

CONTINUOUS REMOTE WATER QUALITY MONITORING NETWORKS



Proven scalable monitoring solutions for Environment Act 2021

One of the key objectives of the Environment Act 2021 is to tackle the major sources of pollution in rivers and improve water quality. As a result, rigorous new monitoring requirements have been established, so it is fortunate that one company, Meteor Communications, has been implementing such networks for many years, and operates the largest real-time continuous water quality monitoring network in the UK.



Matt Dibbs with kiosk remote water quality monitor

In the following article, Matt Dibbs, Managing Director at Meteor Communications Ltd., outlines the implications of the Act and explains how the new monitoring requirements can be successfully implemented. With over 700 remote water quality monitors already installed across the UK, Matt is in an ideal position to describe the ways in which continuous monitoring leads to water quality improvements.

Environment Act 2021

Section 82 of the Act addresses the monitoring of water potentially affected by discharges from storm overflows and sewage treatment works. Under this new law, a sewerage undertaker whose area is wholly or mainly in England is required to continuously monitor the quality of water upstream and downstream of storm overflows and sewage disposal works. Many thousands of these assets exist; often in remote locations without power and communications infrastructure, so the Act presents a significant challenge for the wastewater sector.



ESNET Kiosk at Wastewater Treatment Works

By continuously monitoring upstream and downstream, sewerage undertakers will better understand the impacts discharges have on the receiving watercourse. This evidence will help them to improve asset performance and deliver a progressive reduction in pollution.

Each of the monitoring systems will continuously monitor the key indicators of water quality: dissolved oxygen, temperature, pH, turbidity and ammoniacal nitrogen. The Meteor team has been at the forefront of real-time monitoring for many years and as a result Meteor Communications was asked to submit evidence to the UK Government's Environmental Audit Committee (EAC) during its inquiry into river water quality. Meteor's evidence included a live demonstration of data from hundreds of continuous water quality monitoring sites across the UK.

It was important for the EAC to see the Meteor Communications Environment Sensor Network (ESNET) conducting continuous monitoring of numerous UK rivers, because this provided them with evidence that the technology has been operating successfully for many years, and has been developed to provide solutions for a wide range of applications.

There are tens of thousands of storm overflows and sewerage assets in England in Wales, so the new Act will result in a dramatic increase in river water quality monitoring.

Remote, continuous water quality monitors

For more than 30 years, Meteor Communications has worked with government agencies and water companies to develop remote continuous water quality monitoring systems. The key objectives for this work are as follows:



ESNET Water Quality Monitoring System

1. Low power – Mains power is not available at most sites so it is an absolute requirement for monitors to operate on solar or fuel cell power. Consequently, the sensor, control systems and telemetry must all have a very low power requirement.

2. Reliable sensors –

Labour is a significant cost in remote water quality monitoring, so unplanned maintenance visits should be avoided. In addition to extra costs, unnecessary site visits also increase the carbon footprint of the work. Multiparameter sondes have been developed to provide reliable data over extended periods of time, and Meteor has worked with leading manufacturers and stakeholders to develop operating methods and procedures that reduce downtime to an absolute minimum and maximise data reliability.



Multiparameter Water Quality Monitoring Sonde

3. Communications simplicity and flexibility – Remote locations may have poor communications availability, so water quality monitors must have the flexibility to employ the most effective communications methods available. Data must be delivered in real-time to Cloud-based platforms with secure data visualisation, analysis and alarm capability.

4. Installation – Ideally monitors should be quick and easy to install and require limited infrastructure; delivering data within hours of installation. This lowers costs, improves data availability and provides users with greater flexibility in the choice of monitoring locations.

5. Extra sensor capability – Water quality is also affected by geomorphology and other physical factors so it is often advantageous to measure parameters such as depth and flow, for example. Remote monitors should therefore have the capacity to incorporate extra physical or meteorological sensors quickly and easily.



Portable ESNET system

Meteor's ESNET systems have been developed to meet these needs, delivering robust high resolution real-time water quality data within minutes of deployment. The systems are available as a complete portable monitoring station or as part of a kiosk pumped system for semi-permanent or fixed installations. ESNET therefore enables the commissioning of flexible monitoring networks, tailored to meet the needs of a wide range of catchments challenges.

Challenges affecting the establishment of effective river monitoring networks

As sewerage undertakers start to implement the monitoring requirements of the Environment Act, a number of key issues will need to be addressed. For many, this will be a new area of activity, so it will be necessary to draw on the experience of those organisations that have been operating river water quality monitoring networks for many years. Some of the key issues are likely to be:

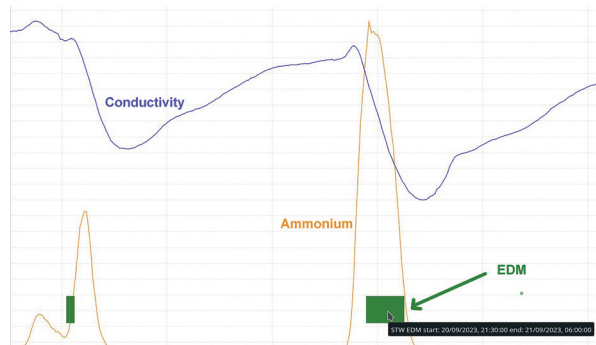
- 1. Installation location** – Careful consideration needs to be given to the choice of deployment location. In some locations a kiosk-based system may be appropriate; in others, a portable system will be more suitable. However, in all cases, it will be necessary for the monitoring location to be representative of the upstream or downstream water quality, so site-specific physical constraints may apply. In addition, landowner permission to access the site and install a monitor is likely to be necessary, but may not be forthcoming. However, projects such as Defra's Demonstration Test Catchments (DTC) have shown how water quality monitoring can inform sustainable agricultural practices, so it is hoped that farmers will regard the provision of access and permission as an opportunity to help improve the environment.
- 2. Network rationalisation** – While the Environment Act calls for monitors upstream and downstream of every asset, there are numerous, mainly urban, locations where storm overflows exist in close proximity to each other. Under such circumstances, it may be possible for single monitors to measure the effects of a small group of discharges, and this 'clustering' was addressed in a recent Defra consultation.
- 3. Network management** – The effective management of large numbers of remote monitors necessitates significant investment in the resources (staff, vehicles and equipment calibration/maintenance facilities) that are necessary to ensure that monitoring is accurate and reliable.
- 4. Data Management** - The advantage of a Cloud based system is that it provides network managers with the opportunity to rapidly check the health of the catchment on a proactive real-time basis. This is one of the most attractive features of Meteor's 'Water Quality as a Service' program, in which customers do not own the monitors as such; they simply purchase and own the data.



Meteor Communications runs a fleet of service vehicles for remote cameras & water quality

5. Sonde management – Water quality monitors must be calibrated on a regular basis. Meteor, has been the originator of an industry-leading calibration and maintenance methodology based on the fast turnaround of multiparameter sondes. To do this Meteor Communications established a dedicated Water Quality Services Hub, at which sondes are serviced and calibrated in a dedicated lab-based instrument maintenance facility, so that they can be routinely swapped with sondes in the field. To ensure data accuracy and reliability, sonde sensors are tested in the lab to meet or exceed manufacturer tolerances.

6. Data interpretation – Many pollution events have specific and identifiable 'fingerprints'. For example, sewage works often produce clearly discernible patterns in ammonium representing daily anthropogenic activity, and rainfall induced agricultural runoff can cause correlated rises in ammonium and turbidity. However, many events can be complex with multiple inputs. As the number of remote monitors increases, careful data management and interpretation tools will be required to help the sector deliver and understand the evidence required to improve water quality in our rivers.



EDM Water Quality graph

7. Data Integration and Reporting
There will be a requirement to share point-reading data, interpreted event data and periodic environmental impact reporting data. The RESTful URL Application Programming Interface (API) method of data exchange and integration has been in use for many years now and allows data to be quickly and easily exchanged between the systems of different parties. In addition, the simple and lightweight Message Queuing Telemetry Transport (MQTT) protocol has emerged as a global standard for data publish and subscribe models and is being offered as a standard service by major cloud hosting providers. System suppliers will also have to provide data reporting that is powerful, efficient and highly configurable. A key requirement of the Environment Act for sewerage undertakers is to report their impact on the environment and a powerful reporting engine for event-aggregations and drill-downs of continuous water quality monitoring data will enable this.

Summary

Clearly, the Environment Act 2021 imposes a requirement for the water/wastewater industry to implement a major network of water quality monitors, delivering data in almost real-time to (what Water UK describes as) a National Environment Data Hub. However, with many years of experience in establishing hundreds of remote continuous river water quality monitors, Meteor's technical staff already know that storm overflows and discharges are not the only factors affecting water quality, and the new networks will help to also highlight and identify other sources of pollution, for the benefit of all stakeholders.

Meteor Communications has been developing, installing and operating remote water quality monitors for many years, so the technology is already proven. The challenges presented by the establishment of large networks are therefore more likely to be logistical; addressing issues such as monitor location, landowner permission, sonde calibration and exchange, and finding the best way to derive insights from large amounts of data.



For over 25 years, Meteor Communications has designed, built and installed remote environmental monitoring systems for global governmental, utility, industrial, consulting and academic organisations. Innovation underpins the success of the company, and all products and solutions have been developed in close cooperation with customers.

Meteor's products provide real-time access to vitally important field data, with two main themes. Remote water quality monitoring stations measure background levels, enabling trend analysis and the identification of pollution from diffuse and point sources. Remote, low-power, rugged cameras provide visualisation of key assets such as construction sites, flood gates, weirs, flumes, screens, grills etc. Both the cameras and the water quality monitoring stations provide immediate access to current conditions with alarm capability, which enables prompt remedial action, as well as the optimisation of maintenance activities.

Meteor Communications provides a wide range of off-the-shelf and bespoke monitoring solutions. Most can be deployed within minutes, are solar powered and do not require significant infrastructure to run. Cloud-based data is accessed via secure login to the Meteor Communications data centre. This is achieved using any web-enabled device and provides instant access to live and stored data, which includes an interactive graphical display.

Meteor Communications has a large installed base of remote monitoring stations and the company's turnover has increased 5-fold in the last 6 years.

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