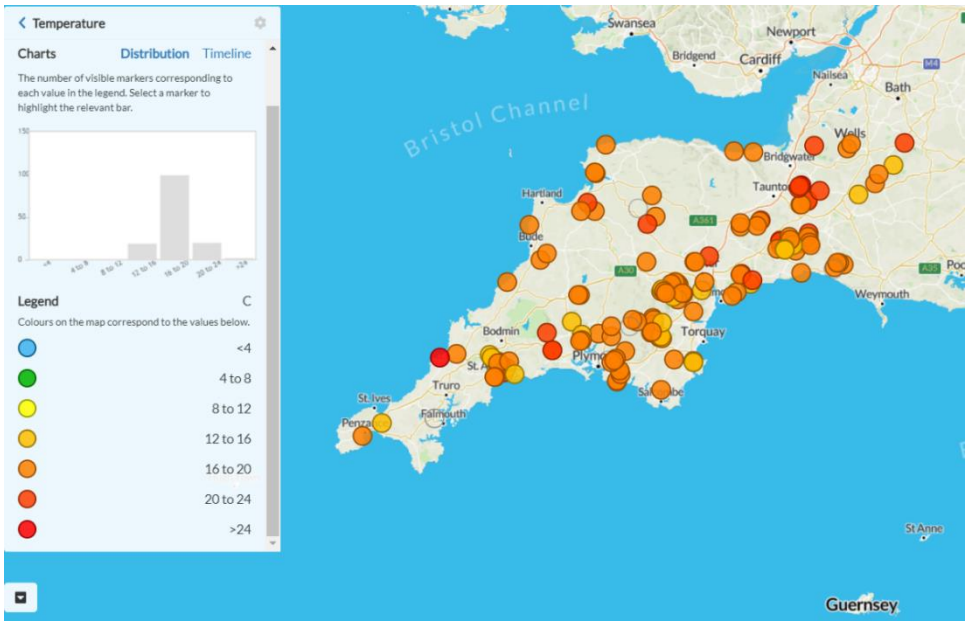
LOCATION	DATE	TYPE OF CHECK	MONITORED BY
Criggan Moors, Par River, SX 01882 61133	16/07/2022	Visual check. Cartographer record.	Roger Smith
South of Minorca Lane, Par River, SX 02657 59788	16/07/2022	CSI sampling. Cartographer record.	Roger Smith
Carbis Stream SX 02834 59401	16/07/2022	CSI sampling. Cartographer record.	Roger Smith
Downstream St Austell North STW SX 0446 5811	26/06/2022	Visual check. Bacteria sample taken upstream of STW.	Joan Farmer, Roger Smith.
Treverbyn Stream, SX 04532 58033	16/07/2022	Visual check.	Joan Farmer, Roger Smith.
Luxulyan allotments, Par River, SX 04732 58045	16/07/2022	CSI sampling. Cartographer record.	Joan Farmer, Roger Smith.
Luxulyan SWW pumping station, Par River, SX 05033 57849	-	-	-
Cam Bridges, Par River, SX 05292 57454	16/07/2022	CSI sampling. Cartographer record.	Joan Farmer, Roger Smith.
Gatty's Bridge, Bokiddick Stream SX 05531 57953	16/07/2022	CSI sampling. Cartographer record.	Joan Farmer, Roger Smith.
Treffry Viaduct, Par River, SX 05650 57179	16/07/2022	CSI sampling. Cartographer record.	Joan Farmer, Roger Smith.
Lady Rashleigh Mine, Par River, SX 06451 56509	18/07/2022	CSI sampling, Riverfly, E.coli, Total Coliform. Cartographer record.	Joan Farmer, Veronica Jones, Simon Tagney, Brian Harrisson, Roger Smith.
Ponts Mill, Par River, SX 07354 55875	18/07/2022	Visual check. Cartographer record.	Roger Smith.
Treesmill, Tywardreath Stream, SX 08873 55385	16/07/2022	CSI sampling. Cartographer record.	Veronica Jones
Par Beach slipway, SX 0776 53261	16/07/2022	CSI sampling. Cartographer record.	Veronica Jones

D. TEMPERATURE

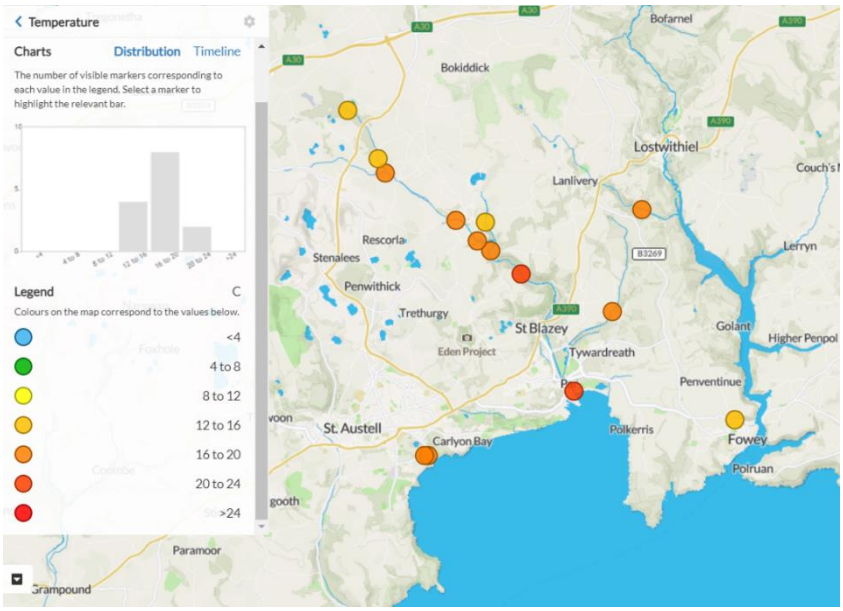
1. This is the WRT's explanation of why this is monitored:

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.



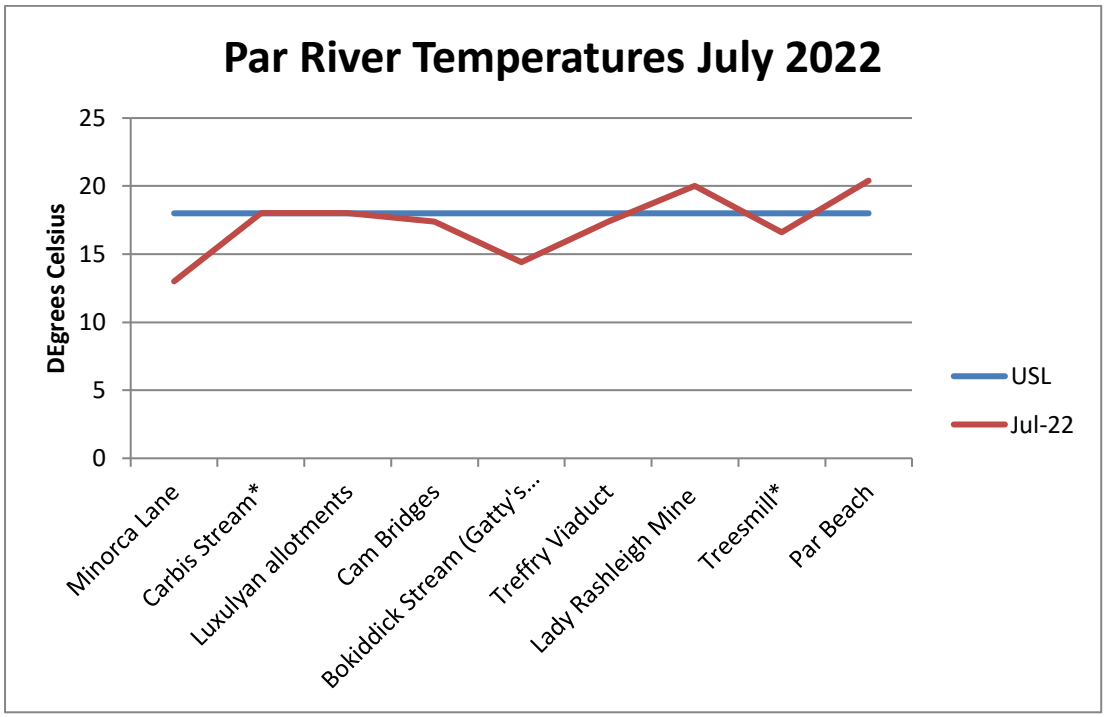
WRT results across the region



Par catchment results

3. Results July 2022

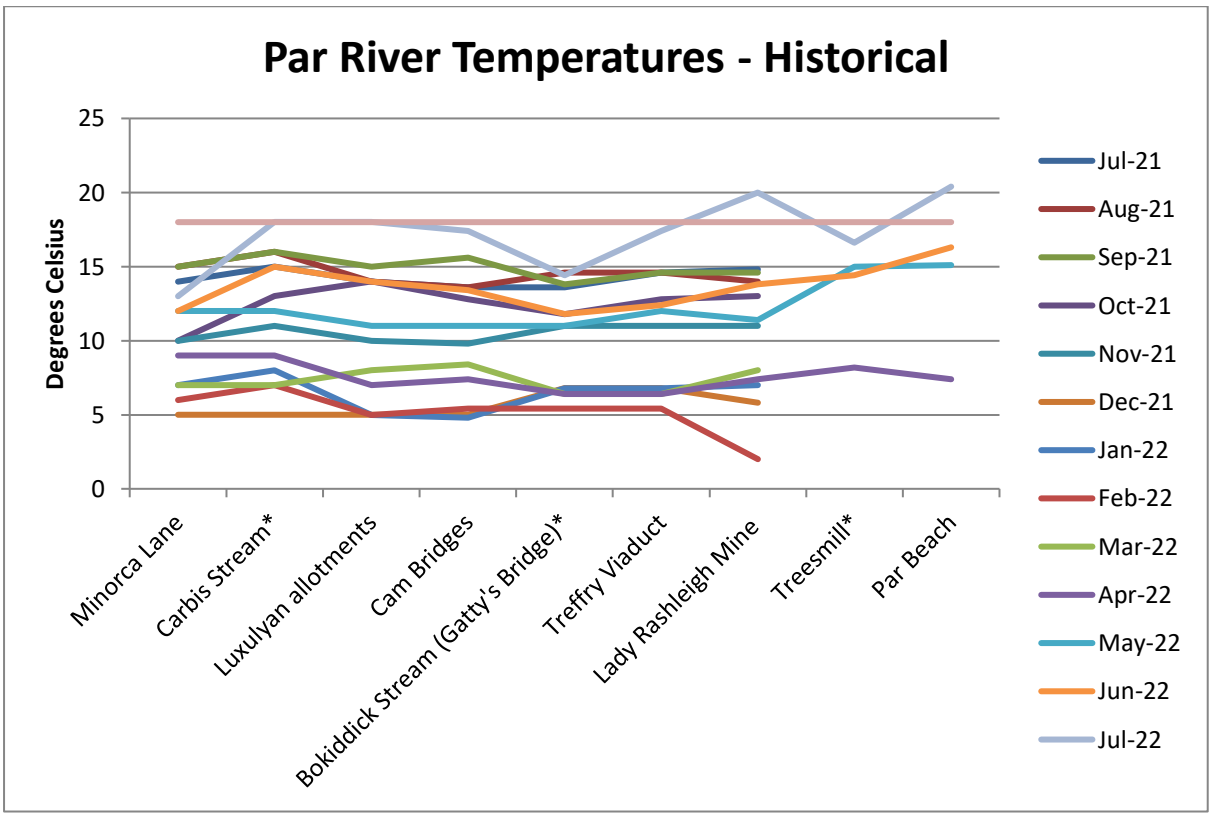
PAR RIVER/TRIBUTARY	LOCATION	Temperature ˚Celsius
Par	South of Minorca Lane, Par River, SX 02657 59788	13
Tributary	Carbis Stream SX 02834 59401	18
Par	Luxulyan allotments, Par River, SX 04732 58045	18
Par	Cam Bridges, Par River, SX 05292 57454	17.4
Tributary	Gatty's Bridge, Bokiddick Stream SX 05531 57953	14.4
Par	Treffry Viaduct, Par River, SX 05650 57179	17.4
Par	Lady Rashleigh Mine, Par River, SX 06451 56509	20
Tributary	Treesmill, Tywardreath Stream, SX 08873 55385	16.6
Par	Par Beach slipway, SX 0776 53261	20.4



*indicates a tributary of the Par River.

USL – Upper Safe Limit. Our assumption (based on anecdotal evidence) is that 18˚ Celsius is the upper safe limit for fish. This may be a simplification but hopefully is a useful rule of thumb.

3. **Historical data** on temperature:



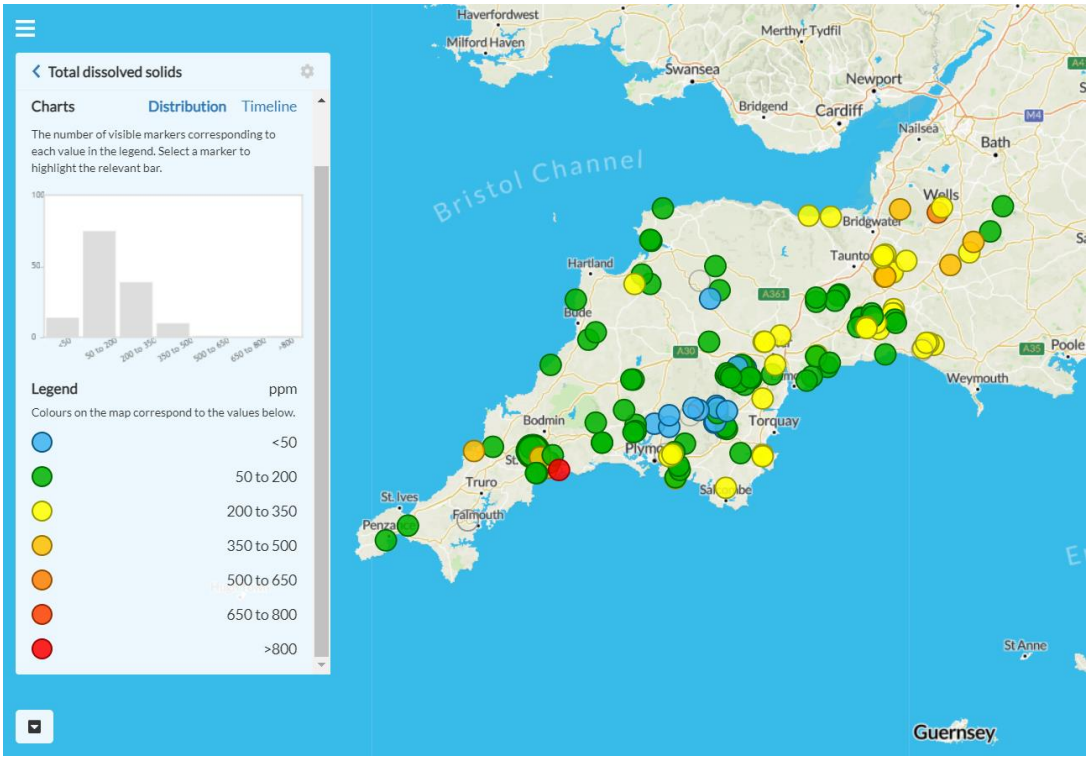
Nothing should be inferred from this because the database is tiny but this is the first occasion that our surveys have recorded river temperatures above 18˚.

TOTAL DISSOLVED SOLIDS

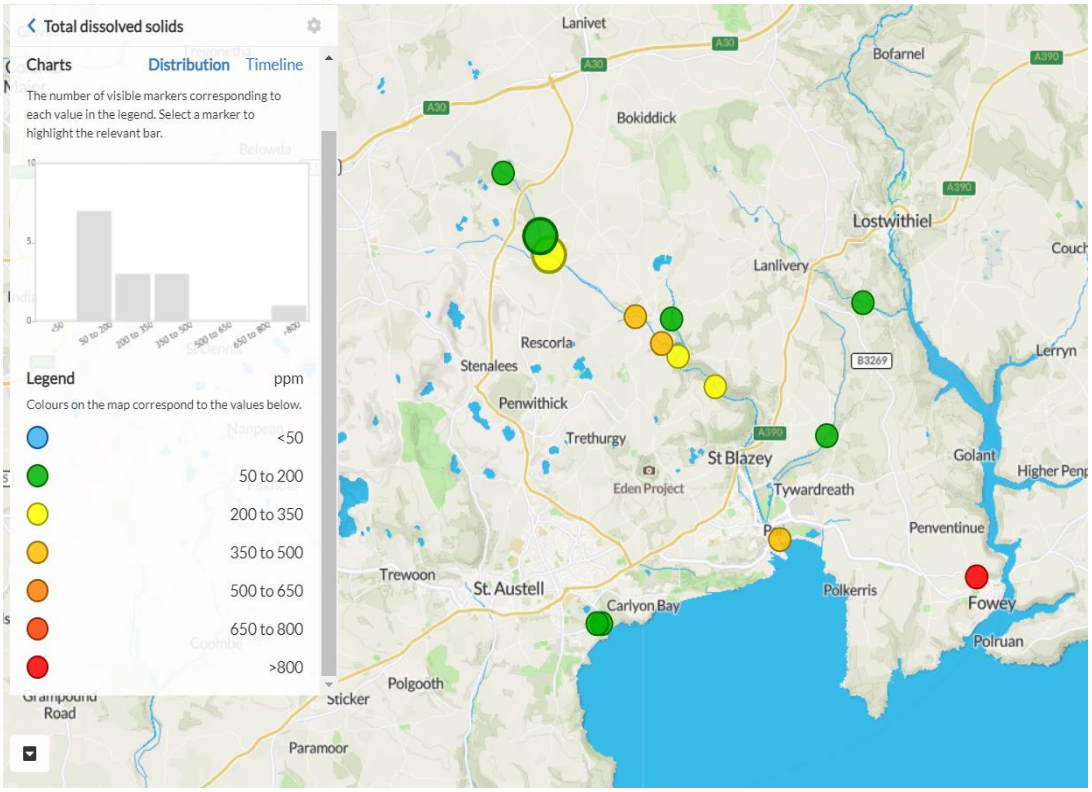
1. We measure these in ppm (parts per million). This is the WRT's explanation:

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.



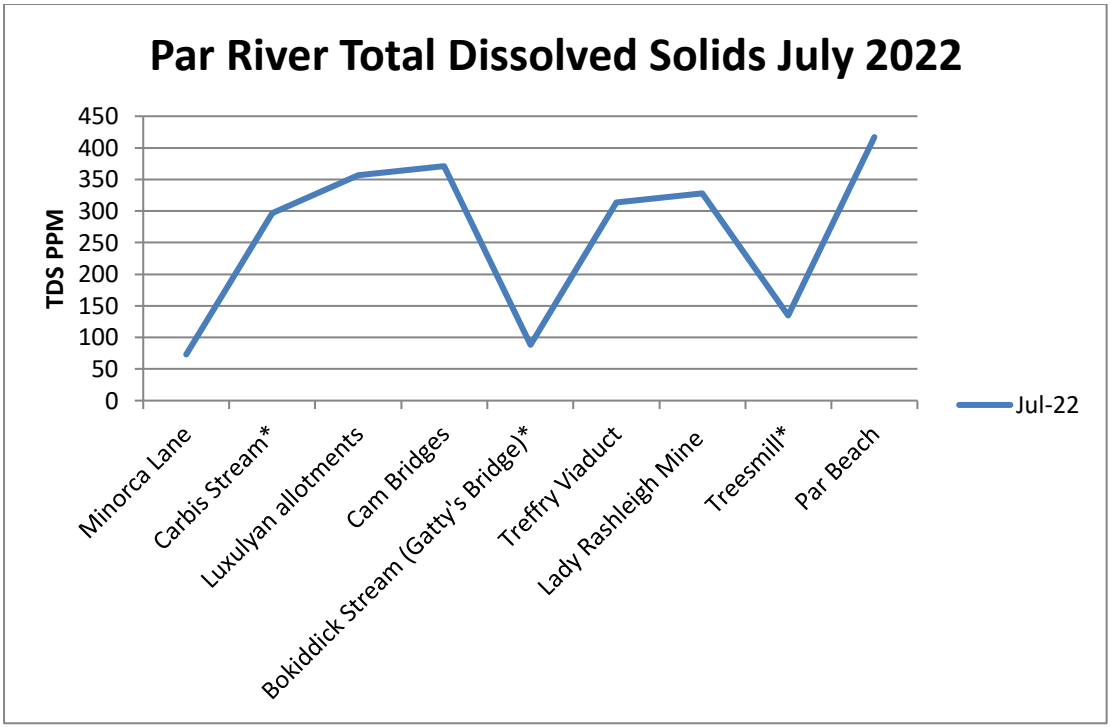
WRT TDS results across the region
(The reading >800 was at Fowey, not one of our readings.)



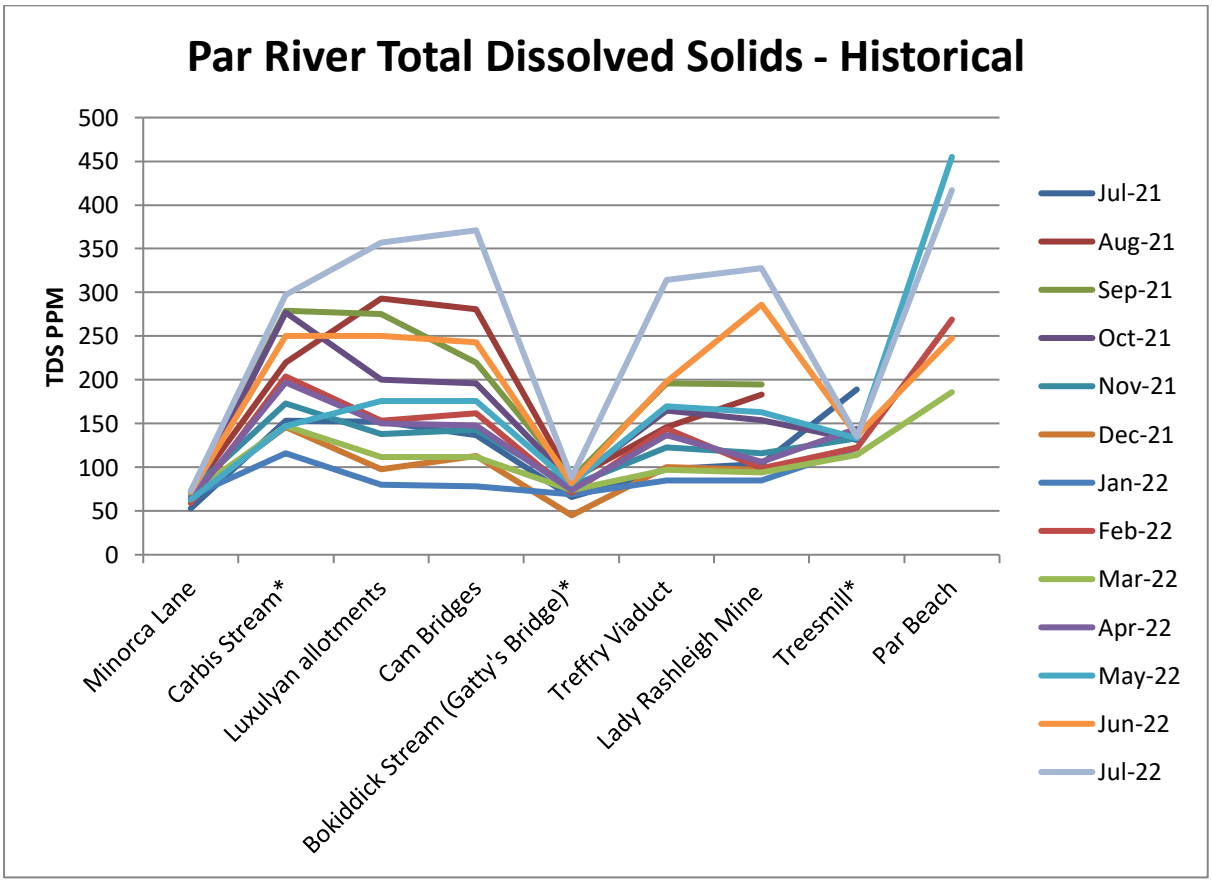
Par catchment results

3. Results July 2022

PAR RIVER/TRIBUTARY	LOCATION	Total Dissolved Solids ppm
Par	South of Minorca Lane, Par River, SX 02657 59788	73
Tributary	Carbis Stream SX 02834 59401	297
Par	Luxulyan allotments, Par River, SX 04732 58045	357
Par	Cam Bridges, Par River, SX 05292 57454	371
Tributary	Gatty's Bridge, Bokiddick Stream SX 05531 57953	88
Par	Treffry Viaduct, Par River, SX 05650 57179	314
Par	Lady Rashleigh Mine, Par River, SX 06451 56509	328
Tributary	Treesmill, Tywardreath Stream, SX 08873 55385	135
Par	Par Beach slipway, SX 0776 53261	417



3. **Historical data** on total dissolved solids:

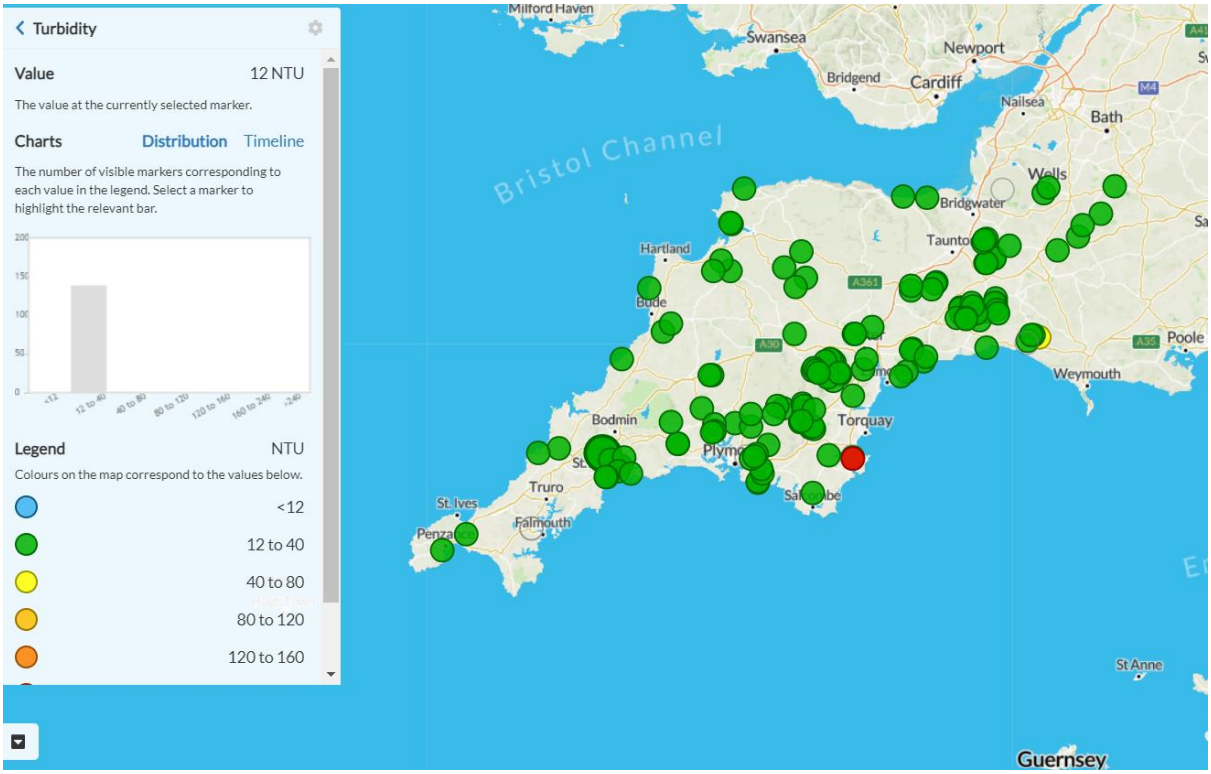


E. TURBIDITY

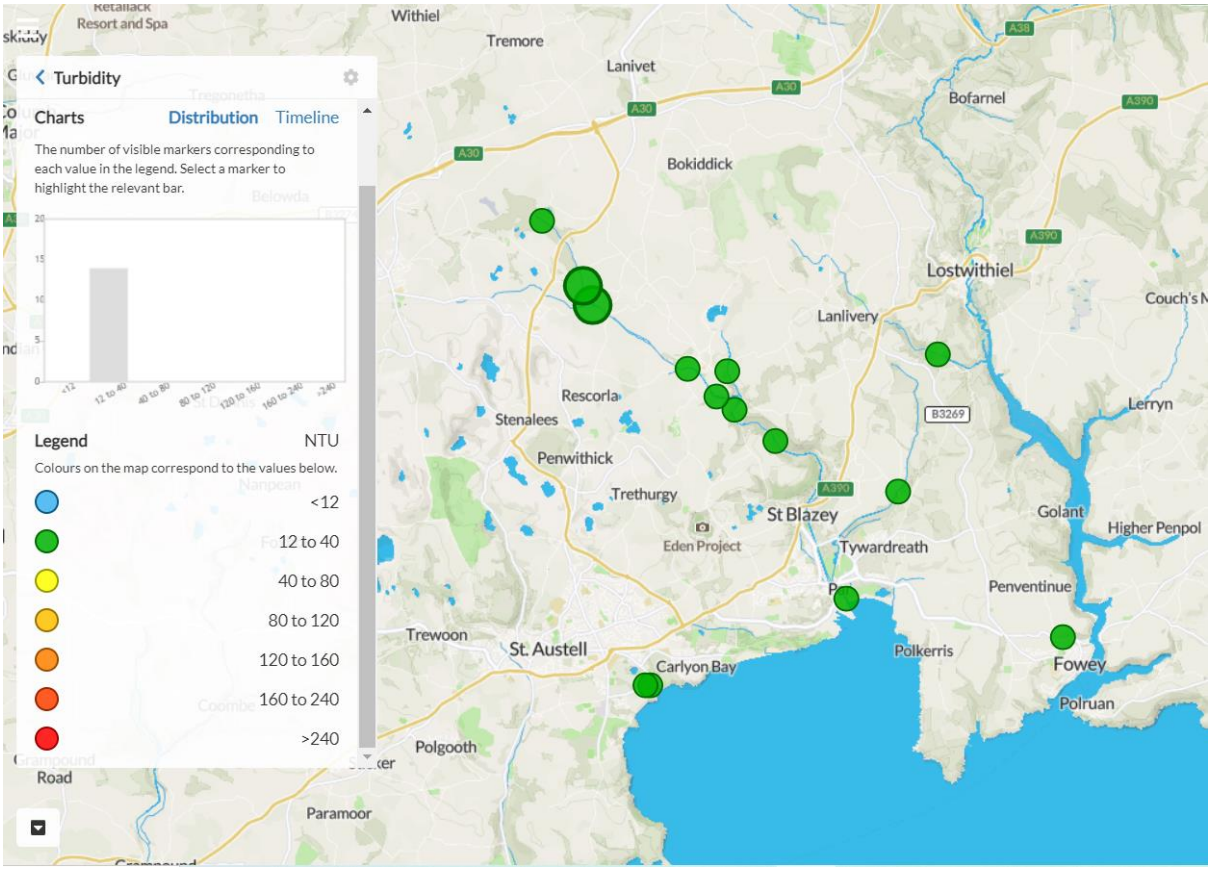
1. This is the WRT explanation of this measure:

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.



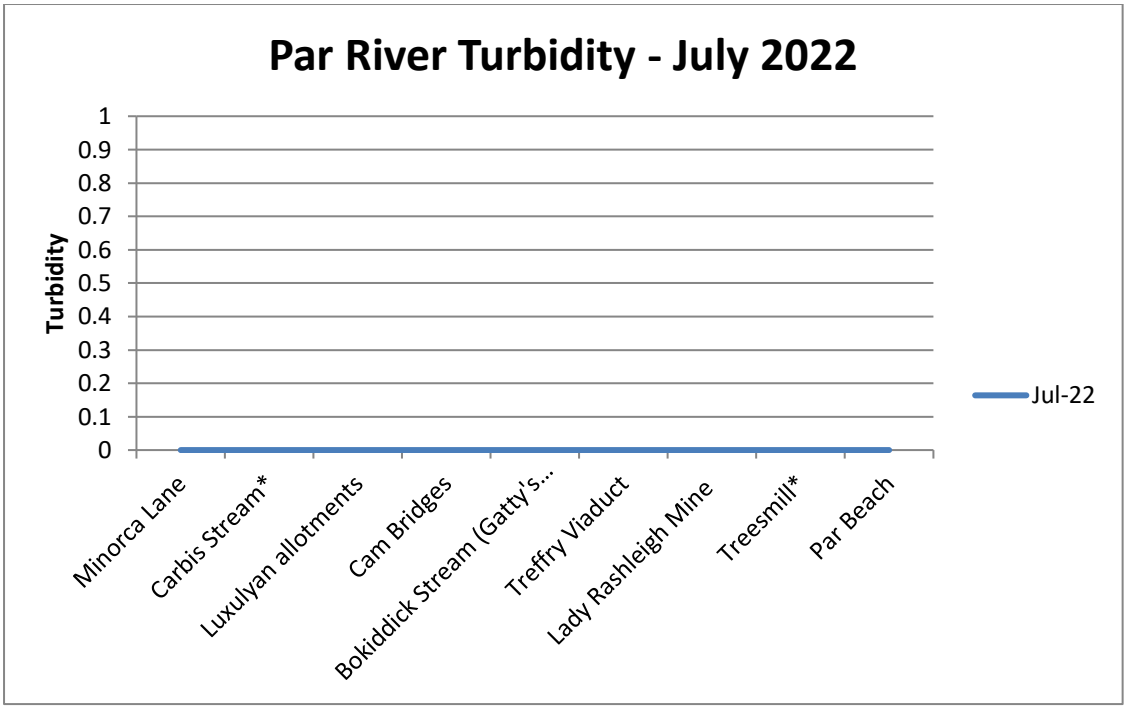
WRT Turbidity results for the region



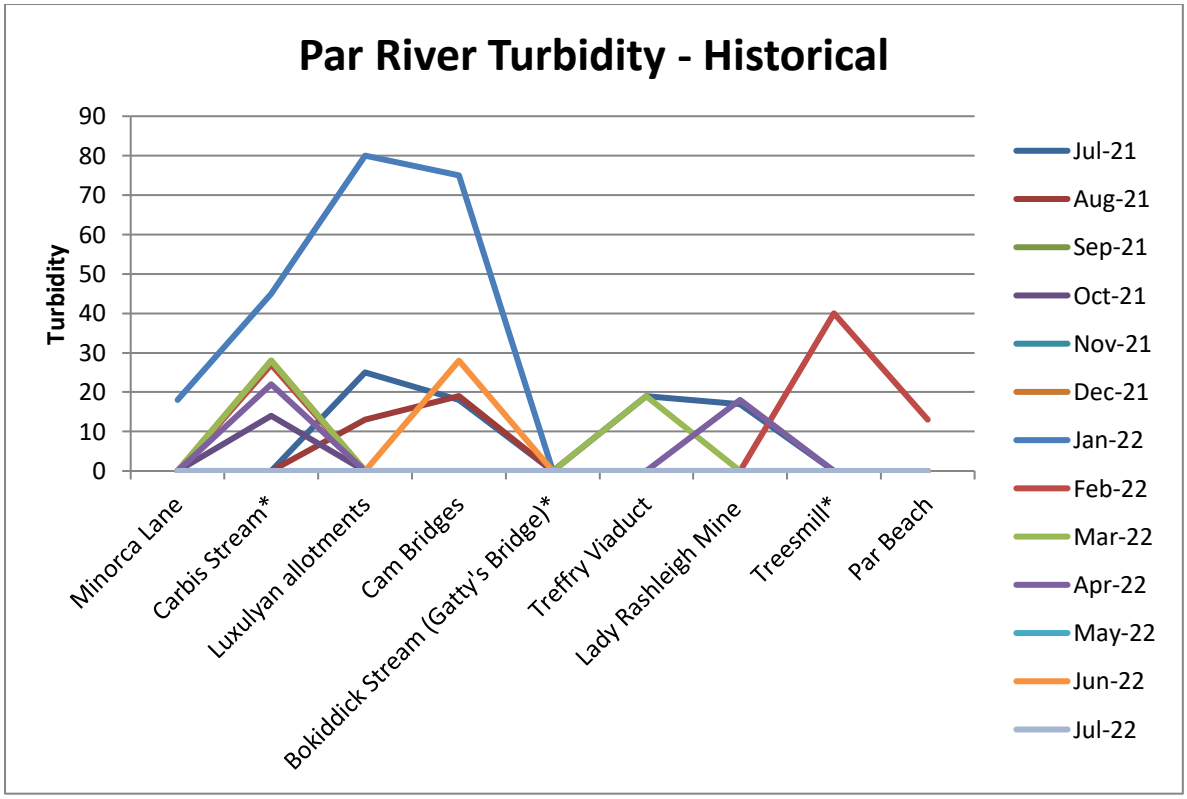
Par catchment results

3 Results July 2022

PAR RIVER/TRIBUTARY	LOCATION	Turbidity
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	0
Tributary	Treesmill, Tywardreath Stream, SX 08873 55385	0
Par	Par Beach slipway, SX 0776 53261	0



4. Historical data on turbidity:



F. 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:

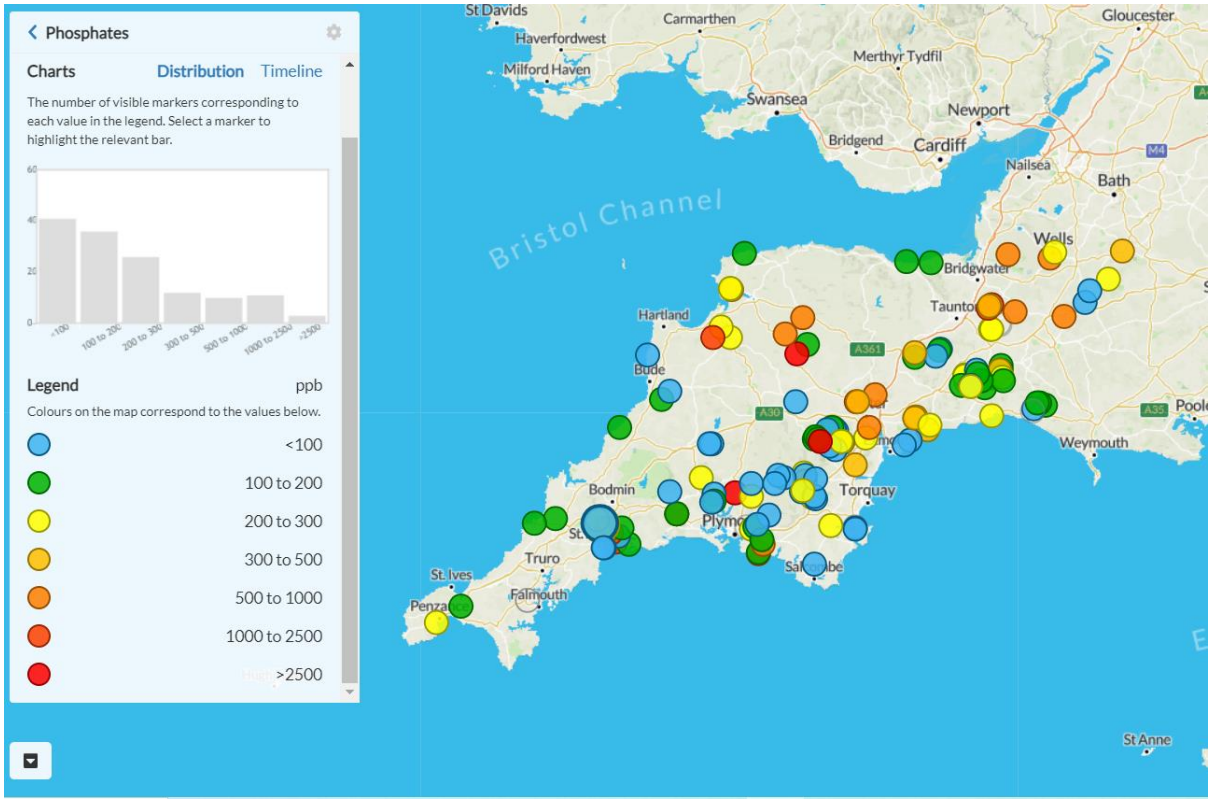
0 – 100 OK

200 – 300 HIGH

500 – 2500 – TOO HIGH

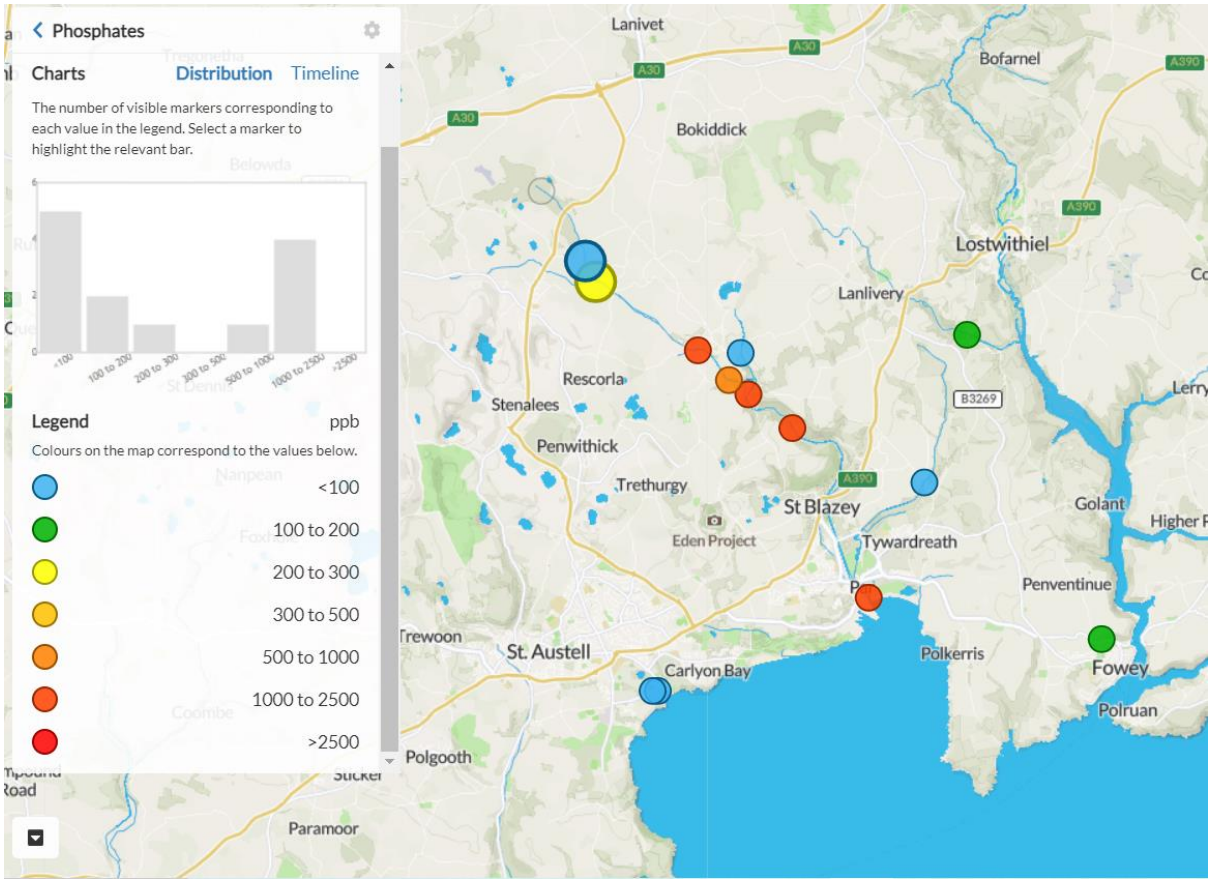
Phosphate levels were relatively low for the second month running. Levels at all sites monitored were OK according to the WRT guidance. Maximum scores of 2500 PPB have been recorded at some sites but these precede the date range in the historical graphs. They have been recorded on Cartographer.

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



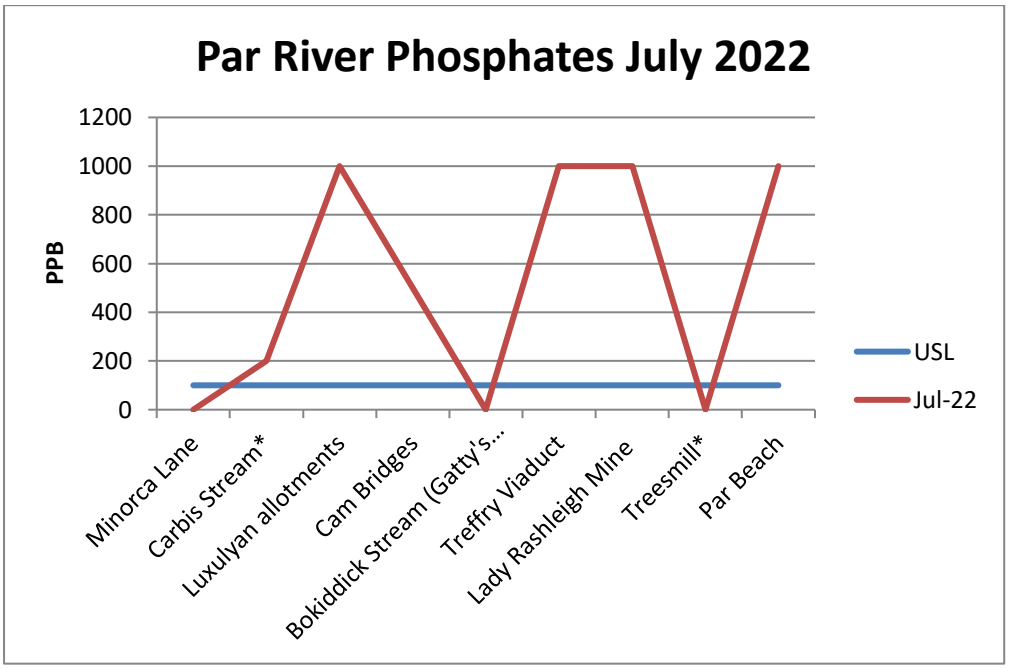
WRT Phosphates results for the region

The Par River does not seem to be such an obvious outlier because of its high phosphate scores but this seems to indicate it is a more widespread concern.



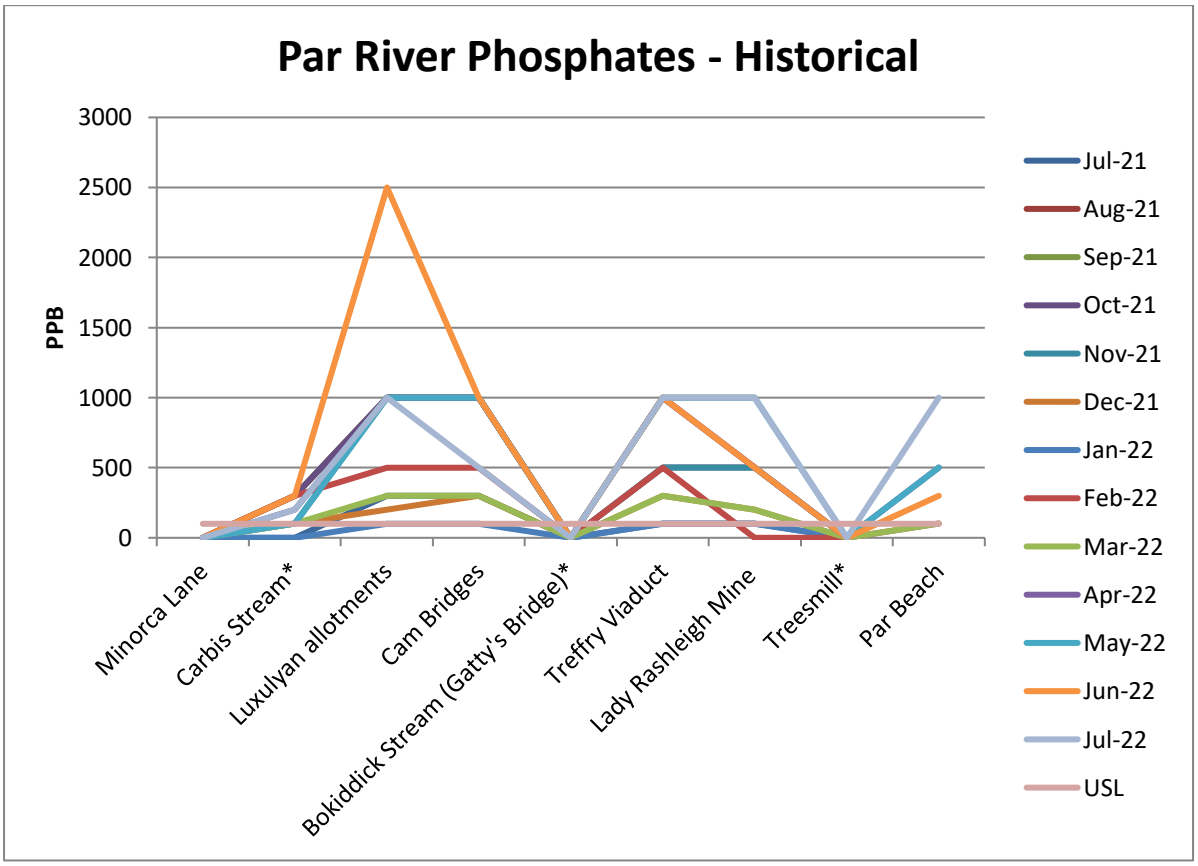
Par River Phosphate levels

PAR RIVER/TRIBUTARY	LOCATION	Phosphates ppb
Par	South of Minorca Lane, Par River, SX 02657 59788	0
Tributary	Carbis Stream SX 02834 59401	200
Par	Luxulyan allotments, Par River, SX 04732 58045	1000
Par	Cam Bridges, Par River, SX 05292 57454	500
Tributary	Gatty's Bridge, Bokiddick Stream SX 05531 57953	0
Par	Treffry Viaduct, Par River, SX 05650 57179	1000
Par	Lady Rashleigh Mine, Par River, SX 06451 56509	1000
Tributary	Treesmill, Tywardreath Stream, SX 08873 55385	0
Par	Par Beach slipway, SX 0776 53261	1000



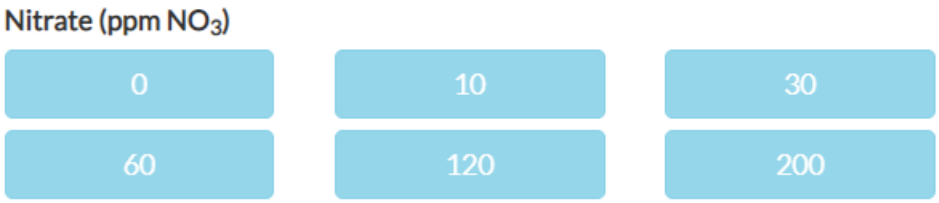
*indicates a tributary of the Par River. USL is 100 Parts Per Billion which, according to WRT, is the Upper Safe Level.

5. **Historical data on phosphates:**



G. NITRATES

1. The WRT kit has these ranges for nitrates:

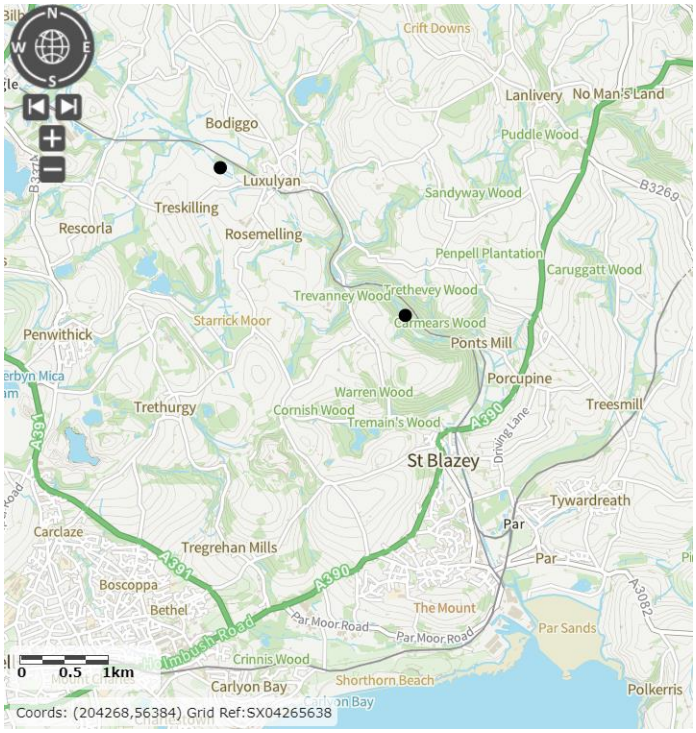


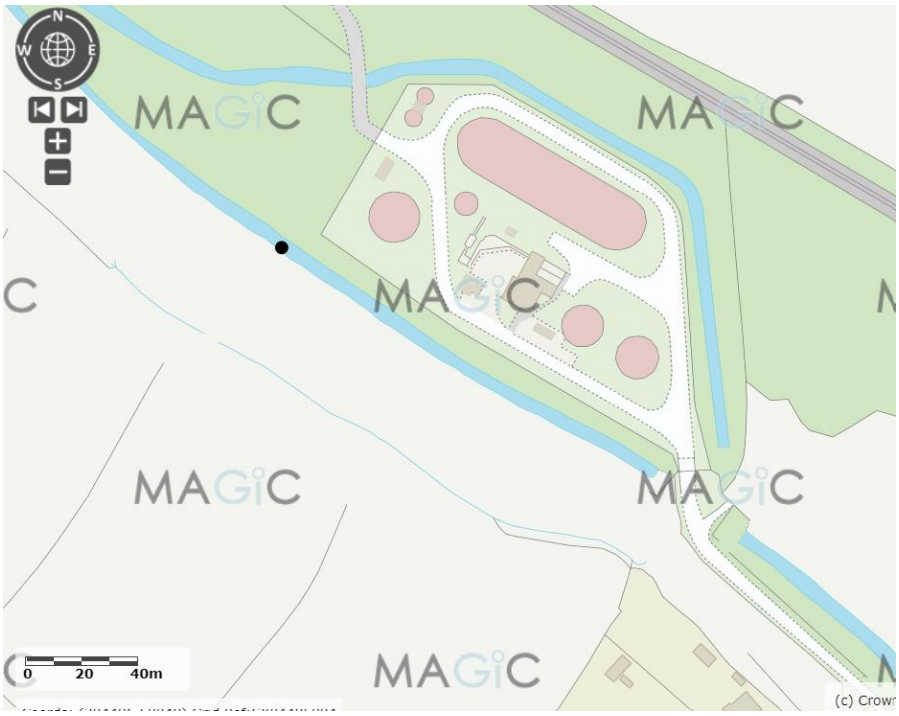
2. We have concerns about the sensitivity of the testing strips so did not carry out any tests this month.

H. OTHER OBSERVATIONS

1. **E.coli (EC) and Total Coliform(TC)**

Two samples were taken. One was at approximately SX 0429 5822, upstream from the St Austell North STW at Luxulyan; the other was at Lady Rashleigh Mine (SX 06451 56509).





The sample was taken upstream from the STW and so would not have been affected by the two outfalls, one of which is a Combined Sewer Overflow, and was not discharging, and the main one, which was (see photo).

(a) Key information:

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

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.

(b) Interpreting the 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**

(c) Bacteria results for a point on the Par River upstream from St Austell North STW. Produced by Joan Farmer:

Test for E coli and Total Coliforms.
Sample taken Upstream of Luxulyan Sewage Treatment Works near the Perimeter fence.
Sample taken 16/07/22. Read on Monday 18/07/22.

E Coli: 483 Very High Risk, Unsafe

Total coliforms: >1000 Very Unsafe.

This is the reading we usually get at Lady Rashleigh Mine, downstream of the STW.

(d) Historical results for Par River near Lady Rashleigh Mine compiled by Joan Farmer

This is our main monitoring point.

Aquagenx CBT EC=TC (Compartment Bag Test)

Surface and Recreational Waters

Par River near Lady Rashleigh Mine SX 06451 56509

Results are shown in MPN/100ml (Most Probable Number)

>1000 is the highest reading on the 32 row chart. 483 is the second highest number.

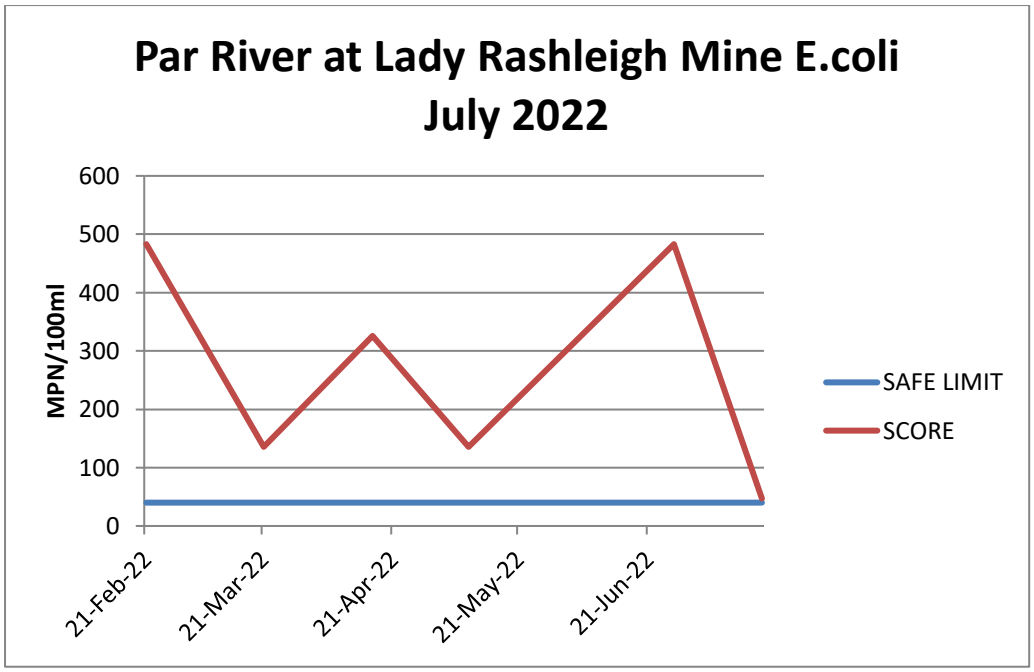
Sample Date	Rain? Notes	Result Date	Results E coli	Health Risk		Results Coliforms	Health Risk
21/02/22	Rain prev. 24hrs.	23/02/22 24/02/22	483 [1] >1000 *See text message attached **483**	Very High Unsafe Very Unsafe Very High Risk /Unsafe		>1000 >1000	V Unsafe V Unsafe
21/03/22	dry	24/03/22	136	High risk Prob. Unsafe		>1000 [2]	V.Unsafe
16/04/22	Dry and sunny. Rain previous day	18/04/22 Temp over 30 C	326	Very High Risk/ Unsafe		>1000 Def. blue In comp 4 and 5	V. unsafe
09/05/22	Dry	11/05/22	136	High Risk. Probably Unsafe		>1000 Def. blue	V.unsafe
27/06/22	Rain in previous 24 hrs	29/06/22	483	Very High Risk /Unsafe		>1000 Def. blue	V Unsafe
18/07/22	Dry	20/07/22	47	Low Risk /Possibly Safe		483	Very High Risk Unsafe

*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.

[1] Readings taken twice on the 1st sample as it took 12 hours to reach the minimum temperature of 25 degrees
[2] 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.

(e) Par River at Lady Rashleigh Mine (SX 06451 56509)

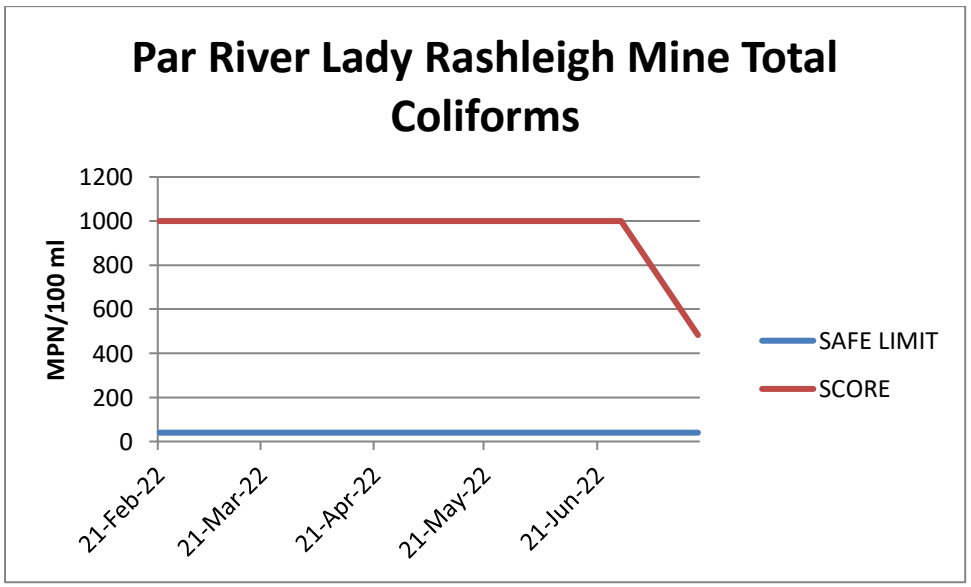
(i) E.coli was 47 MPN/100 ml, which is considered to be **Low Risk/Possibly Safe**.



N.B. The May survey date was 9th May but Excel is still very cooperative.

(ii) Total Coliforms

The reading was 483: **Very High Risk/Unsafe**.

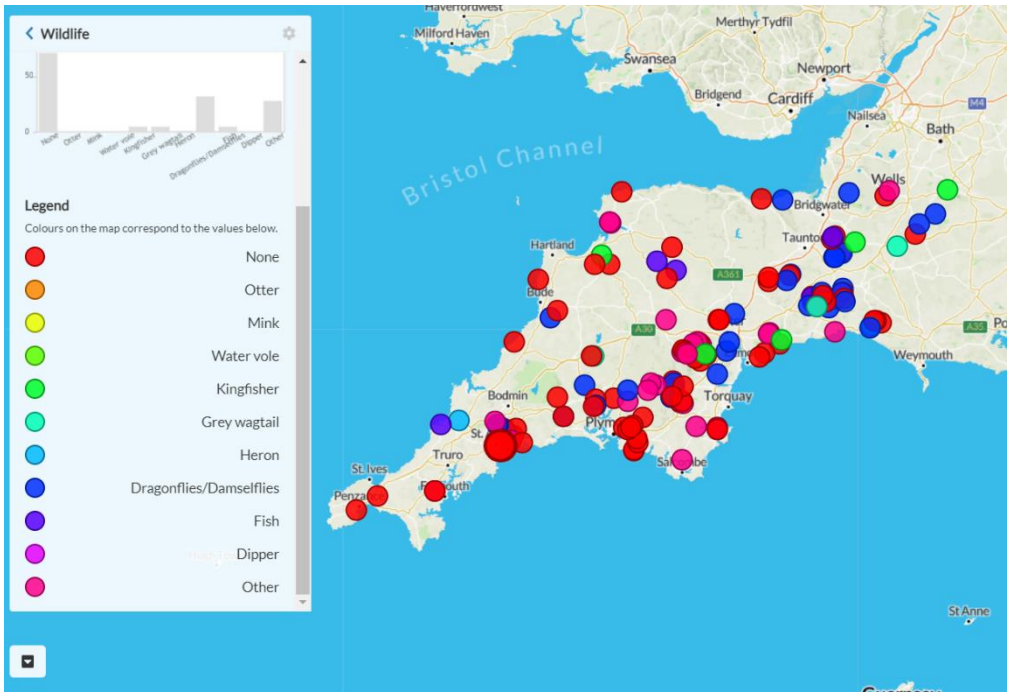


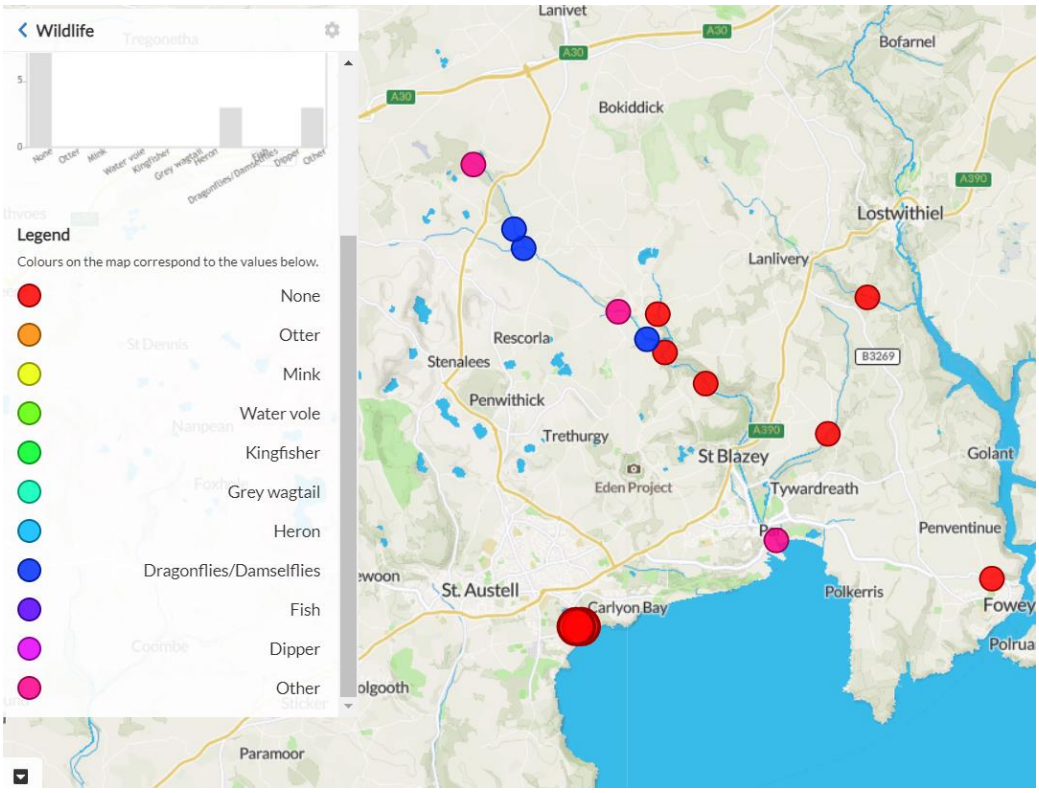
N.B. The survey date was 9th May but Excel was not being very cooperative. Also: The Aquagenx interpretation table has a category of >1000 MPN/100ml. This has been shown on the graph as 1000.

2. Wildlife

(a) Maps

Source: Cartographer.





Otter spraint is included, as usual, under ‘Other’ but not in all the places where it was found.

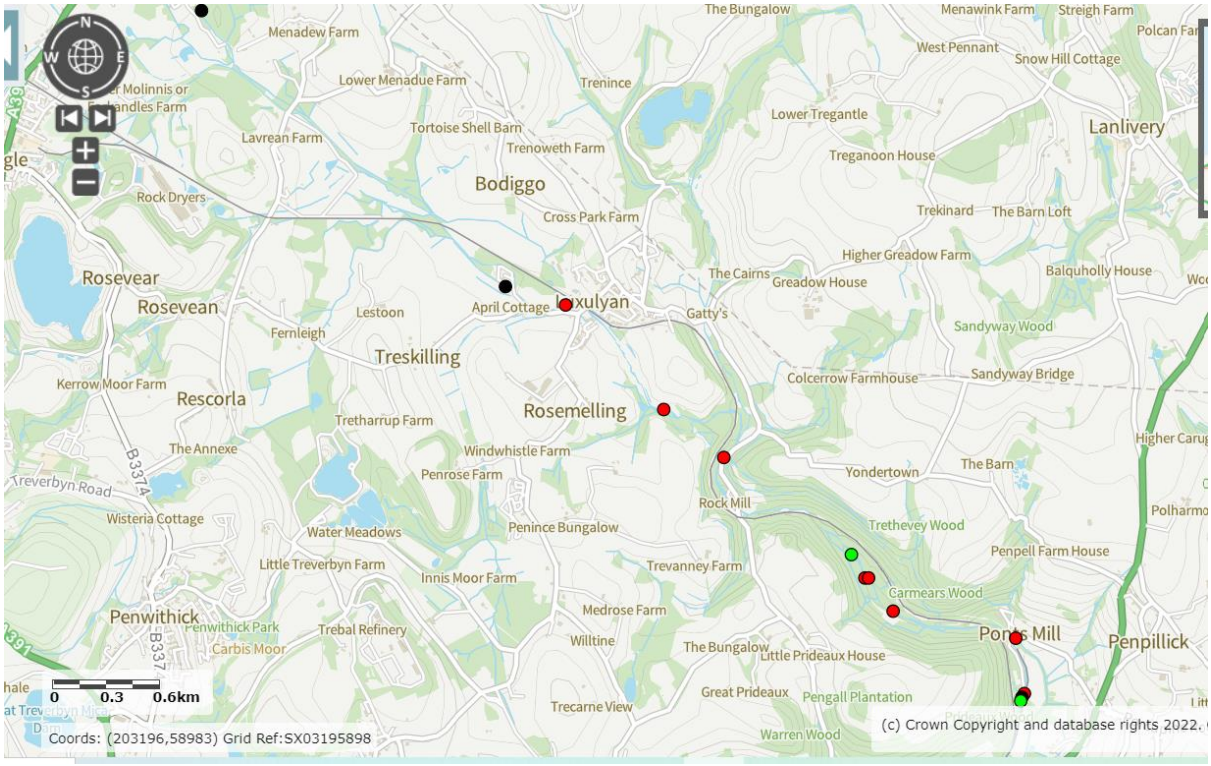
(b) Fish

Our group has rarely seen fish but this month was relatively successful. This is a very subjective, unscientific overview of evidence that we have gathered for the presence of fish. These are the types of evidence:

Black dot = Sighting

Red dot = Fish bones and scales in otter spraint

Green dot = Anecdotal evidence from talking to people fishing



Conversations with a range of local people show that a variety of fish, including trout, salmon and eels have been seen from Ponts Mill upstream to the Minorca Lane area. The consensus seems to be that numbers have fallen drastically, possibly following the two catastrophic pollution incidents in 2013. One fisherman believed that the colouring, and possibly the health, of trout varied, with fish from the Bokiddick Stream appearing to be healthier than those in the main river.

The following photograph is not of good quality but shows fish in the Par River downstream from St Austell North STW at Luxulyan. This is not the first time that they have been seen here. It is impossible to give an accurate figure but the number was in double figures. The fish appeared to be about 6” to 8” in length.

(Tiny fish still survive in the Fowey Consols leat even though it is currently almost dry.)

Fish in the Par River near St Austell North STW

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3. Otter survey:

A. SURVEY CONDITIONS

Date & time	16/7/2022, 18/7/2022
Surveyors	Roger Smith, Joan Farmer,
Areas surveyed	Par River from STW to Cam Bridges; Par River from Treffry Viaduct to Ponts Mill; Upper Par (Criggan Moors and Minorca Lane)
Weather	No rain
River level	Very low
River flow	Steady
Water quality	Too High phosphate levels at Luxulyan allotments (100 ppb). Also Too High downstream. There are also concerns about levels of E.coli and Total Coliforms upstream of St Austell North STW (Very High Risk/Unsafe and Very Unsafe respectively). E.coli and Total Coliforms at Lady Rashleigh Mine were lower (Low Risk/Possibly Safe) but the Total Coliform score was Very High Risk/Unsafe.
Other wildlife	Fish seen in the river near St Austell North STW on 16/7/2022 and upstream from Lavrean on 25/7/2022. Trout were caught (and released) in Luxulyan Valley by a local fisherman on 24/7/2022. A heron was seen at Lavrean on 25/7/2022.

B. EVIDENCE FOR OTTERS ✓

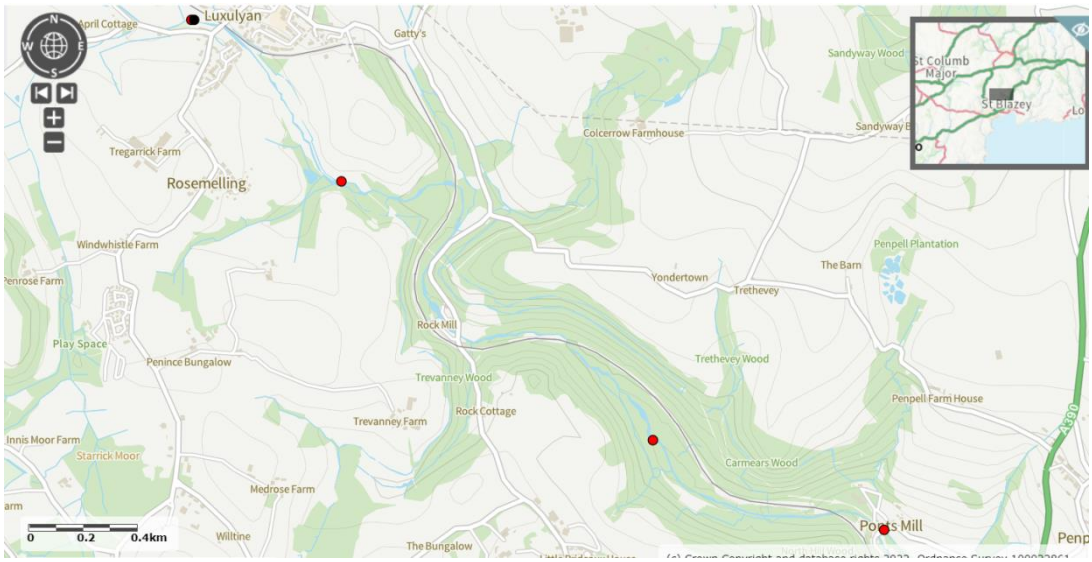
EVIDENCE	SEEN/ ORKS*	LOCATION	NOTES
Spraint - fresh			
Spraint – recent	✓*	SX 0530 5745 Boulder in river downstream from Cam Bridges	First time evidence found here.
	✓*	SX 07312 56164 Under canal bridge Ponts Mill	On boulder beneath bridge.
Spraint - old	✓*	SX 04747 58056 Luxulyan allotments boulder in river	Two spraints.
	✓*	SX 06456 56498 Lady Rashleigh Mine – boulder in river	
Anal jelly			
Sign heap			
Staining	?	SX 04747 58056 Luxulyan allotments boulder in river	Tarry deposit. Not sure it was from an otter.
Tracks			
Path			
Slide			
Holt			
Hover			
Couch			
Live sighting			
Corpse			

***Report sent to ORKS: https://erccis.org.uk/**

C. MAP

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

Red dots – definite evidence. Recorded on ORKS.
Black dots – possible evidence. Not recorded on ORKS.
Green dots – definite evidence but may have been recorded in the previous month, e.g. old spraint.



D. **PHOTOGRAPHS**

1. Staining (foreground) and old spraint on boulder near Luxulyan allotments (SX 04747 58056).

2. Recent spraint on boulder downstream of Cam Bridges (SX 0530 5745). This location has been checked on numerous occasions for the last 20 years or so but this is the first evidence of which I am aware.

3. Old spraint on boulder near Lady Rashleigh Mine (SX 06456 56498), which is a regular sprainting spot.

4. 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.

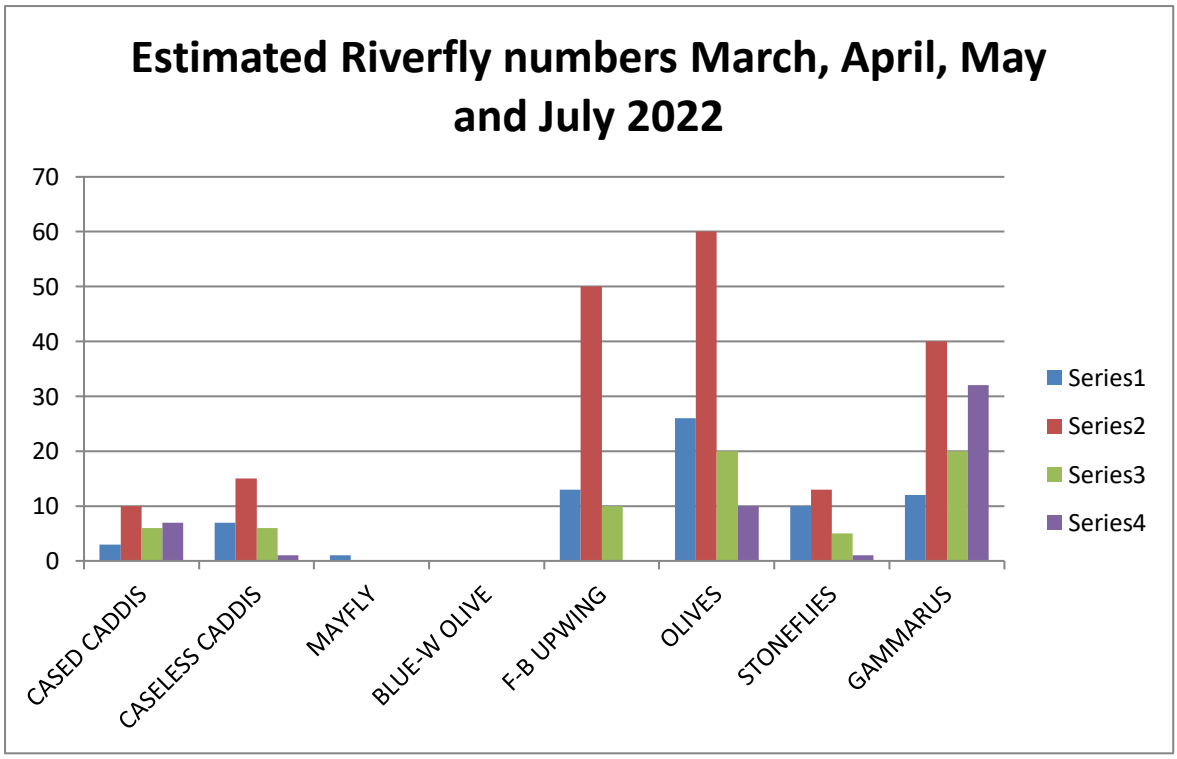
It is impossible to count every invertebrate so this counting method is used:

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

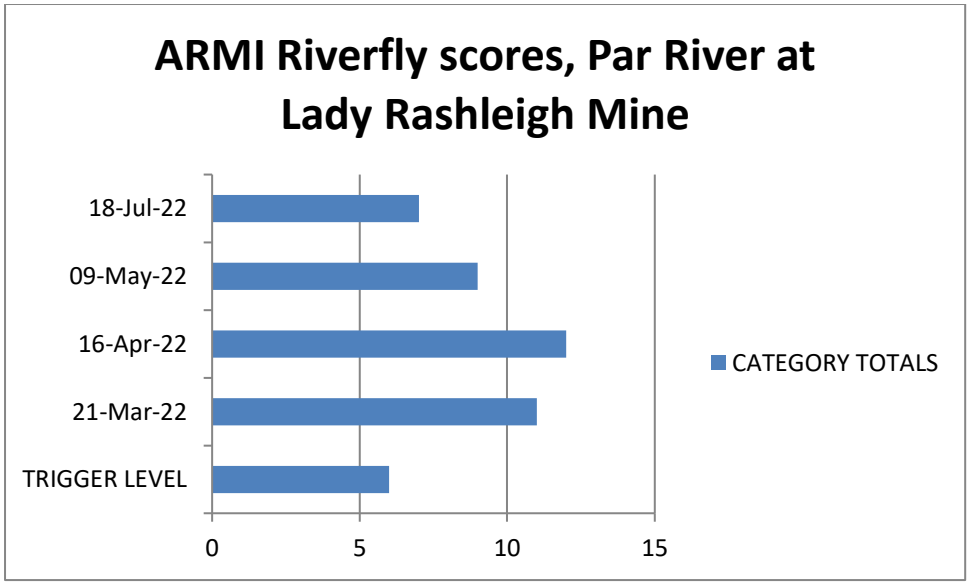
Results, 18th July 2022

	SPECIES	NUMBER	CATEGORY
Trichoptera			
1	**Cased Caddisfly**	**7**	**1**
2	**Caseless Caddisfly**	**2**	**1**
Ephemeroptera 3 tails			
3	**Mayfly (Ephemeridae)**	**0**	**0**
4	**Blue-winged olive (Ephemerellidae)**	**0**	**0**
5	**Flat-bodied up-wings (Heptageniidae)**	**0**	**0**
6	**Olives (Baetidae)**	**10**	**2**
Plecoptera 2 tails			
7	**Stoneflies**	**1**	**1**
Gammaridae			
8	**Freshwater Shrimp**	**32**	**2**
			7

CATEGORY TOTAL	**7**
TRIGGER LEVEL	**6**



Series 1 (21/3/2022); 2 (16/4/2022); 3 (9/5/2022); 4 (18/7/2022).



I. DISCUSSION

1. Positive observations.

(a) There was no visible evidence of pollution. Even in the Carbis Stream, which often is polluted with china clay, the water looked clear.

(b) Fish were seen near St Austell North STW at Luxulyan and upstream from Lavrean Bridge. Indirect evidence for the presence of fish came from otter spraint, plus anecdotal evidence for trout from a local fisherman.

(c) Once again, there was evidence of the presence of otters between Luxulyan allotments and Ponts Mill. Other wildlife included a heron (near Lavrean Bridge), dragonflies and butterflies.

(d) The E.coli reading at Lady Rashleigh Mine was lower than previously, being classed as Low Risk/Possibly Safe.

(e) On a purely subjective (yet arguably important) point of view, the water looked clear and aesthetically the river and its banks looked attractive with summer foliage. This was so not just in Luxulyan Valley but in less frequented stretches too. Two examples are shown in the following photographs.

(f) The riverfly score of 7 exceeded the Trigger level, which is 6.

(g) It is hoped that the Friends of Par Beach will start river monitoring near the beach. Cooperation between the two groups will be invaluable.

Looking downstream from Luxulyan allotments

Looking downstream from the sluice gates at Ponts Mill

2. Points of concern.

(a) Water temperatures were high. Even some of the lower ones may be misleading because they were taken early in the morning (e.g. Minorca Lane). Working on the rule-of-thumb

basis that anything above 18˚ Celsius makes life uncomfortable for fish, this may be of concern but expert advice is needed on this point.

(b) Yet again, phosphate levels from Luxulyan allotments downstream were Too High or High.

(c) Bacteria levels are unhealthy according the Aquagenx test, which is based on US standards for recreational and surface waters. Upstream from St Austell North STW at Luxulyan, the E.coli score was Very High Risk/Unsafe, while for Total Coliforms it was Very Unsafe. Despite finding a lower level of E.coli at our regular testing spot at Lady Rashleigh Mine, the Total Coliform score was Very High Risk/Unsafe.

(d) Although the Riverfly Trigger Level was exceeded, it was only by 1 point. The late discovery of a single stonefly allowed us to exceed the Trigger Level. Three species were not found: Mayfly, Blue-winged olive and Flat-bodied upwings. We don't know if this because of any change in water quality or was due to the survey taking place between breeding cycles.

(e) One of the problems of the Par River is that its course has been heavily modified, i.e. straightened, to the detriment of its biodiversity and also accelerating the speed of flow, particularly after heavy rainfall. Possibly some of this alteration took place a long time ago but near St Austell North STW and Bridges it is noticeable that the bed and banks have been encased in a heavy duty mesh. In places this has broken, possibly as a result of bank erosion, causing a build-up of vegetation and other material (and a hazard for anyone wading in the river).

3. Areas of doubt

(a) While we are able to interpret our phosphate readings (as being OK, High or Too High), we aren't able to make such easy judgements about temperature, total dissolved solids, or bacteria.

(b) We lack the expertise to explain certain observations, for example:

(i) What does the absence of 3 species of riverfly (Mayfly, Blue-winged olive and Flat-bodied upwings) signify?

(b) Presumably higher water temperatures are a result of global warming but what is the effect on biodiversity in the Par River?

(c) What is/are the source(s) of the high levels of E.coli and Total coliforms that our bacteria surveys have recorded (at various times) between Minorca Lane and Lady Rashleigh Mine?

(d) The 'beach' at Lady Rashleigh Mine in Luxulyan Valley is a popular spot for children and animals. Happily, we have seen or heard no evidence of anyone suffering ill health from the water here. Yet with the exception of the July reading

for E.coli, our bacteria results have been consistently poor according to US standards for surface and recreational water.

(e) We think that WRT has recently conducted a survey of the fish population. This will be very interesting in showing if numbers are as they ought to be for the river. Was there any attempt to re-stock fish after the 2 catastrophic pollution incidents in 2013?

(f) Given long term concerns about the impact on the river of the SWW St Austell North STW at Luxulyan, for example over phosphates and the decrepit infrastructure of the pumping station downstream from Bridges, would it be appropriate to make contact with SWW to find out what they do to ensure that the river is not affected negatively by their activities?

(g) Imerys has a permit to discharge into the Carbis Stream from its plant at Rocks near Bugle. It has not been possible to find the details of this permit. Any advice on how to do so would be appreciated because it might lead to efforts to review its terms. During the recent dry weather the Carbis Stream has not been white with china clay but it is likely that the pollution will resume once we get more rain.

(h) Although we have been able to cover much of the Upper and Lower Par, plus some tributaries, there are stretches to which we have no access. One significant section which would be of interest is between Lavrean Bridge and St Austell North STW.

Par River Monitoring Group, 3rd August 2022