Dore Citizens Science Catchment Report

June 27th – Sept 06th 2021

The **River Dore** ('the river of gold') rises in the foothills of the Black Mountains, on the Merbach Hills, a series of 4 springs along the hills, close to the border between England and Wales. It flows for 12 miles through the villages of Dorstone, Peterchurch, Vowchurch, Abbey Dore and Pontrilas, before reaching the Monnow near Llangua. The Upper reaches of the River Monnow flow south in a steep sided valley from its source through the villages of Craswall, Longtown and Clodock, following the border between Wales and Herefordshire and turning to flow in an easterly direction at which point the Monnow becomes a designated main river. The Monnow itself is a tributary which flows into the River Wye at Monmouth. The river is noted for its fishing, including trout and grayling. In 2006, the Game & Wildlife Conservation Trust initiated a programme to clear the river of invasive mink, and repopulate it with water voles.

The Westbrook, part of the Dore catchment, running along the base of the Merbach Hills, runs directly into the Wye.

The upper reaches of the River Dore and Pont-y-Weston Brook flow east and south where the watercourses confluence at Dorstone, continuing south at which point the River Dore becomes a designated main river north of Peterchurch. The Dulas Brook flows south parallel to the River Dore from its source close to Middle Maes Coed, through Ewyas Harold and along with the Worm Brook discharging to the River Dore near Pontrilas.

A team of volunteers, mainly representing residents of the Golden Valley and working as part of the Wye Salmon Association Citizens Science Water Quality Monitoring Team, supported by the Cardiff University citizens Science Initiative, concerned over the impacts of agricultural development on their glorious river and its flora and fauna, have since mid-June 2021, been monitoring the Dore and its tributaries.

See interactive map of monitoring locations at:
https://www.google.com/maps/d/edit?mid=1v7uIfeEQvsZmXG8kg0WCa-j5JkN9LjOd&usp=sharing

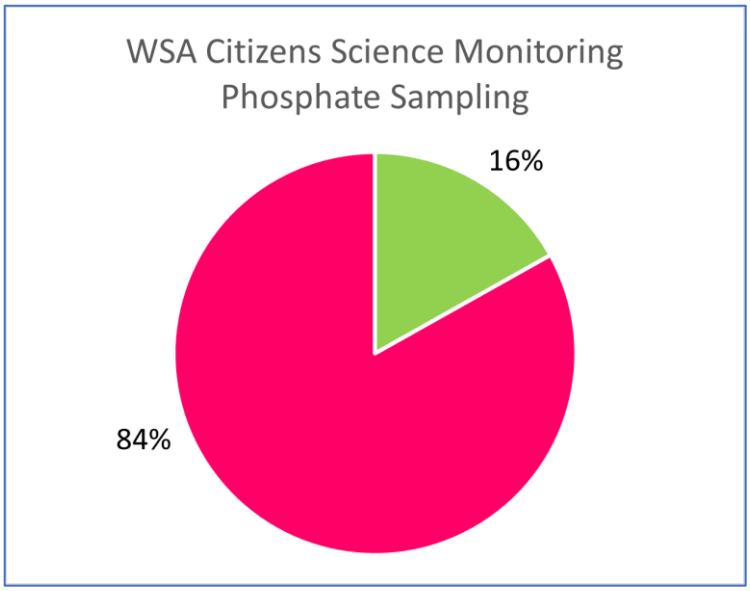
This report documents their findings to date, in particular with regards to phosphate….

Phosphate

Phosphorus is measured in rivers as phosphate. It exists in many forms in rivers and the simplest and most biologically available form is as single (called monomeric) negatively charged, phosphate ions. Environmental Quality Standard (EQS) targets set by regulatory bodies such as NRW and EA express target phosphorus thresholds in term of "phosphate as P", that is phosphate as phosphorus.

WSA Citizen Scientists use Hanna hand-held digital devices, colorimeters, to measure phosphate concentration, as these provide a reliable and accurate method. These measure & record data expressed as ppm phosphate. Standard determinand for assessing bio-available phosphorus in rivers is orthophosphate (as P). If citizen scientists wish to compare their data with regulatory targets, then it is necessary to compare like with like.

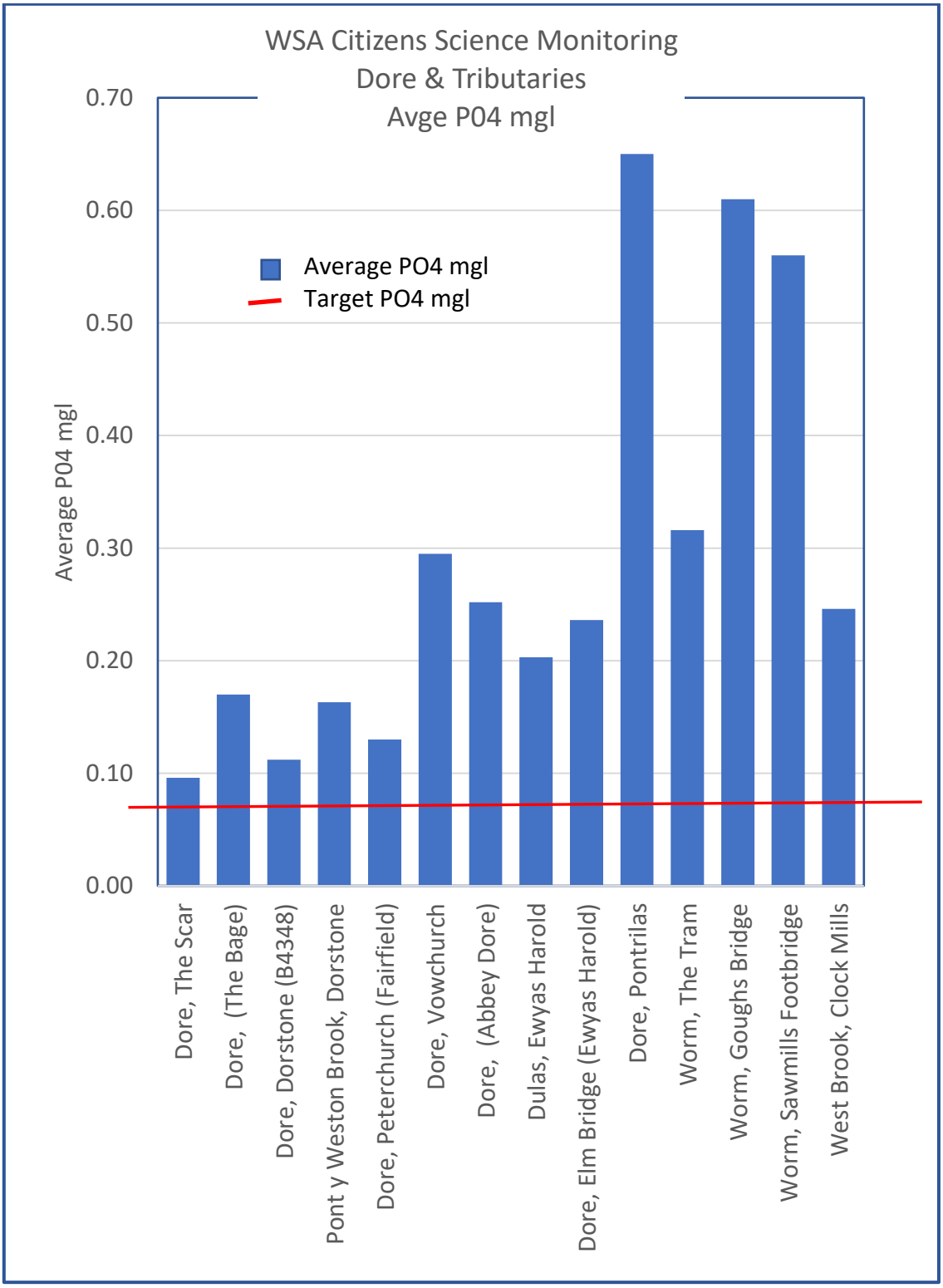
The molecular chemical formula for a negatively charged phosphate ion is PO4. This comprises one atom of phosphorus and four of oxygen. In total, this has a molecular weight of 95, of which the phosphorus atom weighs 31 and the four oxygen atoms 64.
To convert ppm phosphate to ppm "orthophosphate as P", multiply by 31/95 = 0.326. So, 0.2 ppm phosphate is equivalent to 0.065 ppm "orthophosphate as P (phosphate as phosphorus)". Similarly, to convert ppm "orthophosphate as P" to ppm phosphate, multiply by 95/31 = 3.06. So, 0.065 ppm "orthophosphate as P" is equivalent to 0.2 ppm phosphate.



Of the 106 samples taken to date 84% exceeded the EQS good water quality target of 0.025mgl P (0.077mgl PO4), ranging from 0 to 0.85mgl PO4 and averaging 0.25mgl PO4. All monitoring locations exceeded the target some by very significant (up to x8) levels.
Further examination appears to show that average phosphate values rise significantly as the rivers travel downstream. This is shown to be evident both on Dore and Worm, suggesting that there are likely to be numerous point sources.

On Sun 05/Sept local resident and volunteer Marian Wilding Jones walked the Pont y Weston Brook, a tributary of the Dore, travelling up the hill to its source, the Brook was too dry for testing but a great spot when the water comes back. She visited the Ford above Dorstone, describing 'the best water conditions seen this summer, recording 0.06mgl PO4. Three places in the village were tested however, with alarming results, 0.08mgl upstream, versus 0.20mgl in the middle and 0.30mgl the other side (below) the village. A sewage pipe was observed running into the stream, and she attempted to test where a biodisc was located but sadly

couldn't access the spot. Looking at the results, Marian seemed convinced that more than one lot of sewage is discharging into the river!



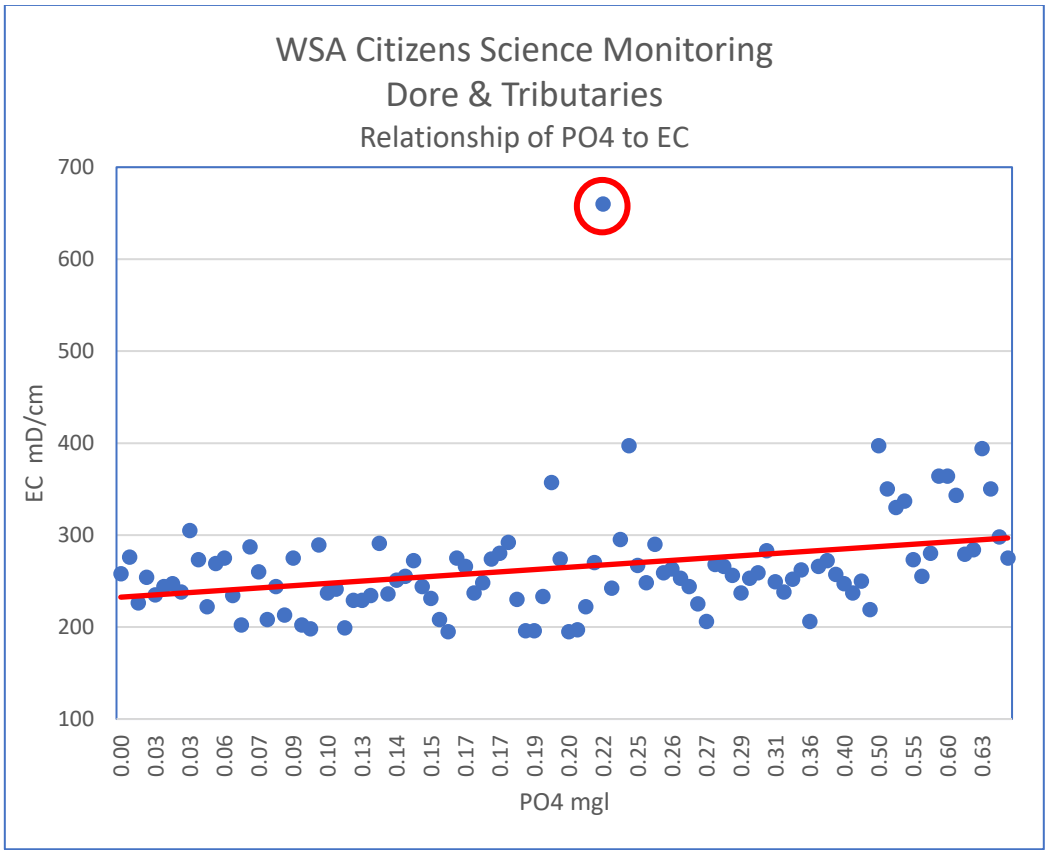
River	Location	Avge P04 mgl
Dore,	Dore, The Scar	0.10
Dore,	Dore, (The Bage)	0.17
Dore,	Dore, Dorstone (B4348)	0.11
Pont y Weston Brook,	Pont y Weston Brook, Dorstone	0.16
Dore,	Dore, Peterchurch (Fairfield)	0.13
Dore,	Dore, Vowchurch	0.30
Dore,	Dore, (Abbey Dore)	0.25
Dulas,	Dulas, Ewyas Harold	0.20
Dore,	Dore, Elm Bridge (Ewyas Harold)	0.24
Dore,	Dore, Pontrilas	0.65
Worm,	Worm, The Tram	0.32
Worm,	Worm, Goughs Bridge	0.61
Worm,	Worm, Sawmills Footbridge	0.56
West Brook,	West Brook, Clock Mills	0.25

Electrical Conductivity

EC or Electrical Conductivity of water is its ability to conduct an electric current. Salts or other chemicals that dissolve in water can break down into positively and negatively charged ions. These free ions in the water conduct electricity, so the water electrical conductivity depends on the concentration of ions. Salinity and total dissolved solids (TDS) are used to calculate the EC of water, which helps to indicate the water's purity. The purer the water the lower the conductivity. To give a real-life example, distilled water is almost an insulator, but saltwater is a very efficient electrical conductor.

Major positively charged ions that affect the conductivity of water are sodium, calcium, potassium, and magnesium. Major negatively charged ions are chloride, sulphate, carbonate, and bicarbonate. Nitrates and phosphates are minor contributors to conductivity, but they are very important biologically. Under some conditions, EC shows positive correlation with phosphorus concentrations. The natural impacts on EC in water are rain, geology, and evaporation. Human impacts include road salt, septic/landfill leachate, impervious surface runoff and agricultural runoff. Conductivity in streams and rivers is affected primarily by the geology of the area through which the water flows. Streams that run through areas with granite bedrock tend to have lower conductivity because granite is composed of more inert materials. Streams that run through areas with clay soils tend to have higher conductivity because of the presence of conductive minerals that are washed into the water from the clay.

A significant change in conductivity could be an indicator of a discharge or other pollutant entering the water. Conductivity varies with the water source, i.e., ground water, agricultural runoff, municipal wastewater, rainfall. A change in water electrical conductivity can indicate ground water seepage or a sewage leak.
The EC of water has a critical influence on aquatic life. Every kind of organism has a typical range that it can tolerate. In a commercial sense, testing the conductivity of water may be specifically useful for fisheries. Salts and other substances also affect the quality of water for irrigation or drinking, so water conductivity meters can be used when testing the output of water treatment plants.



EC data collected followed an expected pattern showing a positive correlation with phosphorus concentrations. The exception being the 660mS/cm recorded on the Worm at the Tram on 16/08. Other parameters (PO4, pH, temp) were not recorded as unusual and no water or climatic conditions were recorded to explain. Volunteers are requested to investigate further if large changes in EC are observed. Sampling above and below to try to ascertain likely root causes.

Prepared by Wye Salmon Association
06/09/2021