



Department
for Environment
Food & Rural Affairs

Continuous Water Quality Monitoring Programme

Interim Technical Standard

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Introduction

Upon commencement, section 141DB of the Water Industry Act 1991 (inserted by section 82 of the Environment Act 2021) will place a duty on sewerage undertakers operating wholly or mainly in England to continuously monitor the quality of the receiving water upstream and downstream of their storm overflow and from discharges from wastewater treatment works. This will allow sewerage undertakers to assess the impact of discharges from their assets on the receiving watercourse.

This document constitutes guidance only. Sewerage undertakers should check the statutory provisions to determine what the statutory requirements are. References to “requirements” in this document refer to non-statutory requirements of the guidance.

Purpose

The purpose of this document is to provide guidance to sewerage undertakers on the interim data production and assurance expectations of the CWQM programme. In due course, we intend to replace this interim technical standard with an assurance framework covering performance standards for various aspects of the programme. The scheme will include the following areas:

- Equipment
- Installation, use & maintenance
- Data acquisition & handling

Background

An independent review of existing assurance standards was commissioned by Defra and delivered in May 2023. It concluded that while there are multiple existing certification schemes in place to monitor water quality, a single standard with the ability to support the continuous water quality monitoring (CWQM) programme as required does not yet exist. It identified a requirement for appropriate certification schemes to be brought together in an overarching framework and the production of a bespoke standard for the CWQM programme.

A separate commission from Defra to then develop a new bespoke CWQM standard and associated certification scheme has been undertaken. This “standards recommendation” work is included in the **Appendix**. It identified different models to implement the assurance standard in the long-term and recommended a preferred approach. Defra’s intention is that CWQM programme activities by sewerage undertakers should be assessed by independent organisations.

The preferred option is for companies to obtain Environment Agency Monitoring Certification Scheme (MCERTS) certification and accreditation for CWQM programme activities (“Model 4” in Section 6 of the **Appendix**) with certification and accreditation activities via CSA Group and the United Kingdom Accreditation Service (UKAS). MCERTS covers a range of monitoring, sampling, testing and inspection activities. It is built on proven International and European standards to ensure monitoring data is of a high standard.

It is recognised that it will take significant time and operational resource to develop the relevant MCERTS standards, as well as time for the supply chain and industry to meet these standards.

Current Position

The statutory duty for CWQM under section 141DB of the Water Industry Act 1991 (inserted by section 82 of the Environment Act 2021) has not yet commenced. However, the Defra Technical Guidance (released August 2023) sets the expectation that sewerage undertakers install CWQM at 25% of storm overflows and wastewater treatment works before 2030.

While work on accreditation and certification is being developed, the standards recommendation recommended an interim approach; for sewerage undertakers and contracted service providers to use existing standards to develop quality management systems to cover the areas described in the published Defra technical guidance, the recommendations in the standards recommendation document and external standards referred within.

The new CWQM MCERTS scheme will aim to encompass the guidance in these documents. A high-level overview of the likely scope of each part of the MCERTS scheme is provided in Table 1 below.

Note on monitoring levels of ammonia

Section 141DB(3)(d) of the Water Industry Act (inserted by section 82 of the Environment Act) will require “levels of ammonia” to be measured as a water quality parameter. As detailed in the Defra Technical Guidance and the standards recommendation, ammonium (NH_4^+) can be monitored to produce derived ammonia (NH_3) when combined with temperature and pH. These can be combined to indicate total ammoniacal nitrogen (TAN) present. Our current view is that technology to directly and continually monitor ammonia (NH_3) in a watercourse is not sufficiently developed to meet the requirements of the programme. We will keep this matter under review as this technology matures.

Minimum sensor requirements in the interim recommendations are outlined in the **Appendix** (Page 7, Table 1). Requirements for ammonium (NH_4^+) sensors are outlined in **Appendix** Table 1. There are no interim requirements specified for ammonia (NH_3) sensors. No practical accepted and accredited peer-reviewed methodologies for measuring unionised ammonia directly in watercourses currently exist. The use of ammonium to derive levels of ammonia is an internationally recognised and applied methodology. Sensors to detect ammonium and derive levels of ammonia using pH and temperature are a recognised and proven technology that can be used in portable and fixed monitoring applications.

If new technologies/methodologies are tested sufficiently for application across different environments they can be assessed for suitability for the CWQM programme via the upcoming MCERTS performance criteria. MCERTS standards are under continual review and certification requirements can be updated when the need is identified. Innovation and development in the sensor industry for continuous monitoring is encouraged and supported across all parameters.

The requirements for ammonium sensors in the **Appendix** include a footnote. It notes that ammonium sensors can achieve +/-10% at typical riverine concentrations, but recognises that at the lowest concentrations this will be most difficult due to potential interferences from other ions, noise etc.

Current technologies may not be able to achieve the specified accuracy at the lowest range of the sensor readings. There is ambition to achieve +/-10% accuracy at typical in-river concentrations and water companies should work with equipment manufacturers to obtain evidence of the accuracy across the range specified in Table 1.

Action for Sewerage Undertakers

Sewerage undertakers must ensure monitors installed and data produced to meet the duty under section 141DB(3)(d) of the Water Industry Act (inserted by section 82 of the Environment Act) CWQM programme meet these interim technical standards and the proposed content of the MCERTS standard (Table 1). Evidence of certification will be required but not immediately. The timescale for certification is under review and will be communicated with the commencement of section 82.

	Equipment	Installation, use & maintenance	Data acquisition & handling
Description	To include the measuring device (sensor & associated electronics) along with site infrastructure (mounting & support; power supply; housing; telecoms; pumps etc.)	To include installation; instrument maintenance & calibration; maintenance of supporting equipment (pump, batteries, pipes etc.); check measurements in field; record keeping to demonstrate measurement traceability	To include capture, storage, sharing, validation & quality assurance of these standards
Interim requirements	<ul style="list-style-type: none"> • Minimum technical sensor requirements (Atkins 2.1) • Sensor functionality (Atkins 2.2) 	<ul style="list-style-type: none"> • Minimum installation requirements (Atkins 3.2) • Maintenance (Atkins 4.1) • Calibration (Atkins 4.2 – essentially ISO 17025) • Acceptable downtime (Atkins 4.3) 	<ul style="list-style-type: none"> • Data storage (Atkins 5.2 – incl. various ISO standards) • Data provision in near-real time (Atkins 5.3) • Data validation (Atkins 5.4) <ul style="list-style-type: none"> ○ Standard operating procedure development for data validation should be industry collaboration via PR24 WINEP EnvAct_MON5 to produce industry good practice guidelines.

<p>Proposed Future requirements</p>	<ul style="list-style-type: none"> • New MCERTS to assure measuring devices and ensure they are fit for purpose • Based on two existing MCERTS standards & BS-EN-17075: <ul style="list-style-type: none"> ○ MCERTS: performance standards and test procedures for continuous water monitoring equipment – part 2 on-line monitors - GOV.UK (www.gov.uk) (v3.1, August 2010) ○ MCERTS: Performance standards and test procedures for portable water monitoring equipment - GOV.UK (www.gov.uk) (v2.1, August 2010) ○ BS-EN-17075 describes performance standards & test methods, based on MCERTS standards. NB: does not describe a certification mechanism. 	<ul style="list-style-type: none"> • ISO 17025 applied to calibration activity. Traceable reference solutions required. Records ref. source of solutions, expiry date, cleaning & calibration procedures etc. required • New MCERTS to QA the operation & maintenance of the monitoring systems to ensure ongoing good data quality • QA of appropriate cleaning & maintenance of supporting infrastructure required. Demonstrated by detailed maintenance procedures & effective record keeping. Likely based on ISO 17025. 	<ul style="list-style-type: none"> • Atkins Section 5 does not cover mechanism to check & confirm compliance with standards • Update existing MCERTS standard to include sector-specific section <ul style="list-style-type: none"> ○ MCERTS - Performance standards and test procedures for environmental data management software - GOV.UK (www.gov.uk) (v4, December 2017) ○ This standard encompasses development, validation & maintenance of software used for processing monitoring data.
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Appendix A. Standards Recommendations

AtkinsRéalis



CONTINUOUS WATER QUALITY MONITORING STANDARD

**Assurance standard for
the programme of
continuous water
quality monitoring to
meet the requirements
of Section 82 of the
Environment Act**

Department of Environment, Food and Rural
Affairs

07 August 2024
Final

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Notice

This document and its contents have been prepared and are intended solely as information for Department of Environment, Food and Rural Affairs and use in relation to advising on assurance standard requirements for Section 82 of the Environment Act.

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This document has 26 pages including the cover.

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1. Introduction

Section 82 of the Environment Act 2021 (see Appendix A) introduced a legal requirement for water companies to continuously monitor the quality of the receiving waterbody upstream and downstream of their assets. The new duties are due to be brought into force through section 141DB (s141DB) of the Water Industry Act 1991. When brought into force, the new duties will require water companies operating wholly or mainly in England to monitor the quality of the receiving water upstream and downstream of their assets on a continuous basis (in practice on at least an hourly frequency) and make this data available in near real-time. This network of continuous water quality monitors, 'the programme', will provide data to allow water companies and others to assess the impact of discharges from their assets on the water quality of the receiving watercourse.

In August 2023, Department for Environment, Food & Rural Affairs (Defra) published draft technical guidance¹ which outlined current proposals for how the duty in s141DB of the Water Industry Act 1991 should be met and the extent of exceptions to the duty. This technical guidance document set out the objectives of the programme and the minimum requirements of the programme.

1.1 Objectives of the programme

As stated in the draft technical guidance, the objectives of the programme are to:

- Quantify the local water quality impacts of water company assets on a watercourse;
- Increase stakeholder and public understanding of the impact on water quality of discharges from water companies' assets;
- Inform water companies improvement programmes to meet the Storm Overflow Discharge Reduction Plan (SODRP) targets; and
- Inform regulatory action.

To achieve these objectives, the draft technical guidance states that 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 water company assets change over time; and
- Show water quality impacts of water company assets in near real time.

1.1.1 Storm Overflow Discharge Reduction Plan

The first objective of the programme is that it will enable the local water quality impacts of water company assets on a watercourse to be quantified. This objective is linked to the Storm Overflows Discharge Reduction Plan (SODRP)². This plan sets several targets for water companies. The first of these is that water companies will only be permitted to discharge from a storm overflow where they can demonstrate that there is **no local adverse ecological impact**.

¹ Continuous Water Quality Monitoring Programme – technical guidance for sewerage undertakers, August 2023

² [Storm Overflows Discharge Reduction Plan \(publishing.service.gov.uk\)](https://publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1154422/storm-overflow-discharge-reduction-plan.pdf)



This target must be achieved for:

- most (at least 75%) of storm overflows discharging into or near 'high priority sites' (as defined in Annex 1 of the SODRP) by 2035;
- all (100%) storm overflows discharging into or near 'high priority sites' by 2045; and
- all remaining storm overflows sites by 2050.

Annex 1 of the SODRP states that 'no local adverse impact' for inland waters means achieving the Urban Pollution Management Fundamental Intermittent Standards (UPM FIS) or 99 percentile standards³ for ammonia and dissolved oxygen downstream of the discharge point⁴.

The programme is therefore intended to provide data which can be used to assess the local impact of discharges from storm overflows against the UPM Fundamental Intermittent Standards or the 99 percentile standards for these two parameters. The monitoring data will provide evidence as to whether improvement schemes, to reduce the number of spills from storm overflows, are achieving the required outcomes. If the data indicates these standards are not being met, this may trigger further investigation and additional improvement works.

1.2 Purpose of this document

This document supplements the draft technical guidance and provides an assurance standard to ensure the programme of monitoring is fit for purpose and provides data of a suitable quality to ensure the programme objectives, as set out in Section 1.1, are met.

The aim of this assurance standard is to set out the minimum requirements that should be met when water companies design, install and operate their continuous water quality monitoring programme. This document does not set out to repeat the recommendations within the draft technical guidance. Where necessary, this document refers to the draft technical guidance and adds additional specific requirements that must be met to ensure a compliant programme.

1.3 Structure of this document

This document sets out the assurance standards, which stipulate the minimum requirements for the continuous water quality monitoring programme covering the following topics:

- Section 2: Equipment standards;
- Section 3: Siting and installation standards;
- Section 4: Maintenance, calibration and acceptable down-time standards; and
- Section 5: Data capture, storage, sharing and validation.

Consideration has also been made as to the most appropriate quality assurance model for ensuring each water company's programme meets the requirements of this standard. Recommendations on the most appropriate quality assurance model are given in Section **Error! Reference source not found.**

³ These standards are set out in Urban Pollution Management, 3rd Edition. Foundation for Water Research – Section 2 Regulatory Aspects (fwr.org)

⁴ See 6.1 Appendix B for further detail on ammonia and the terminology adopted in this document.



2. Minimum equipment standards

The following section details the minimum technical specification that all equipment must meet, if not exceed, in order to be deemed appropriate for the collection of key water quality parameters under Section 82 of the Environment Act (2021).

2.1 Continuous monitoring specification

All monitors must accurately and reliably monitor and store data on a series of key water quality parameters, as required by the Environment Act 2021. These include:

- Dissolved oxygen
- Temperature
- pH
- Turbidity
- Ammonia

It is recognised that technologies to directly monitor concentrations of ammonia (NH₃) in a watercourse are not yet available to meet the requirements of the programme (as set out in the draft technical guidance) and to compare directly with relevant Environmental Quality Standards (EQS) and the UPM FIS standards (see also Section 1.1.1). As a result, ammonium (NH₄) measurements made using accredited methodologies⁵ may be used, with ammonia derived from concurrent readings of pH and temperature. The ranges, accuracy and resolution of the sensors deployed must meet or exceed the requirements detailed in Table 1. Equipment installed that does not meet these minimum requirements will be deemed non-compliant for this purpose.

It is the responsibility of the water company to request, evaluate, and retain for assurance purposes, detailed and robust evidence from equipment manufacturers as to how the equipment being installed compares against the criteria detailed in Table 1. Although not currently covered in the legislation or draft technical guidance, it is recommended that conductivity be included as a measurement parameter as it will assist with future data validation (see Section 5.4) and as such a minimum requirement for conductivity has been included in Table 1.

Table 1 - Minimum sensor requirements

Response time	< 30 seconds			
Operating temperature	-5 to +50°C			
Parameter	Recommended Methodologies	Range	Accuracy	Resolution
Dissolved Oxygen (% saturation)	Optical	0 - 200%	±2% (of reading)	0.1%
Dissolved Oxygen (mg/l)	Optical	0 - 20 mg/l	±0.2 mg/l	0.01 mg/l
Temperature	Thermistor	-5 to +50 °C	±0.1°C	±0.01°C
pH	Glass electrode	0 - 14 pH units	±0.1 pH units	±0.01 pH units
Turbidity	Nephelometric	0 - 3000 NTU*	±5% (of reading)	0.1 NTU



Ammonium	Accredited methodologies ⁵	0 - 5 mg/l	±10 ⁶ % (of reading)	0.01 mg/l
Conductivity	Electrode	0 - 50,000 µS/cm	±1% (of reading)	1 µS/cm

* Nephelometric Turbidity Units.

2.2 Sensor functionality

In addition to the technical specification detailed in Section 2.1, sensors deployed for the continuous monitoring of water quality parameters must have the following additional functionalities:

- For the stated sensor performance, the minimum requirements given in Section 2.1 Table 1 must be applicable across the whole working temperature range of the instrument. Robust evidence must be supplied by manufacturers to support this and be available for assurance purposes.
- All spare and replacement parts must meet the same performance standards as their replacements, adhering to the criteria detailed in Section 2.1, Table 1.
- The instruments must be robust and fit for the purpose of use in the field. Evidence to support this must be provided.
 - All sensor housing and associated battery housing units must be waterproof and meet or exceed IP68 standard. Evidence must be supplied by instrument providers in support of this protection.
 - Display units must be waterproof and meet or exceed IP67 standard. Evidence must be requested from instrument providers in support of this protection.
 - The sonde and sensor assembly bulkheads must be capable of withstanding exposure to detergents; methanol-based cleaning agents and Virkon disinfectant. Evidence must be supplied by instrument providers in support of this protection.
- Equipment must be capable of hourly monitoring intervals, increasing in resolution to 15-minute intervals following receipt of a remote event trigger.
- The sensor assemblies must be capable of direct connection to a PC, or tablet for the purposes of calibration and/or software update.
- All data and calibration information and recorded data must be stored securely within instrument memory and recoverable in the event of power failure.
- The pH sensor equipment must have an automatic pH buffer recognition and must accept manual entry of temperature corrected pH values, if required.
- An integrated and effective anti-fouling wiper system that cleans all the sensors must be provided. Evidence to support this must be provided.
- All sensor systems must be fully interchangeable to reduce instrument downtime in the event a sensor replacement or calibration.
- Systems must be able to be upgraded to accommodate at least two additional parameters without requiring redesign or reinstallation.

⁵ Accredited Methods, for example in accordance with 'Ammonia in Waters 1982, Methods for the examination of Waters and Associated Materials. ISBN 0 11 751613' or through other forms of accreditation arising from the assurance model selected for the continuous water quality monitoring programme (see Section 6).

⁶ Current technologies may not be able to achieve the specified accuracy at the very lowest range of the sensor readings. There is ambition to achieve 10% accuracy at typical in-river concentrations and water companies should work with equipment manufacturers to obtain evidence of the accuracy across the range specified in Table 1.



- The system must have a means of reporting faulty conditions remotely.



3. Siting and Installation standards

All systems are required to be suitably engineered and installed to facilitate the collection of high-quality, long-term data, minimising equipment downtime. While it is recognised that each installation location is unique and site-specific challenges may present themselves to water companies, the following are considered minimum installation requirements that must be met in order for a system to be considered compliant.

3.1 Siting of systems

The siting of systems in relation to target assets is covered in the published draft technical guidance. The optimal position of downstream monitors should be identified using an estimation of the point of complete cross-sectional mixing of contaminants and the maximum point of harm arising from ammonia (as set out in the draft technical guidance). Calculations and assumptions used to determine this position must be retained for assurance purposes. Importantly, following the calculation of adequate mixing zone distance, where locations are selected that do not adhere to this minimum distance, a detailed explanation and justification for site selection is required.

3.2 Installation requirements

- Pumped kiosk systems are recommended as the primary method of monitoring in the draft technical guidance.
 - Where the installation of pumped kiosk systems is not practical, in-river installations are permitted however evidence to support this decision must be provided.
 - Documentation relating to option selection must be retained for assurance purposes.
- All system inlet hoses must be installed in a location representative of in-channel conditions across the year, within 500 m downstream of the point of complete lateral mixing in adherence with the draft technical guidance.
 - When selecting an optimal system location, seasonal vegetative growth must be considered and avoided if such growth will negatively impact sensor readings or inhibit sensor maintenance.
 - Installation of systems in localised hypoxic zones must be avoided.
- Pumped kiosk sample inlet hoses must be secured in a fixed position in channel, located to maximise the representativeness of any sample collected.
 - Attachment of the sample inlet hose directly to the channel bed in instances where bed sediment may be drawn through, resulting in an unrepresentative reading of parameters (in particular turbidity), must be avoided.
 - Inlet hoses must be fitted with a strainer to avoid entrapment of detritus.
 - Inlet hoses must not be installed orientated against the direction of flow.
- If an in-river system is selected;
 - A secure anchoring system must be in place to ensure long-term security.
 - In areas of high nutrient concentrations and slow flow, where biofouling can be considered a significant risk to in-river sensor performance, enhanced biofouling reduction measures must be considered, e.g., the installation of copper guards.
- All systems must be designed and installed following an assessment of local hazards and catchment conditions, that may result in damage to the kiosk and inlet hose, or in-river system, where appropriate. Examples of catchment hazards include, but are not limited to:
 - Flood risk
 - Systems to be installed in areas of flood risk should consider the need for a flood risk activity permit.
 - Systems should also be installed/ designed to minimise flood damage and data downtime, if applicable.



- Local catchment management practices (e.g., in-channel weed cutting) must be considered and appropriate mitigation put in place to ensure system operation is unaffected.
- Installation must follow biosecurity best practice to ensure no risk of spreading Invasive Non-Native Species (INNS) between sites.
- All systems must have a means of protection against inadvertent or unauthorised access to either the control system or the sensor.
- To ensure access and the safety of the personnel involved in maintenance and calibration visits, safe access to all sensors deployed must be designed into both pumped kiosk and in-river systems.
- Installation of equipment must comply with the installers' internal Health and Safety policies and procedures.
- All equipment should be installed in line with the manufacturer's instructions.



4. Maintenance, calibration and down-time

The following section details the recommended procedures to demonstrate competence in calibration and maintenance of multi-parameter water quality monitoring instrumentation under this legislation. It will further set out the minimum requirements for equipment downtime.

4.1 Maintenance

- Methods and procedures, inclusive of biosecurity and health and safety procedures, for the maintenance of equipment must be produced by the company undertaking the maintenance.
- Maintenance of multiparameter sensors should be undertaken at a minimum of 4-week intervals. Maintenance schedules should, however, be adjusted based on site-specific conditions, for example: to minimise the impact of fouling of sensors.
- Where detailed evidence can be provided that sensors maintain their calibration for a period exceeding 4-weeks, a request to regulating authorities can be submitted, to extend the minimum maintenance interval to a maximum of 8-weeks.
- Where the routine maintenance interval coincides with non-standard working hours, maintenance must be undertaken on the first standard working day that follows.
- Where maintenance cannot be undertaken within a 4-week, or agreed frequency with regulating authority, interval due to health and safety risks, detailed evidence for the reason of deviation will be kept. An action plan will be created and the reason for deviation and action plan will be stored for a minimum of 25 years for assurance purposes.
- Multiparameter sensor faults relating to sensor failure, must be attended to within 72 hours of the fault being identified. Where the 72-hour time period lapses, a detailed record of the deviation will be created and stored before attending to sensor faults.
- Maintenance of multiparameter sensors will at a minimum include:

Bio Hazard Reduction (strip, clean and dry of sondes, sensor and cables) to include:

- Stripping sonde body of all sensors where possible;
- Cleaning and drying of sonde body;
- Cleaning and drying of sensors;
- Cleaning battery compartment (where applicable);
- Cleaning and drying of guards (where applicable); and
- Cleaning and drying of sonde connection cables.
- Record keeping
 - Sondes must be identified with a unique serial number.
 - Sondes must be tracked through the maintenance, calibration and deployment cycle.
 - A database recording where and when identifiable sondes are currently in use, and have been deployed must be kept and made available to support the data validation process (see Section 5.4).



4.2 Calibration

Sensor calibration must be done under controlled conditions in a laboratory. Sensor calibration and storage must be done in line with the ISO/IEC 17025:2017 (or latest relevant revision). Methods and procedures demonstrating compliance with the requirements of ISO 17025 (General requirements for the competence of testing and calibration laboratories standard) must be produced.

- Detailed records, as outlined in the ISO/IEC 17025:2017, will be stored and be made available to regulating authorities if requested.
- Calibration certificates must be created for every calibration undertaken. These must be stored for a minimum of 25 years and made available for review by regulating authorities.
- The calibration certificate must identify the sensor under calibration using a unique serial number, detail the parameters calibrated and include a record of sensor performance.
- Sensor performance variables need to be recorded, where applicable, and must include but are not limited to:
 - Raw Voltage output from pH and ammonium probes at all calibration points;
 - Slope of pH and ammonium sensors in millivolts;
 - Unit values of calibration.
- As a minimum, multiparameter sensors should be calibrated at 4-week intervals. Where detailed evidence can be provided, that sensors maintain calibration post deployment for a period exceeding 4-weeks, a request to regulating authorities can be submitted to extend the minimum calibration interval to 8-weeks.

4.3 Acceptable Downtime

- Equipment downtime due to sensor faults will not exceed 10% of the monitoring time in an annual cycle (i.e. data will be captured 90% of the monitoring time in an annual cycle) and present no data gaps longer than 2 consecutive weeks.
- Where events occur, such as drought, resulting in water levels too low for monitoring by sonde, a record will be kept and provided to the regulatory authority. Where evidence (in line with regulatory requirements) of these events is provided to regulators, the recorded period will not be included in downtime calculations. These records must be made available to support the data validation process (see Section 5.4). A detailed record should be kept of downtime, which will provide comment where agreement was reached with the regulatory authority to exclude specific downtime events.



5. Data capture, storage, sharing and validation

As set out in the draft technical guidance, water companies must develop a visualisation platform to host the data which represents assessed water quality, in both near real time and in the long term. Water companies must also make the underlying water quality data from individual monitors available to third parties, through Application Programming Interfaces (APIs). More detailed data must be made available to regulators as required. If monitors or telemetry services are not operating, this and the reasons why (e.g. maintenance, instrument failure) must also be made clear. Information regarding re-instatement of the services must be provided.

Water Companies must also provide an annual report to the Environment Agency, to include at least the monitoring duration and ecological impact of each asset for each parameter. As outlined in Section 1.1.1, the SODRP sets out that water companies will only be permitted to discharge from a storm overflow where they can demonstrate that there is 'no local adverse ecological impact'. Annex 1 of the SODRP states that 'no local adverse impact' for inland waters means achieving the UPM FIS or 99 percentile standards for ammonia and dissolved oxygen downstream of the discharge point.

Table 1 sets out the minimum sensor requirements which includes the accuracy requirements for each determinand. As no field-based equipment exists for the direct determination of ammonia that would be practical given the scale of deployment required under Section 82, ammonia must be calculated from ammonium using concurrent measurements of pH and temperature, each of which will have different error bounds. When comparing the calculated ammonia concentrations and the measured dissolved oxygen concentrations to the UPM FIS and 99 percentile standards, the error bounds in both values should be considered.

The monitoring data is intended to provide a significant improvement in the information that is available to assess the water quality of our rivers. It is also intended to provide evidence as to whether improvement schemes to reduce the number of spills from storm overflows are achieving the required outcomes of no local adverse ecological impact and other water quality objectives. It must be noted that the UPM FIS and 99 percentile standards were designed for use primarily in modelling studies rather than with measured data. Therefore the monitoring data can be used to give an indication of whether the UPM FIS or 99 percentile standards are being met; if the data indicates there is a risk that the UPM FIS or 99 percentile standards are not being met, this may trigger further investigation and additional improvement works.

This remainder of this section of the standard covers the requirements for the capture and storage of data, and the hosting of data on a visualisation platform. It also covers the requirements for annotation of the data that is made available in near real-time and data validation of the long-term dataset to meet the annual reporting requirements. This standard does not cover the requirements for additional data (e.g. Event Duration Monitoring data) that should be displayed on the platform, or how water companies should visualise and interpret the data on the platform or assess the impact of each asset.

5.1 Telemetry Units

Telemetry outstations must be capable of remote operation and configuration with regards to sampling intervals. The outstation must be able to store at least 3000 readings in an internal memory buffer. A reading is a date and time-stamped string of data representing all the outputs of sensors fitted to the monitor.



5.2 Data Storage

- Streamed data must be stored by a data centre categorized to at least Tier III (based on the Uptime Institute data centre classification system⁷).
- The data centre must hold certification for the UK Government Cyber Essentials scheme⁸.

In addition, they must hold the following accreditation:

- ISO 9001:2015 – Quality Management
 - This is the internationally recognised standard for quality management.
- ISO 14001:2015 – Environment Management
 - Data centres use significant resources that need to be managed. This is an important environment protection standard. It helps organisations understand and potentially reduce environmental impacts. It also demonstrates commitment to environmental responsibility.
- ISO 27001:2022 - Information Security Management
 - This is a global best practice standard used to implement information security management systems and is used to ensure data protection and security.
- ISO 50001:2018 – Energy Management
 - Data centres use large amounts of power. A good energy management system will help reduce greenhouse gas emissions and identifies potential energy supply risks.

5.3 Near real-time data provision

- Water quality data must be made publicly available on a visualisation platform in near real time (within one hour), and in a common format across England.
- The measured values of each of the parameters set out in Table 1 should be made available.
 - Dissolved Oxygen
 - Temperature
 - pH
 - Turbidity
 - Ammonium
 - Conductivity⁹
- In addition, the concentration of ammonia, calculated using raw values of ammonium, pH and temperature should be made available.
- Where a graphical representation of near real-time data is made, the graphs should be annotated with descriptive text to enable the user to identify activities or issues that may affect data returns.
- It is recommended that the data is checked and annotated on a daily basis. Automation of this process is acceptable, but any automated process must be quality assured as part of the procedure set out in Section 5.4 and quality assurance records made available on request from the Regulating Authority.
- Annotations should include:

⁷ [Uptime Institute Tier Classification System - Uptime Institute](#)

⁸ [About Cyber Essentials - NCSC.GOV.UK](#)

⁹ Although not currently covered in the legislation or draft technical guidance, it is recommended that conductivity be included as a measurement parameter as it will assist with future data validation.



- Maintenance visits
- Sonde changeover
- Loss of sample (pump failure)
- Loss of sample (sonde out of water)
- Failure of sensor or sensors
- It is advisable to add additional information such as calibration step changes and measurements that may lead to a significant change in the measurements .

5.4 Data Validation

To ensure the accuracy, reliability, and integrity of the long-term dataset the following steps are recommended.

- Develop a Standard Operating Procedure (SOP) for data validation.
 - Create a clear and concise SOP outlining all data validation procedures, roles and responsibilities.
 - The SOP should include detailed procedures for three validation steps: initial data evaluation (Step 1), error verification (Step 2) and final data provision (Step 3), as described below and in Figure 5-1.

Define the ideal frequency for carrying out Step 1 (Section 5.4.1, Figure 5-1, this document) and Step 2 (Section 5.4.2, Figure 5-1, this document) of the validation process.

- Step 1 should be carried out on a frequent basis (suggested weekly) to minimise the potential for significant differences in the dataset that is available to interested parties and the dataset that is used for the annual reporting requirement.
- Step 2 should be carried out on a minimum of an annual basis to align with the annual reporting requirement.

Identify the minimum data requirements for data verification, including access to calibration and maintenance records (see also Section 4).

Implement event-based validation and ground-truthing triggers after equipment repositioning and persistent exceedances of water quality thresholds.

Set out the required record-keeping processes.

- Track all data validation activities and the name of the validator.
- Ensure validation records are easily accessible and integrated with raw data archive for transparency.

Update the SOP as the need arises to reflect updates in regulations, technology, and internal practices.

- Ensure that data validators are trained and experienced in water quality data collection, quality control and validation.
- Implement internal quality assurance checks to ensure the effectiveness of the data validation process.

5.4.1 Step 1: Initial data evaluation

- Store and archive all incoming data from water quality sensors.
- Implement a robust back-up system to prevent data loss due to equipment failure or other events.
- Retain all raw data: Apply ISO/IEC 27040:2024.
- Do not modify or alter raw data: maintain the data in its original, unprocessed format to preserve its integrity and avoid introducing unintended alterations.
- Carry out an initial data check to include:
 - All required parameters are included (see Table 1, this document).



- Ammonia concentrations have been calculated correctly using raw values of ammonium, pH and temperature.
- Correct formatting of raw data.

All data points are time and date-marked and have consistent measurement units.

- Any automated flagging of data is marked as 'suspect data – provisional until verified'.
- Any data which is suspected to be erroneous by manual methods is marked as 'suspect data – provisional until verified'.
- Identify any gaps in the dataset which need to be investigated further in Step 2.
- This data should be saved as 'Provisional raw data_V1'.

5.4.2 Step 2: Verification of errors or gaps in the dataset

- Any potential errors in the data that have been identified by automated or manual methods must be verified.
- A record of the information used to verify errors must be kept. This could include reference to:
 - Calibration and maintenance logs or site visit records to verify suspected errors or data loss associated with:
 - Failure of the sensor;
 - Pump failure;
 - Instrument performance factors such as calibration drift and fouling;
 - Sonde changeover;
 - Adverse weather, vandalism or any other issues which caused downtime of the sensor.
 - River flow gauged data to verify periods when the sensor was out of water.
 - Correlations/Interactions between water quality variables (interference).
 - Site location characteristics (e.g. sensors located in very small watercourses which could be subject to e.g. stagnation or siltation).
 - Typical measurement range for each of the water quality parameters.

Where documented and substantiated causes of data errors or gaps have been identified the data should be marked as 'suspect data – verified'.

Where errors are suspected but no information is available to verify the error the data should be marked as 'suspect data – unverified'.

This dataset should be saved as 'Validated raw data_V2'.

5.4.3 Step 3. Data evaluation and provision

- The data used to evaluate and report on the impact of each asset should be the 'Validated raw data_V2' (see Section 5.4.2, this document).
- The validated dataset should be made available on an annual basis to supplement the annual report to the Environment Agency, and at the request of the Environment Agency at any other time.
- Any other interested parties may also request access to the validated dataset.



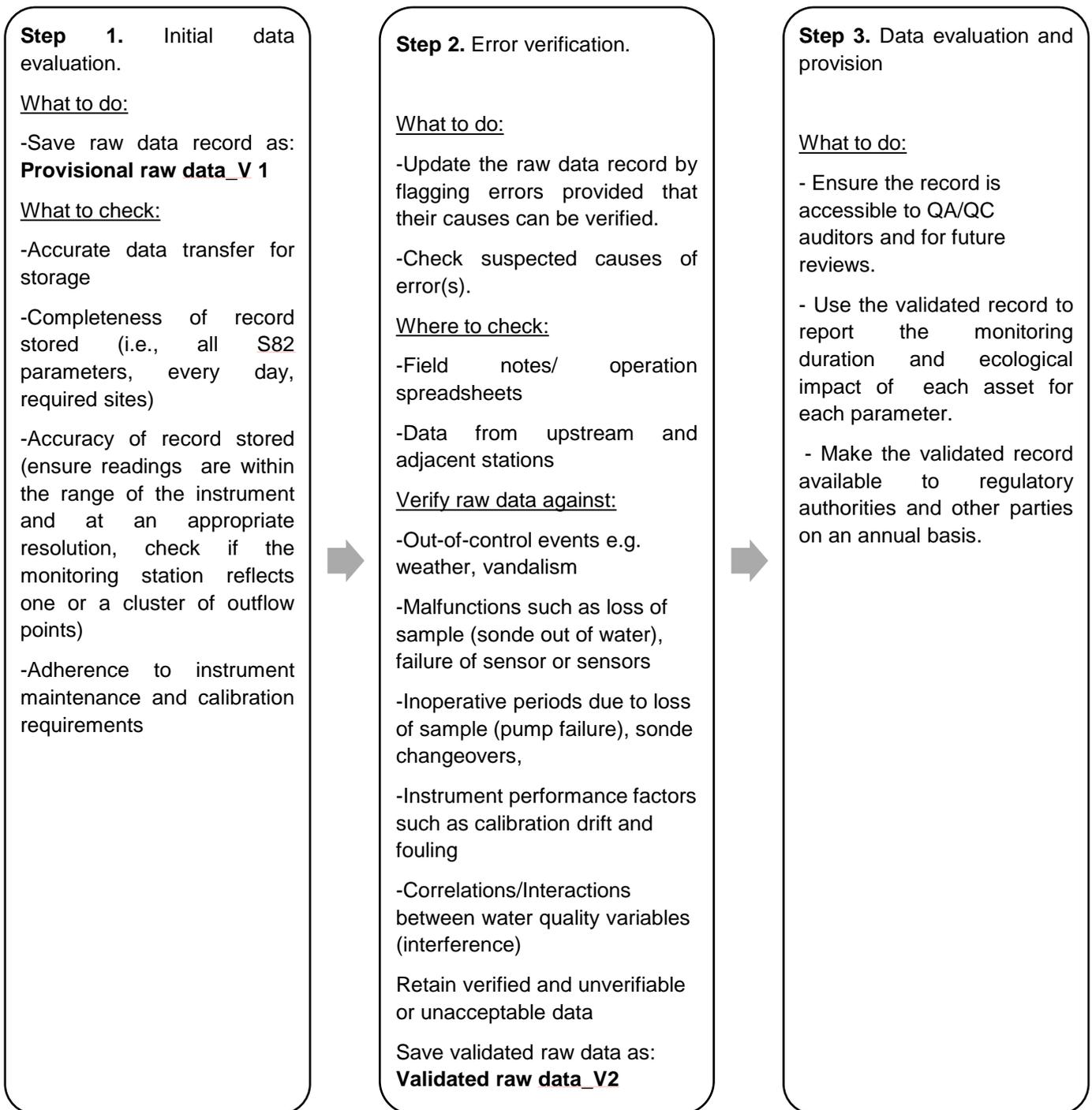


Figure 5-1 – Data validation steps



6. Assurance

Government will ultimately require the implementation of performance standards for the provision and maintenance of continuous water quality monitoring technology. This will ensure high standards of data quality and consistency by service providers.

A review of currently available assurance standards was carried out to determine applicability to continuous water quality monitoring in rivers under Section 82 of the Environment Act 2021.

A review of ISO17025:2017 'General requirements for the competence of testing and calibration laboratories' was conducted. However, the scope of the standard is focussed on sampling and laboratory services and does not currently cover the continuous monitoring activity described within this guidance. There is potential that the standard can be used to assure the end-to-end process of continuous monitoring as an overall analytical methodology. This would require discussion with the United Kingdom Accreditation Service (UKAS), the UK national body responsible for the implementation of this standard.

The current Environment Agency Monitoring Certification Scheme (MCERTS) series: 'Performance Standard for Organisations Undertaking Sampling and Chemical Testing of Water' and 'Performance Standards and Test Procedures for Continuous Water Monitoring Equipment', were reviewed for applicability. The relevant standards contained in these two series being:

- Performance Standard for Organisations Undertaking Sampling and Chemical Testing of Water: Part 1 – Sampling and chemical testing of untreated sewage, treated sewage effluents and trade effluents; covering sampling and laboratory analytical requirements in addition to the general requirements of ISO17025.
- Performance Standards and Test Procedures for Continuous Water Monitoring Equipment: Part 2 - Performance standards and test procedures for on-line monitors, covering the testing and certification of continuous water monitors.

The scope of both of these standards do not adequately cover the requirements of continuous water quality monitoring in rivers. Update of the standards or provisions of a new standard to meet the requirements of continuous water quality monitoring would require discussion with the Environment Agency.

This review has identified a lack of quality assurance frameworks available that can be immediately implemented to meet the needs of continuous water quality monitoring in rivers. Further development activity led by Defra/Environment Agency, will be required for an assurance framework.

Following this initial review, consultation workshops with Regulators and Water Companies were carried out to set out a series of potential options for implementation of a quality assurance framework (see Figure 6-1).



Models for Implementing S82 Standards

Scope – Equipment certification, calibration/maintenance, analysis & data provision

Assurance Model Options	Dis-benefit	Benefit
1. In-house Quality Management system working to (QMS) with effectiveness monitored through annual EA Operator Monitoring Assessment (OMA)	<ul style="list-style-type: none"> Potential for company variation and EA regional variation in assessment of effectiveness of systems Public & Secretary of State concerns with Operator Self Monitoring (OSM) model Concept of WaCo 'marking their own homework' 	<ul style="list-style-type: none"> Simple to implement with limited additional resource and cost requirements
2. QMS working to ISO17025 standard with effectiveness monitored through EA audit National Water Quality Instrumentation Service (NWQIS)	<ul style="list-style-type: none"> Requires EA resource to implement. 	<ul style="list-style-type: none"> Provides national consistency Independent assurance Regulator is close to process - NWQIS agree in principle
3. QMS with effectiveness monitored through ISO17025 Accreditation (Testing & calibration) via UKAS	<ul style="list-style-type: none"> Continuous monitoring not currently within scope of UKAS service offering would require development project to be initiated Increased costs and FTE resource to manage 	<ul style="list-style-type: none"> Provides a high degree of consistency Independent assurance Reduced burden for regulator resources
4. Quality Management system (QMS) with effectiveness monitored through accreditation to EA Monitoring Certification Scheme (MCERTS) Standards via CSA Group/ United Kingdom Accreditation Service (UKAS) (consider need - equipment MCERTS certification)	<ul style="list-style-type: none"> Continuous monitoring not currently within scope of MCERTS, would require scope to be included in existing standards / new standards to be defined Significant Increased costs and Full Time Equivalent (FTE) resource to manage for water companies and equipment manufacturers 	<ul style="list-style-type: none"> Provides nationally consistency Independent assurance Encompasses equipment certification



Figure 6-1 – Options for the implementation of a quality assurance standard for continuous water quality monitoring in rivers

Both Regulator and Water Company representatives in the consultation workshops recognised the need for independence in monitoring of compliance with a quality assurance framework. There appeared to be consensus that a form of assurance through the existing Environment Agency Operator Monitoring Assessment outlined in Option 1 was not appropriate.

Options 2-4 remain potential implementation models for consideration. There was considerable discussion in the consultation workshops on the practicalities of implementing Options 2-4 in terms of resource requirements by the Environment Agency, certification/accreditation bodies and Water Companies, to both develop an assurance framework, determine the timescales needed to implement the framework and determine the on-going resources required to deliver the assurance.

Options 2 and 4 will require the Environment Agency to commit operational resource. Development of a new MCERTS standard has been estimated to take up to two years and hence a new standard will not likely be in place before April 2026. Option 3 will require liaison with UKAS to discuss the feasibility and timescales that would be required to develop an appropriate assurance service. However, Water Companies are required to implement the requirements of the Environment Act from April 2025.

6.1 Recommendations and next steps

It is our recommendation that as an interim measure to meet the requirement to have an assurance process in place from April 2025, Water Companies and their contracted service providers undertake to develop, and or use, existing standards to develop quality management systems (QMS) to cover the following areas as described in the published draft technical guidance, this assurance standard and the external standards that are referred to in this document.



- Minimum equipment standards
- Installation standards
- Siting of monitors
- Maintenance and Calibration
- Data capture, storage, sharing and validation.

Further work needs to be carried out to determine the most appropriate and feasible assurance model for use in the longer term.

It is our view that options 2-4 would all be acceptable models, however Defra and the Environment Agency have indicated a scheme should be selected from Options 3 or 4, with a preference expressed by Defra for companies obtaining MCERTS accreditation for continuous water quality monitoring (Option 4).

In order to determine the most feasible model the following steps need to be taken:

- Review of resource availability within the Environment Agency to develop and update their existing standards to meet the specifications/requirements set out in this standard.
- Review of resource availability within the Environment Agency for the long-term delivery of the assurance model against the updated standards.
- Consultation with certification/accreditation bodies to determine the timescale needed to develop and implement an independent assurance against the standard. This could include assurance delivery through CSA Group, United Kingdom Accreditation Service (UKAS) or a combination of these bodies for different aspects of the technical standard, e.g. equipment certification by CSA Group and laboratory-based calibration & maintenance accreditation by UKAS.

The aim of this additional work would be to enable the audit of continuous water quality monitoring activity by water companies to be carried out by an independent accreditation body by April 2026.



APPENDICES

Appendix A. Extract from 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. Sewerage 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) The duty of a sewerage undertaker under this section is enforceable under section 18 by—
 - (a) the Secretary of State, or
 - (b) the Authority, with the consent of or in accordance with a general authorisation given by the Secretary of State.
- 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 to the level of risk to water quality);



- c. Provision for the publication by sewerage undertakers of information obtained pursuant to subsection (1).



Appendix B. Note on ammonia

It is recognised that technologies to directly monitor concentrations of ammonia (NH₃) in a watercourse are not yet available to meet the requirements of the programme (as set out in the draft technical guidance) and to compare directly with relevant Environmental Quality Standards (EQS) and the UPM FIS standards.

In aqueous solutions an equilibrium exists between ammonium (NH₄⁺, sometimes referred to as ionised ammonia) and ammonia (NH₃, sometimes referred to as unionised ammonia) as described by Equation 1.



The total concentration of the two species is commonly termed either total ammoniacal nitrogen, or total ammonia. The dynamic equilibrium that exists in water is very important as ammonia is toxic to aquatic organisms. This equilibrium is extremely dependent on pH with high pH favouring the formation of ammonia. The equilibrium is dependent to a lesser extent on temperature, pressure and the ionic concentration of the water.

Environmental quality standards have been developed for the protection of aquatic life.

The Water Framework Directive sets 90 percentile standards for total ammonia with different concentrations corresponding to High – Poor ecological status.

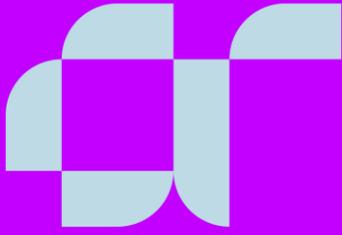
Two sets of standards have been developed for use in Urban Pollution Management modelling studies to assess the impact of wet weather discharges from storm overflows and to design solutions to ensure discharges from storm overflows are environmentally protective. These are the Fundamental Intermittent Standards (FIS) and 99 percentile standards.

The FIS standards are expressed in terms of concentrations of ammonia (referred to in FIS as unionised ammonia) and are directly relevant to ecosystem impact. The 99 percentile standards are used to limit organic loading on a waterbody. 99 percentile standards for both total ammonia and unionised ammonia have been developed.

The nomenclature used to describe this equilibrium varies by source. In this document we refer to **ammonium** (NH₄⁺) and **ammonia** (NH₃) to indicate ionised and unionised forms respectively.



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