



Department
for Environment
Food & Rural Affairs

Continuous Water Quality Monitoring Programme

Provisional technical guidance for sewerage
undertakers on implementing s.82 of the Environment
Act 2021

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1. Executive summary

S.82 of the Environment Act 2021 requires sewerage undertakers to continuously monitor the quality of the receiving water upstream and downstream of their assets. This will allow sewerage undertakers to assess the impact of discharges from their assets on the receiving watercourse.

The statutory duty only applies to watercourses through which water flows and excludes other bodies of water such as coasts and lakes. The duty applies to transitional waters (estuaries). The act requires sewerage undertakers to monitor for pH and temperature, turbidity, dissolved oxygen, ammonia, and anything else specified in regulations made by the Secretary of State.

Monitoring must be at least every 15 minutes at high-risk times and can be every hour at other times. Where discharge outlets are within 250m of one another they may be clustered and monitored by one pair of monitors. Sewerage undertakers must make all reasonable efforts to place downstream monitors at the ideal point for monitoring, at the point of cross-sectional mixing. If this is not possible, then the monitor must be placed at the first suitable point downstream on the watercourse, not more than 500m downstream from the point of cross-sectional mixing. Data should be published in near real time and include contextual information, such as event duration monitoring. Sewerage undertakers should focus on high priority sites in the initial phase of installations, with total rollout to be complete by 2035.

2. Introduction

The implementation of continuous water quality monitoring of sewerage undertaker assets [“the programme”] is a legal requirement for water companies, introduced by section 82 of the Environment Act 2021.

Environment Act 2021, s.82

(1) In Chapter 4 of Part 4 of the Water Industry Act 1991, after section 141DA insert-

141DB - Monitoring quality of water potentially affected by discharges from storm overflows and sewage disposal works

- 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,
 - c) where the storm overflow or works discharge into a watercourse.
- 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.
- 4) ...
- 5) The Secretary of State may by regulations make —
 - a) provision as how the duty under subsection (1) is to be carried out (for example, provision as to the type of monitor to be used and where monitors must be placed);
 - b) provision for exceptions from the duty in subsection (1) (for example, by reference to descriptions of asset, frequency of discharge from an asset or the level of risk to water quality);
 - c) provision for the publication by sewerage undertakers of information obtained pursuant to subsection (1).

The monitoring network will apply to both storm overflows and sewage treatment works. This sits alongside the duty arising from section 81 of the Environment Act, which requires water companies to publish data on the frequency and duration of discharges from storm overflows.

This document provides provisional technical specifications for the water industry to make plans for implementation of water quality monitoring upstream and downstream of storm overflows and sewage treatment works discharges to watercourses. This document has been developed in consultation with the Storm Overflows Taskforce, specifically with the Water Quality Monitoring Technical Monitoring sub-group comprising water industry, regulators, government, and supply chain representatives.

These rules are subject to consultation and therefore **are not final and may change** following the consultation process, which is due to conclude 23 **May 2023**. Implementing legislation for the statutory duties will follow after the consultation has closed.

Government is also conducting a separate research project on equipment, installation, and data standards. As such, the information below may be amended following the completion of this project, as well as the consultation, as understanding develops. Government is also working to deliver a call for innovation, in partnership with Innovate UK, to investigate issues including how additional metrics may be monitored and measures to bring down the cost of the programme as it is rolled out. More detail on this will be made available later this year.

3. Objectives and scope

Programme objectives

The objectives of the programme are to:

- quantify the local water quality impacts of sewerage undertaker assets on a watercourse,
- increase stakeholder and public understanding of the impact on water quality of discharges from sewerage undertaker assets,
- inform sewerage undertaker improvement programmes to meet the Storm Overflow Discharge Reduction Plan targets; and,
- inform regulatory action.

To achieve these objectives, the monitoring must:

- be linked to existing regulatory standards,
- provide data which can be attributed to the target assets,
- provide understandable data to the public,
- provide understanding of how performance and water quality impacts of sewerage undertaker assets change over time; and,
- show water quality impacts of sewerage undertaker assets in near real time.

We also anticipate that this programme will, as an inevitable by-product, inform long-term water quality trends for a given position on a watercourse.

Continuous monitoring of the water quality impacts of sewerage undertaker assets is also appropriate in water bodies other than inland watercourses, such as lakes, groundwater and coasts. The complexity of these environments makes them very challenging to monitor effectively. However, there is high public and commercial interest in doing so. There is also high public and commercial interest in water quality monitoring of public health impacts of sewerage undertaker assets. This is especially true near bathing sites or where there is industry dependent on good water quality, such as shellfisheries.

As the statutory programme does not apply to such sites, neither government nor the sector yet know what data can be measured, nor how best they should be monitored. Sewerage undertakers should consider sites in this category for pilot projects and investigation works. These pilots will form part of the Water Industry National Environment Programme (WINEP) and will be industry-wide to share information and learning. Investigations will inform future amendments to the monitoring framework and outcomes must be reported to the Environment Agency. More details of government and regulator expectations for these pilot projects are laid out in section 10.

4. Statutory monitoring guidance - freshwater watercourses

4.1. Defining watercourse

"Watercourse" is defined by section 219 of the Water Industry Act 1991 as all "*rivers, streams, ditches, cuts, culverts, dykes, sluices, sewers and passages through which water flows (except mains or other pipes belonging to the Environment Agency, Natural Resources Wales or a water undertaker)*".

This definition includes estuaries, but not coasts, canals, groundwater or inland bodies of standing water such as lakes. In borderline cases, decisions on what constitutes a watercourse should be informed by reference to the OS MasterMap Water Network.

4.2. Defining continuous monitoring

Continuous water quality monitors installed as part of the programme must provide data continuously and at an appropriate interval. To ensure the data can be used to assess the performance of assets against the full [Urban Wastewater Management Fundamental Intermittent Standards](#), intervals between testing must not be longer than 15 minutes.

When using a pumped kiosk, the collation of 15-minute data significantly increases operational costs and can lead to high wear on equipment. Therefore, sewerage undertakers may monitor at 1-hour intervals, but must switch to 15-minute data intervals at times when there is a risk of harmful discharge, as defined below. All monitors must be equipped with the telemetry technology to allow interval switching, both manually and by using contextual data such as intelligent sewer monitoring, weather radar, and other high-risk factors that contribute to either storm overflow operation or a change in the quality of the final effluent discharge. To allow for contaminants to reach the downstream monitor, there must be a lag on reverting back to 1 hour testing.

Monitoring intervals

Sampling must take place at least every 15 minutes if either of the following conditions are met:

- during storm overflow operation; or
- where anything occurs that affects, or has the potential to affect, the water quality of a final effluent discharge.

At other times, sampling must take place at least every hour.

Where the conditions are met, testing must stay every 15 minutes for 24 hours following the end of the event which triggered the switch.

4.3. Monitoring parameters

Monitors should accurately and reliably monitor and log data on a series of key parameters that look at the water quality of the watercourse.

The minimum requirements for statutory monitoring are as follows:

Minimum parameters

Monitors should capture the following information both up and downstream from an asset:

- levels of dissolved oxygen
- temperature and pH values
- turbidity
- levels of ammonia

4.4. Technical specifications

While monitors may be recycled after improvements are made to the target asset (see section 6 on timelines), due to the length of the programme fixed installation of pumped kiosks are recommended as the primary method of monitoring. Fixed installations will reduce the risk to the safety of the technology from theft or vandalism, mitigate against variable river levels, and provide a safe environment for maintenance visits, among other benefits. In-river installations may be more suitable in circumstances in which the risk to the safety of the monitors from theft or vandalism is very low, where river level variation is low, or where a fixed installation is infeasible. It is left to sewerage undertakers' discretion where in-river installations will be more suitable.

To accommodate future innovation in water standards or in technology, monitors should be able to be upgraded to accommodate at least two additional parameters without requiring redesign or reinstallation.

The government recognises that the technology to directly monitor levels of ammonia in a watercourse are not yet sufficiently reliable to meet the requirements of the programme. We recognise that ammonium can be monitored as a proxy for ammonia when combined with temperature and pH.

4.5. Siting

Where monitors are sited in relation to the target asset is a key consideration in the rollout of this programme. The following recommendations have been developed to balance practicality with the need to create a scientifically robust programme. It is crucial to the success of the programme that the monitors provide data that can be used to assess asset performance against existing water quality standards. Of the four statutory parameters, the maximum point of harm arising from ammonia is to be used as the key determinant for siting decisions.

- **Common outfalls and culverts:** Common outfalls and culverts where multiple assets discharge to a channel can be considered as one discharge at the point of discharging to a watercourse. Assets forming a common outfall must be clearly identified on any reporting requirements (see section 8 on data).
- **Clustering:** Where there are two or more assets with discharge outlets in 250m of one another in a single length of a watercourse, these can be considered a cluster and monitored by one pair of monitors. The downstream monitor for a cluster should be placed at the point of cumulative cross-sectional mixing, usually the point of cross-sectional mixing for the last asset in the cluster. This will naturally mean that the first asset in a cluster will be further away from the downstream monitor. To assure quality of data, the downstream monitor should be no more than 500m downstream from the point of cross-sectional mixing for the first asset in the cluster. The limit of the cluster is measured from the discharge point of the first asset in the cluster. That is, if there is another asset within 250m of the last asset in the cluster, this should not be included in the cluster. This is to avoid clusters being “chained”, which may result in the downstream monitor being more than 500m downstream from the point of mixing.
- **High-intensity clustering:** In the rare occasions where there are high numbers of outlets in a cluster, more downstream monitors will be required in order to assure that the source of any contamination can be identified. There should therefore never be more than 10 assets in a cluster. This means monitors should be placed at appropriate intervals on a stretch of watercourse to ensure that there are not more than 10 assets in a cluster.
- **Upstream monitors:** Upstream monitors should be placed at a suitable site that will give a representative sample of the water quality immediately upstream of the discharge from the asset to be monitored.
- **Monitors serving as both up- and downstream monitors:** Upstream water quality assessment is an essential part of determining the impact of a discharge on the water quality of a water course. In specific circumstances set out below, the downstream monitor for one standalone storm overflow (i.e., a storm overflow that is not in a cluster with another discharge outlet) can serve as an upstream monitor for the next asset on the watercourse. This is only possible where the siting of the downstream monitor for the upstream asset can be shown to always be representative (during all types of weather) of the water quality at the point immediately upstream of the downstream asset. This might be the case when the distance between the assets is low and where there are no significant features between the assets likely to distort water quality, such as another source of pollution (see section 4.6 on exceptions).
- **Downstream monitors:** Downstream monitors should be placed at the point in the watercourse where there will be complete cross-sectional mixing of contaminants. This is the optimal point for testing river water quality for contaminants, as it is the point of maximum harm. The [Technical Guidelines for the Identification of Mixing](#)

[Zones](#) should be used as a starting point on assessing this for individual water bodies. Siting at the ideal location should be possible at most sites.

Local and site-specific factors should also be considered in final siting of downstream monitors. Factors that may need to be considered include:

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

For exceptional cases where siting at the optimal point is not possible, then the monitor should be placed at the first suitable point downstream. To ensure data validity, the downstream monitor should not be more than 500m downstream from the point of cross-sectional mixing. Considering sewerage undertakers powers of compulsory purchase, high installation or land purchase cost alone does not provide justification for siting the monitor away from the optimum testing point.

- **Duty to investigate:** Where assets are in a cluster and the downstream monitor detects a harmful discharge, the sewerage undertaker should investigate the source of that discharge and make this information public alongside the continuous water quality data. This investigation should be undertaken in two phases. Firstly, a desktop assessment using corresponding complimentary data, allowing chronic impacts to be identified. This preliminary assessment should be completed within 90 days of a breach being detected.

If the preliminary assessment is inconclusive, a longer term assessment should be carried out using data analysis of longer datasets to properly assess the source and significance of any impact. This should be completed within 12 months of detecting a breach of standards.

- **Sub-optimal sites:** Where monitors are sited away from the optimal monitoring point, this should be notified on all data reporting (see Section 8 on data).

4.6. Exceptions

We propose to exempt only those sites which it is technically impossible to monitor. The following is proposed as exceptions from the statutory duty to continuously monitor upstream and downstream of sewerage undertaker assets. This exception reflects that it is not technically possible to monitor in these environments, as the sensors will fail if left exposed to the air.

Exceptions

- Any watercourse with a year-round, permanent depth below 4cm throughout the permissible distance from the optimum monitoring point.

5. Statutory monitoring guidance- estuarine watercourses

The intent of the Environment Act is that estuarine waters are included in the monitoring programme. Some estuarine waters present significant challenges when it comes to continuous monitoring, including tides changing the direction of flow, and high tidal ranges. There will also be practical challenges in siting monitors to give meaningful data in large estuaries with high dilution. Understanding impacts from assets is therefore more complex compared to monitoring inland waters. Importantly, optical ionic sensors will detect sodium ions, and will register these as false positive readings for ammonium. Further research is required to establish how these waters can be effectively monitored by the programme.

To allow sewerage undertakers to conduct pilot programmes in estuaries to better understand how these waters can be monitored, these sites will be phased in from PR29.

Alongside the statutory parameters, sewerage undertakers should also explore how to achieve enhanced monitoring of faecal indicator organisms at sites with high amenity value such as designated bathing waters or waters for industries which rely on good water quality (such as shellfisheries). There is great public interest and value in providing real-time information on the public health impacts of sewerage undertaker assets. Sewerage undertakers should explore direct and indirect continuous monitoring of faecal indicator organisms. Indirect monitoring would rely on monitoring other parameters to assess the levels of faecal indicator organisms. This is relevant to both estuarine and coastal waters and should be reflected in both the statutory and non-statutory pilots.

6. Timeline and prioritisation

6.1. Phasing

All sewerage undertakers should begin roll-out as soon as practicable and not later than 2025. Full monitoring of statutory assets must be completed no later than 2035.

Sewerage undertakers are required to monitor at least 40% of all assets which are not exempt by the end of PR24, which must include all assets defined as high priority sites below.

High Priority Sites

High priority sites are:

- Sites of Special Scientific Interest (SSSIs),
- Special Areas of Conservation (SAC),
- Urban Wastewater Treatment Regulations sensitive areas,
- chalk streams,

- any assets within 5km upstream of designated inland or estuarine bathing waters; and,
- waters currently failing WFD ecological standards due to storm overflows or final effluent.

6.2. Monitor recycling

Where a monitor has been placed on an asset which has then been improved and now meets the plan targets, that monitor can be removed and installed at a different asset once it has been established that the improvement has been successful. In practice, this will mean the monitor cannot be recycled until the monitors have provided at least ten years' worth of data once the improvement has been completed.

7. Governance and assurance

Government will require accreditation of monitoring technology to ensure a high standard of data. Defra have commissioned an independent external partner to assess and make recommendations on the suitability of installation, calibration, maintenance and data validation standards. This project will report in the spring of 2023. Defra will confirm these standards ahead of implementing legislation later in 2023.

8. Data availability and visualisation

Water quality data must be made publicly available in near real time (within one hour), and in a common format across England. This will help to meet the programme objective of increasing public understanding. Sewerage undertakers should develop a visualisation platform to host the data which assesses water quality in both near real time and over long-term trends, preferably in the form of an interactive map. It is recommended that the visualisation platform include a traffic light system (or another suitable user-friendly visualisation tool). This should be linked to the Urban Pollution Management Fundamental Intermittent Standards.

The visualisation platform should include at least two data categories. First, immediate readings of parameters should be shown in text format (both measured and derived unionised ammonia values must be shown). Long term averages should be available, based on ten-year averages, stating the water quality standard for each parameter. To facilitate analysis of long-term trends, the water quality data should be available indefinitely. Long term trends should also be visualised in a user-friendly way, such as through a traffic light system.

Sewerage undertakers must also publish EDM data, overlaid on the visualisation platform, to contextualise the water quality data. The visualisation platform should note the time that the target asset was last active. Other contextual information should include the number of

assets in a cluster, flow monitoring data, and river level gauges. Defra may specify further contextual information to be added following the consultation.

Sewerage undertakers must also make the underlying water quality data from individual monitors available to third parties through APIs. More detailed data must be made available to regulators.

Where a monitor has had to be placed at a suboptimal monitoring point, this should be made clear on all data reporting. If a monitor is not operating, this and reasons why (e.g. maintenance, instrument failure) should also be made clear, and contextual information added on the work to bring the monitor back online.

9. Annual reporting requirements

Water and sewerage companies must provide an annual report to the Environment Agency, to include at least the monitoring duration and ecological impact of each asset for each parameter. Exempt assets must also be included, including details of the exemption and evidence made available on request. Annual Reporting must be provided in a template format as set by the Environment Agency.

10. Non-statutory monitoring

The scope of Section 82 of the Environment Act excludes waterbodies through which water does not flow, such as coastal waters and lakes. There is significant and increasing public interest for understanding the impact of sewerage assets on water quality data relating to both ecology and public health at these sites. However, as with estuarine sites, and for similar reasons, there is not yet a sufficiently robust understanding of how best to continuously monitor these waterbodies and effectively link to asset performance.

Several non-statutory drivers are likely to be put in place via the WINEP where companies can demonstrate customer demand/willingness to pay. These investigative drivers would allow sewerage undertakers to invest in pilot investigations on how best to monitor coasts, lakes and other standing bodies of water, canals and groundwater. These investigations must:

- review and refine existing methodologies
- answer a range of unresolved questions, to include:
 - optimal siting,
 - technology availability and focus for innovation,
 - appropriate data verification and interpretation against standards; and,
 - relevant additional metrics (such as faecal indicator organisms).

Delivery of monitor installation is proposed through the WINEP, in PR29. Industry-wide investigations and any catchment pilot studies linked to this research should be complete by 2027 to inform PR29 planning for monitor installation.