ENVIRONMENT ACT 2021 - RIVER MONITORING REQUIREMENTS

This article will outline the water quality monitoring requirements of the Environment Act 2021, and discuss some of the issues that need to be addressed in the development of monitoring networks. The author, Dr Liam Goodes, works for OTT HydroMet which includes the trusted product brands of Hydrolab and Sutron, but some of the solutions discussed are delivered by sister company Hach.

Background

In its 25 Year Environment Plan, issued in 2018, the Government pledged to deliver cleaner air and water, to protect threatened species and to provide richer wildlife habitats. It promised to secure clean and plentiful water by 'improving at least three quarters of our waters to be close to their natural state as soon as is practicable'.

In addition to storm overflows, river water quality can be affected by a variety of factors including agricultural and industrial pollution.

Many wastewater treatment plants are unable to cope with the volumes generated during periods of high rainfall, so wastewater is allowed to 'spill' into watercourses. However, the volume of water entering the drainage system can be reduced by measures such as sustainable urban drainage systems (SUDS) and natural flood management (NFM). So, this is not just an issue for the water and wastewater sector; it is vitally important that other sectors also play their part – these include government, highways, local authorities, drainage boards, agriculture, developers, industry etc.

The Environment Act 2021 was the first major piece of environmental legislation to be enacted following the UK's departure from the EU. The Act aims to improve air and water quality, tackle waste, increase recycling, halt the decline of species, and improve the natural environment. It provides the Government with powers to set new binding targets for water quality, air quality, biodiversity, and waste reduction. The Act also established the Office for Environmental Protection (OEP), which will hold the Government and other public bodies to account.

At the same time as the Environment Bill was progressing through parliament, the cross-party Environmental Audit Committee (EAC) was conducting its own investigation which culminated in the publication of a report titled: 'Water quality in rivers'. This report made a number of recommendations that related to monitoring, and some of these were included in the Environment Act 2021. Philip Dunne MP, Chair of the EAC, said: "You can't improve the quality of our waterways unless you know how bad they are to start with, and unless you can measure progress against a baseline."

Water and sewerage companies (WaSC) are already required to install Event Duration Monitors (EDM) at storm overflows, but the Act imposes a requirement to continuously monitor water quality upstream and downstream of discharges, so that, for example, pollution alerts could be provided to regulators and the public.

The EDM data for 2022 storm overflows was published in March 2023. It showed that the ten WaSCs in England have 14,580 storm overflows, and that 91% of these were fitted with EDMs. On average, each overflow spilled 23 times for an average of 5.8 hours.

Around 89% of storm overflows discharge to rivers; 10% to coastal and estuarine waters, and 1% to groundwater.

Environment Act 2021 monitoring requirements

In section 81 of Part 5 (Water) of the Environment Act 2021, sewerage undertakers wholly or mainly in England are required to report on discharges from storm overflows in near-real time (within one hour). This EDM data will show where the discharge to the environment happened, when it started and when it ended.

Data from EDM improves visibility of sewage discharges into rivers and watercourses and helps sewerage companies to better understand where improvements can be made. EDM also helps the Environment Agency to monitor the performance of water companies. However, EDM does not provide any information on the volume of the flow, or the effects on the receiving waters. One of the main purposes, therefore, of Section 82 is to determine whether storm overflows have affected water quality, and to make this information available in real-time.

Section 82 of the Environment Act 2021 reads as follows:

(1) A sewerage undertaker whose area is wholly or mainly in England must continuously monitor the quality of water upstream and downstream of an asset within subsection (2) for the purpose of obtaining the information referred to in subsection (3).

(2) The assets referred to in subsection (1) are—

(a) a storm overflow of the sewerage undertaker, and

(b) sewage disposal works comprised in the sewerage system of the sewerage undertaker, where the storm overflow or works discharge into a watercourse.

Sensor array of the Hydrolab HL7 multiparameter sonde

(3) The information referred to in subsection (1) is information as to the quality of the water by reference to—

(a) levels of dissolved oxygen,

(b) temperature and pH values,

(c) turbidity,

(d) levels of ammonia, and

(e) anything else specified in regulations made by the Secretary of State.

Defra Consultation: implementing Sections 81 and 82

The implementation of the Act's monitoring requirements has prompted a number of important questions, and it is anticipated that Defra will respond to these issues by publishing appropriate technical guidance.

The consultation ran in May 2023, and sought the views of invited consultees on issues such as measurement parameters – whether it would be possible to monitor phosphates and nitrates, and whether ammonia or dissolved oxygen should be used to determine the maximum point of harm. Consultees were also invited to submit comments and suggestions relating to the location of downstream monitors, exemptions and the definition of a cluster – a group of discharges that are sufficiently close for just one pair of monitors to be necessary. Importantly, the consultation also sought views on the ways in which data could be managed and displayed.

Water quality monitoring networks – issues to consider…

1. Timing

When asked about the anticipated timing of monitor installations, Philip Dunne MP said: "During the next pricing review period, which begins in January 2025, we will start to see these monitors being installed, and I would hope by the end of that five-year period we should have close to full coverage of the outfalls which need to be monitored."

In the short-term it is likely that WaSCs will wish to conduct pilot monitoring projects in the locations of greatest priority. These locations will be those that are already used for bathing purposes or for other water-based recreational activities such as fishing, canoeing, kayaking, sailing etc.

2. Measurement Equipment

Mains power and communications may not be available at many measurement sites, so the monitors will need to be low-power; to run from solar panels, and offer flexible communication options. These challenges have faced the Environment Agency for decades and have resulted in the development of portable and kiosk-based monitors that rely on multiparameter water quality sondes.

OTT HydroMet remote water quality monitoring station for long-term deployment

There are two main options for sonde deployment. (1) directly in the river, attached to a structure and protected by a stilling well. (2) inside a flow-through chamber, testing pumped water samples.

Ideally, it should be possible to install the monitors without the requirement for capital works. This lowers costs and speeds up installation times. It also allows flexibility in the choice of monitoring location because it would be simple to move the monitor if necessary.

HACH WQM Kiosk

In most lowland situations, multiparameter sondes such as the Hydrolab HL4 and HL7 will be appropriate for ammonia measurements. However, in some situations, such as upland rivers, greater sensitivity will be required, so the HACH Amtax SC Ammonium Analyser may be more appropriate.

The monitoring parameters required by the Section 82 will detect most pollution incidents, but if further investigation and laboratory analysis is likely to be necessary, it would also be possible to install a water sampler that could be triggered in the event of a pollution incident.

3. Datalogging and Communications Equipment

Most multiparameter water quality sondes also feature internal dataloggers so that data can be stored locally. However, in order to leverage the value of the data, it should be possible to transfer raw data and processed data (averages, maxima, minima, calculated values etc.) to a central server in almost real-time.

Sutron XLink 500 transmits water quality data back to the office via cellular or IRIDIUM® satellite.

These sondes should also be able to issue alerts when pre-set conditions arise.

The method by which routine data and alarms are transmitted is likely to vary from site to site. In most locations cellular communications will suffice, however, coverage in remote locations can be poor so it should also be possible to utilise alternative methods, using OTT and Sutron technology such as radio or IRIDIUM® satellite.

4. Data Management and Display

The challenge for data management and display will be (1) the volume of data from such large numbers of continuous monitors, (2) extracting useful insights from the data, and (3) being able to present the data to stakeholders with different needs.

WaSCs will be able to extract a wide variety of useful insights from the data, such as:

- baseline water quality over different seasons
- the level of harm (if any) of different outfalls
- influence of other pollution sources
- pollution alerts
- data to inform investment at wastewater treatment sites (especially smaller sites)
- protection for drinking water treatment plants

The data should also provide visibility of water quality for the public. Here, a traffic light display is likely to be more useful; helping river users to determine, for example, if it is safe to swim. However, the public should also be provided with an opportunity to drill down to measurement values in almost real-time.

Aquarius water data management software is being used to gather, manage and display data from thousands of measurement points in other countries, so it would be a good candidate for becoming the 'National Environment Data Hub' referred to by Water UK in May 2023.

AQUARIUS cloud-based software provides alerting and public notification for events like toxic algal blooms

5. Service and Calibration

Many storm overflows are located at remote sites, so monitoring equipment should be able to operate unattended for extended periods of time. However, it will be necessary for sondes to be recalibrated regularly in order to maintain data quality.
The sensor with the shortest calibration period is usually the ammonium ISE sensor, from which total ammoniacal nitrogen can be automatically calculated using values from the pH and temperature sensors. Typically, this sensor requires recalibration every 4 to 8 weeks. This work could be undertaken in the field, but most practitioners simply swap sondes in the field with pre-calibrated sondes, and return the field sonde to a laboratory. This provides an ideal opportunity for sondes to be checked, cleaned and recalibrated. This will necessitate investment in calibration laboratories and sufficient service engineers to conduct site visits at the required frequency.

OTT HydroMet Service

6. Site location

Practical considerations will vary from site to site. For example, landowner permission may be necessary at some sites, and at others there may be vandalism or theft concerns, dictating that the sonde will need to be submerged out of sight. The optimal monitoring location should be chosen to ensure that the difference between upstream and downstream water quality is accurately measured. However, flexibility will be necessary to accommodate site variability.

Naturally, the location of the downstream monitor is of particular importance; it should be located at the first suitable point downstream. To ensure data validity, the downstream monitor must not be more than 500m downstream from the point of cross-sectional mixing of the target discharge outlet.

Of the four statutory parameters, the maximum point of harm arising from ammonia is to be used as the key determinant for siting decisions. Ammonia was selected as the determining metric as it should be easier to identify the point of maximum harm, which is the first point of full cross-sectional mixing.

The Defra consultation also listed the local factors that should be considered:

- river features or geography, including catchment type, variable annual flow, sources of dilution, and sources of diffuse pollution;
- the influence of other pollutant sources or significant sources of dilution on the end data; and,
- health and safety considerations for access for maintenance or repair.

7. Leveraging the value of the data

Naturally, the availability of real-time continuous data will provide all stakeholders with a clear understanding of river water quality at any moment in time. It will also enable the water companies to target and schedule improvement measures, and to subsequently check the success of improvement measures.

Conclusions

The size and complexity of the new monitoring requirements will impose a requirement for cooperation among potential suppliers, so OTT HydroMet and HACH will be well-placed to help meet the requirements.

The recent publicity surrounding storm overflows will help to raise awareness of key issues such as:

- reducing peak flows during storm events
- natural flood management
- sustainable urban drainage
- limiting toilet waste to the 3 Ps
- identifying the root causes of river pollution

Improvement measures will be costly, so it is essential that decisions are underpinned by accurate reliable data. The new monitoring networks will provide a comprehensive picture of not just the impact of storm overflows, but of river water quality generally. This will dramatically improve our understanding of the factors affecting water quality so that improvement measures can be targeted and effective.

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