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NEWSLETTER

...from the Foundation for Water Research

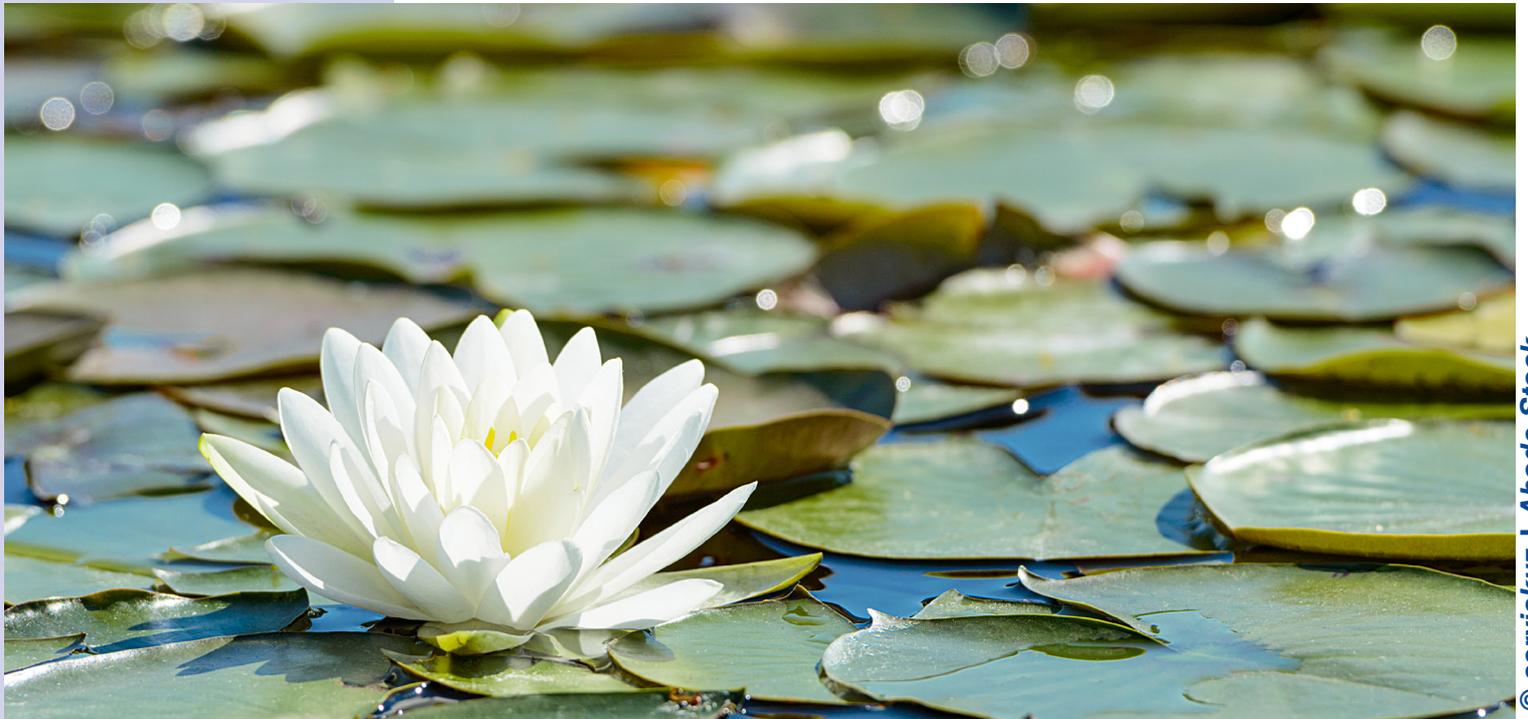
November 2022

Autumn Issue

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NEW CHAPTER FOR THE FWR



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Introducing the Institution of Environmental Sciences: planning for the future of the FWR

Welcome to this first edition of the FWR Newsletter, in its new home within the IES family. As a fast-growing, interdisciplinary and dynamic professional body, the IES is looking forward to continuing the important work of the FWR.

We will ensure that FWR research is brought to new audiences, and that the crucial topics in the water environment are viewed through a systemic and multi-disciplinary lens.

In future editions of this newsletter we will be updating the format to a more modern design. In addition we will shortly be announcing a series of webinars, the

launch of several technical panels, and many other water-related events and initiatives.

Water is having a turbulent time. It is high on the public agenda, with contested science and institutional accountability at the heart of an increasingly angry debate.



Carolyn Roberts
Vice President of the IES



Pollution and dead zones

In August this year there were toxic blue-green algal blooms in some of England's apparently most pristine lakes. This was cyanobacteria scum, toxic to humans and animals, building up year on year thanks to increasing nutrient concentrations, compounded by warming of the water in the lake. The Environment Agency has spent £700,000 over the past decade tackling cyanobacterial blooms. Similar dead zones are observable in major rivers such as the Severn, where fish have been killed and organic debris blankets the substrate. There are arguments about the source of the nutrients, with water companies blaming farmers and agricultural run-off, but farmers claiming water companies are too quick to point the finger. To everyone's frustration, the science remains uncertain.

Water quality in rivers and bathing areas is also under increased scrutiny. Only 14% of surface waters are in good ecological



condition. A statement in 2020 confirmed that not one river met the legal standard for good overall health, which includes chemical as well as ecological indicators.

The Environment Agency has called for imprisonment of people responsible for the most serious incidents, whether these be water companies or farmers. In that scenario, the science is likely to be vigorously argued.

The water companies are the focus of the combined sewer overflow (CSO) concerns. These overflows, combining foul water with rainwater, spilled on 372,544 occasions, resulting in 2.6 million hours of untreated sewage dumped last year – a minimum estimate, as many may pass undetected. As those conducting 'citizen science' in rivers observed, CSO events occurred not only in wet periods, but also in dry conditions, and sometimes regularly during each day or week. This is not how this system was intended to work, and the public are rightly asking what is going wrong.

The Environment Agency formerly assessed rivers annually, but now only once every three years, which makes it very difficult to get a true picture of the state of our rivers. The proportion passing the high or good standard has been falling over the last decade, and the number of water bodies assessed

each year has fallen by 20% also over the last decade. Ofwat have started funding a programme managed by the Rivers Trust and United Utilities to train 'citizen scientists' to monitor ten catchments, but this is experimental, not for legal compliance reasons. Similar adjustments have been made to the monitoring and display of information on bathing water quality, with Southern Water adjusting its mapping system so that not all releases of sewage are flagged up on published maps.

In the meantime, under the Water Framework Directive, the UK is supposed to reach good ecological status in all surface and coastal waters by 2027, a deadline already postponed twice. This is unlikely to be met.

Flooding

Flooding is a similarly depressing picture, on the increase despite commendable upstream-focused programmes by water companies and others, attempting to trap and infiltrate more rain in headwaters to reduce downstream flood events. There are experiments with beavers and rewilding, but obvious if mundane solutions such as sustainable urban drainage (SUDS) are still questioned. UKWIR's newsletter for Autumn 2022 promotes work to 'understand the costs, benefits, timescales and challenges of alternative solutions to decide whether to invest in SUDS over traditional grey infrastructure'.

Many scientists would argue that the time for such discussion is already over and will simply delay implementation,



whilst insurance claims rise. In London, it is inevitable that the Thames barrier will need to be replaced, in the face of rising sea levels and increasing storminess, and the planning horizon for this replacement is very long. In the meantime, the statistics weigh heavily on the organisations and residents based in Central London and the Thames estuary.

Water supply

From too much to too little – how to ensure resilience of future water supplies. This summer has tested all our willingness to reduce consumption – the extent to which ‘demand management’ is feasible will affect how much new supply infrastructure will be needed to build to meet the shortfall. All options are under consideration – trans-catchment networks and greater interconnectivity, new reservoirs in the south, and desalination (with its associated cost and carbon emissions). The Grand Union Canal, Severn and Thames links could be used as routes to transport water from wetter to dryer parts of the country – a revival of schemes first considered in the 1970s. But science tells us that there are associated risks

of transferring alien species across the country and introducing different water chemistries into receiving rivers.

Without both reduced consumption and increased supply, the hosepipe bans that are already relatively frequent are likely to increase in duration as climate change progresses. Meanwhile, 3 billion litres of water are lost every day through drinking water leakage, a problem that science and technology are finding highly challenging to address. All these issues are likely to result in increased costs for consumers, while water companies are under fire for the extent of their debt burden, their large pay-outs of dividends to shareholders, and the generous salaries of their Chief Executives.

Climate change will exacerbate all these trends, increasing unpredictability and uncertainty. Water presents genuinely ‘wicked’ problems, with incomplete knowledge, competing demands from stakeholders, and a rapidly changing physical and political landscape. There have been some successes. In the period 2017 to 2019, public water supply compliance with

the drinking water regulations was 99.95% and rising further: an example of clear science and sound delivery.

Concluding remarks

Sadly, overall, public trust in the governance of water is at an all-time low. We urgently need a deep and systematic understanding of the science to reduce the uncertainty embodied in these wicked problems and assist in the development of resilient solutions. This is where the IES will contribute, by mobilising our expert membership, and the audiences of the FWR, to illuminate, debate and influence the future for water. The articles in this newsletter touch on the some of the most important issues, and we look forward to your feedback and participation.

Professor Carolyn Roberts
Vice President of the IES



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WASTEWATER MATTERS

The state of our rivers and the pollution crisis

Oliver Grievson, FWR Wastewater Co-ordinator

Over the past two years, the coverage of the wastewater industry in England has been pretty much the centre of the headlines.

Never have storm overflows had as much attention as they have had during this time period. The water industry has been quite clearly put in the firing line and blamed for the woes of our river environments.

It is clear that our rivers are in poor condition and the UK is firmly on course for regaining its title as 'the dirty man of Europe', with polluted waterways and a lack of freshwater bathing. However, how have things changed? How have things

become so bad so quickly? The truth is that they haven't; the water industry is just monitoring a lot more than it ever has in the past.

So, what caused this problem in the first place?

The UK sewerage system - before changes were implemented in the 1970s - operated as a combined gravity system, meaning that both foul water (sewage) and rainwater used the same pipes, directing all the flow to wastewater

treatment plants for treatment. This has the benefit of flushing debris that collects in the sewer down to the plant so it can all be treated. As a result of having a combined system, there is a need for a relief valve, should the volume of flow become too high. The relief valve is a 'storm overflow' and should only be used when sewage is so dilute that it is practically rainwater.

The argument is that these storm overflows are being used far too frequently and the quality of river waters is consequently very poor. This can be seen in the report written by the Environment Audit Committee, published in January 2022.

This shows that our rivers are not in a good state, particularly with regards to

Biology

Fish

42% at good status

Invertebrates

76% at good status

Macrophytes and phytobenthos

45% at good status

Physical modification

Morphology

49% at good status

Flow regime

88% at good status

Water quality

Dissolved oxygen

82% at good status

Ammonia

92% at good status

Phosphorus

45% at good status

Hazardous substances

Chemical status

0% at good status

Chemical status excluding uPBTs

93% at good status

Figure 1. State of the water environment, taken from Environmental Audit Committee report on water quality in rivers. © Parliamentary Copyright House of Commons 2022

the biological status and the levels of phosphorus. The root cause of this has been firmly blamed on storm overflows as well as agriculture.

So, why the interest in storm overflows?

Firstly, in 2013, Richard Benyon – then the Minister for Natural Environment and Fisheries – directed water companies to monitor the vast majority of storm overflows. This was both the first time the policy had been released and the first time that storm overflows were monitored. All the work to monitor overflows was done within the last asset management period (from 2015-20), and when the results started to become known, there was a realisation that the way the wastewater network operated was less than ideal.

The monitoring showed that in 2020 there were over 400,000 overflows from the sewerage network, decreasing by 8% to 372,533 in 2021. Of course, this data is not for every consented overflow in the country and does not include the unpermitted overflows that have been raised in recent television programmes (Dispatches, August 2022).

So, what is the solution to the pollution crisis in rivers of the UK?

Firstly, there needs to be a reduction in the use of storm overflows by water companies. The wider water industry already recognises this.

Another solution might be investment in the issue and improved monitoring. DEFRA has released the storm overflow reduction programme, which has identified the need to invest over £56 billion over the next 25 years, as well as the need to monitor overflows up and downstream of discharge points, in line with Section 82 of the Environment Act.

However, all of this seems to be too little over a very long timescale, particularly given the current financial crisis. Yet unfortunately, if not resolved relatively quickly, the environmental cost will outweigh the financial cost. This is the balance that must be considered. What is sure is that the state of rivers in the UK will not move forward without some decisive action being taken.

Oliver Grievson
FWR Wastewater Co-ordinator

The Institution of Environmental Sciences

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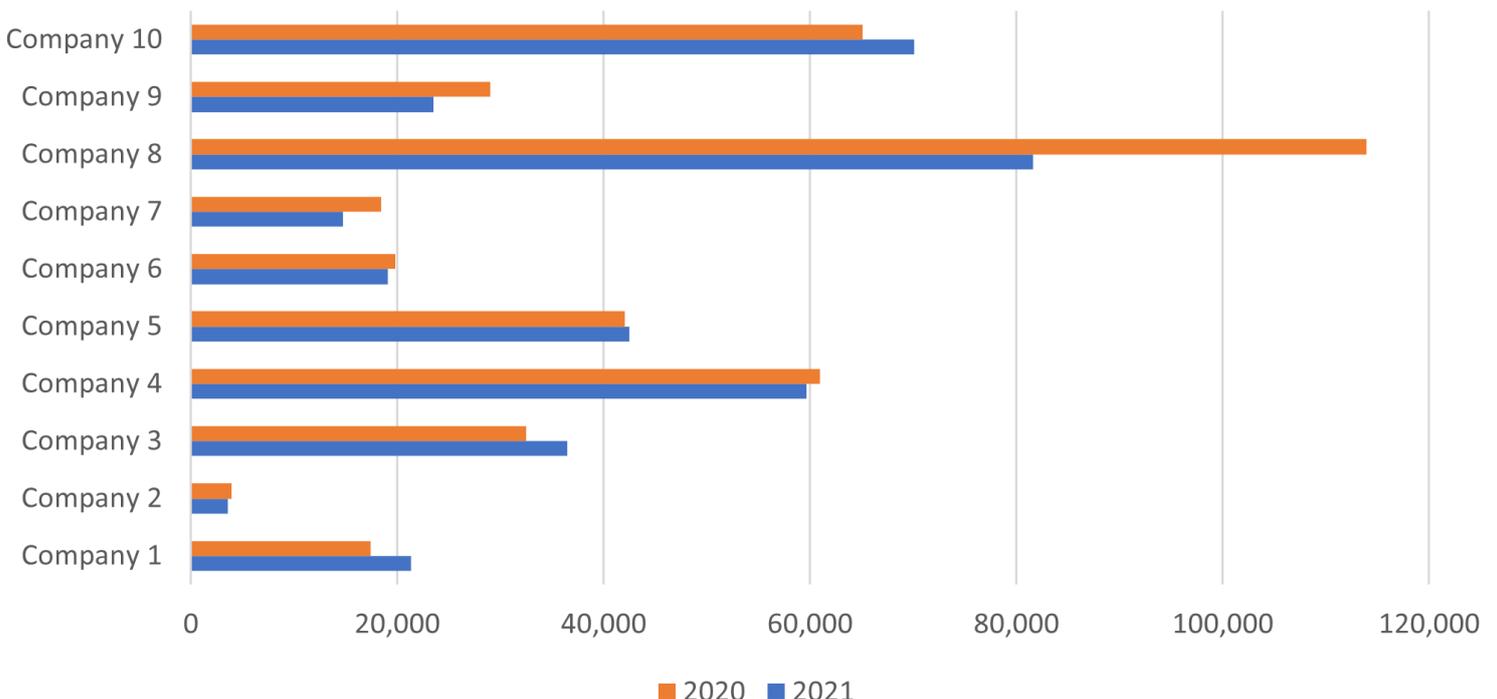


Figure 2. Storm overflows in England and Wales in 2020 and 2021

In pursuit of clean water

Ashley Smith, Founder of Windrush Against Sewage Pollution

Here begins a tale that may spark some recognition right across England – where only around 14% of rivers are in good ecological status – as well as in Wales, which has well-known problems, and even Scotland, which has also not escaped the grey hand of sewage pollution.

About 5 years ago, the shocking revelation that our rivers and seas were being used as dumping grounds for untreated sewage lurched into public view and was met by a mixture of alarm, horror and scepticism. Back then, there was still some respect for the reassurances from water companies, the Environment Agency (EA), and government, who told us that all was fine and, as undesirable as it was, it was only dumped as a safety measure to stop it from flooding our homes.

Since then, a tide of hard evidence has overwhelmed that largely false claim and shown that it really happens because water companies have profited from failing to invest in the adequate infrastructure and assets to do the job



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they are paid for, and the uncatered-for sewage has to go somewhere.

At the end of 2017, I founded Windrush Against Sewage Pollution (WASP, now a registered charity) and along with some of my neighbours set about fighting the decline of our local River Windrush. It had become clear that the EA was merely managing its demise and worse than that, it was normalising it.

Ever since, WASP and a growing number of small groups and national NGOs have been working at the sharp end of discovering and delivering the evidence required to bring truth into view. Our endeavours have brought the scandal to the public via BBC Countryfile, Panorama, ITV Tonight, Riverside, many more local and national news items, and countless newspaper articles. Without a relatively free press, we would have achieved nothing.

Groups like Surfers Against Sewage, the Angling Trust, Wild Fish, Ilkley Clean River, the hugely influential solo act of Feargal Sharkey, WASP, and many more, have been outspoken in the media. and growing public awareness brings alarm and impatience for change. The Rivers Trust has delivered an excellent resource in its interactive map¹, with which you can discover that you are never very far from a source of untreated sewage in England and Wales.

The ‘unchained’ groups have been most vocal and uncompromising. The restraint of the big NGOs in receipt of industry and government money is one topic that rises to the surface occasionally and an uncomfortable reality is emerging: working with the polluters and government has not delivered for people and the environment. While many worthy habitat improvement schemes have been delivered, they are no substitute for preventing the terrible pollution of the water that flows through them.

It is expensive for water companies to commit to fixing years of neglect, whereas it is relatively cheap to designate a few thousand pounds for groups working to improve riverbanks or conduct studies. The cheaper option can develop a relationship that groups on the receiving end do not want to sour, and it is here that the dangers of greenwashing become evident.

The events of recent weeks (including the aftermath of September’s mini-budget) and the threat of the removal of swathes of environmental protection should have come as no surprise, emanating as it has from a self-declared deregulatory government. This was the tipping point for some of the big players like the RSPB and the National Trust and if they will stand fast now rather than capitulate again into ‘collaboration’, which has so far led nowhere, we may see a real change

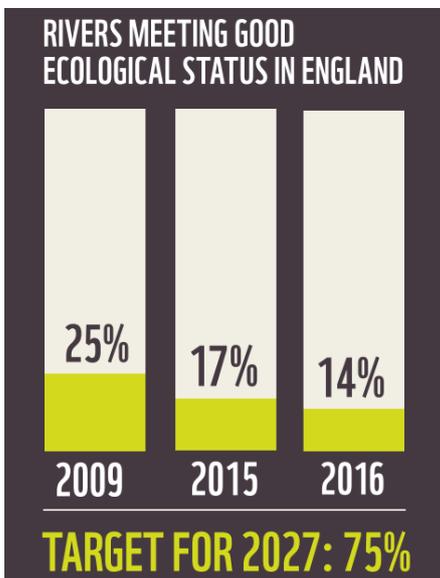


Figure 1. From WWF ‘Flushed Away’, 2017



Figure 2. WASP has used a variety of water quality sampling techniques to indicate the impact of point sources. © Ashley Smith

in the government’s attitude towards stopping pollution being profitable.

The much-hyped Environment Act of 2021 followed a bold attempt at a Private Members Bill by MP Philip Dunne, with whom WASP and other groups worked on what we all suspected would be blocked, as it was. However, it helped to develop public awareness, and the new law had to be drafted to respond to pressure from an increasingly disgusted public. Water and sewage pollution were specifically included.

The final stages of the Environment Bill saw Conservative MPs being forced by the government to vote down a crucial part extracted from Philip Dunne’s Bill: the requirement that water companies take all reasonable steps to end the dumping of untreated sewage. This led to claims that the MPs had voted to dump untreated sewage, irritating many of them. However, the reality is they blocked the means to stop it. Now, we must look at where that legislation leads us: to timescales as distant as 2050.

The Act means that illegal sewage spills identified as widespread by WASP’s Professor Peter Hammond will be allowed

to carry on unchecked if improvements in hard to quantify ‘impact’ can be demonstrated. Potentially effective law is being diluted and subverted.

Gaps in the EA’s capabilities create a void that seemingly is to be filled by citizen scientists. This in turn appears to be bringing funding of £7M for a monitoring project managed by the Rivers Trust. To put this in context, the simple upgrade of Witney Sewage Works (serving a population of around 45,000) to reach current demands is billed

at £8.8 million. In other words, it is a comparatively cheap price if it can buy the water industry time on failing outfalls; we hope the Rivers Trust will avoid this trap.

The project is seen by some as giving credence to citizen science and voice to the public. Our opposing view is that it is extremely unlikely to produce results worth the effort unless there are hard agreements on what triggers will invoke guaranteed action to stop pollution.

WASP has experienced problems in this area already with the EA and water industry, which is why we moved away from trying to prove impact and went straight to the heart of the matter: compliance with the law.

When WASP started asking difficult questions about the state of our local river, the EA soon tried to subdue our efforts and a presentation at our village hall painted a glorious picture of the River Windrush, quoting huge and varied invertebrate samples and abundant macrophytes – aquatic plants growing in or near water. The clear evidence of eutrophication; the effect of excess nutrients was ignored. They are set out in the following slide sourced from the Agency itself.

River with high plant nutrient concentrations

- Water often cloudy
- Often beds of accumulated sediment
- Abundant filamentous algae
- Prone to over-night oxygen sags
- Low plant diversity, reduced habitat for aquatic animals

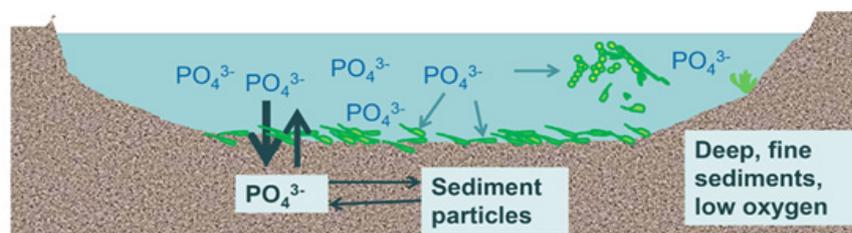


Figure 3. Environment Agency slide

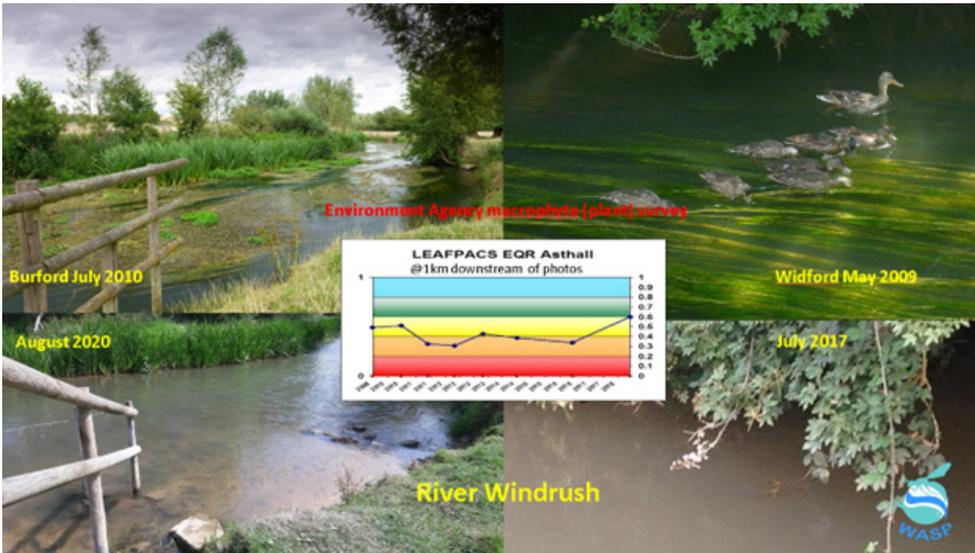


Figure 4. Images taken in the same locations at the same time of year. © Ashley Smith.

Pre-armed with expert knowledge and the evidence of our own eyes, we questioned why the presentation was based on a stretch of river upstream of the damaged river we were talking about. We asked for the data relating to stretches where we saw a very different scene.

When we requested an up-to-date survey of the plants we had seen disappear, we were presented with written evidence that showed that the macrophyte abundance and variety were bafflingly slightly better than when they were photographed ten years before, as can be seen in the comparisons in Figure 4, along with the EA graph.

We were asked to disbelieve the evidence of our own eyes and accept the view of the Agency which we were told (off the record) had counted more bankside plants to make up the numbers.

Aquatic invertebrates are also regarded as good indicators of pollution events in rivers which soon pass downstream after discharges cease. The presence and population levels of species with variable tolerance to pollution can tell the tale of what has happened either as acute or chronic events. There are extremely thorough sampling techniques in which the bugs are killed, preserved, identified and counted and a more practical version called Riverfly monitoring. In this nationally established method,



Figure 5. Riverfly extreme: ecologist Vaughan Lewis taking an invertebrate sample during a lengthy untreated sewage spill near Witney. © Ashley Smith.

trained volunteers collect 3-minute 'kick samples' from the riverbed and identify and count groups of invertebrates.

A survey conducted for us by an extremely experienced Riverfly trainer showed a shocking decline from the upper to the lower River Windrush. However, the EA team would not recognise it as valid, instead relying on its own incomplete and far from current evidence which painted a far rosier picture.

Our scepticism of the likely action following citizen monitoring is therefore evidence and experience-based.

We also have direct knowledge of a series of events in which demonstrably inaccurate reports have been accepted by the Environment Agency without challenge.



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The fact that the regulator is willing to accept clearly dubious and downright dishonest reports from the water industry, but unwilling to engage with citizen evidence that does not accord with its narrative, confirmed to us that we had to focus efforts where the law was strong and we could obtain incontrovertible evidence.

Luck dictated that my neighbour, Professor Peter Hammond, is a mathematician who had worked at the Big Data Institute in Oxford. He obtained 15-minute interval flow data measured by water companies. This opened a vivid picture of what was going on behind the scenes, and we have since combined his analysis and other evidence to expose the way in

which the companies behave both operationally and financially.

Peter has used artificial intelligence² and more conventional techniques^{3,4,5} to identify hitherto unreported and illegal pollution events in huge numbers far exceeding those found by the EA. His work was recognised by the recent House of Commons Environmental Audit Committee report as superior to that undertaken by the Agency⁶. It undoubtedly led to the current investigation of all water companies for failing to treat the required volume of sewage before dumping the excess – the cause of so much pollution.

The exposure of this illegality and the serious failures of the regulators both environmental (EA) and economic (Ofwat) could now force serious demands on the shareholders of the companies to make them obey the law, particularly as every year the Boards of Directors of the companies have signed off that they have had sufficient funding to do so. The groundwork has been done but public pressure is what will force government and regulators to act rather than give in to industry protestations which are all about keeping profits flowing.

So, we come full circle to the adoption of citizen science sampling which, while giving a clearer and more accurate picture of the state of our waters may, used wisely, drive change but may also be insidiously used to defer compliance with the law and to engage and muffle the voices of motivated people who may otherwise be heard demanding an end to illegal sewage pollution.

We all want clean waters but where there is a lot of money at stake, we can expect aims to protect the environment to be undermined if they eat into profit. We have already witnessed this with the weakening of the Environment Act. How the environmental sector defends



Figure 6. *Nocardia* foam – filamentous bacteria which cause problems in sewage treatment processes and was linked to very poor effluent at Bampton in Oxfordshire. This was recorded as natural foam by water industry consultants but easily and conclusively attributed to the sewage works when WASP placed floating plastic pipes up and downstream of the outfall.
© Ashley Smith.



Figure 7. Downstream of the sewage outfall within minutes of deployment. The upstream pipe remained clear. © Ashley Smith.

against further damage cannot be left to chance and needs to be planned intelligently and with an eye on the true goal: clean rivers and seas. The recent alliance of the Wildlife Trusts and other NGOs shows promise, but they have a long way to go to match the determination and expertise of companies polluting for profit.

Ashley Smith

Founder of Windrush Against Sewage Pollution

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