ENVIRONMENTAL
Standards Scotland
Ìrean Àrainneachdail na h-Alba

Storm overflows - an assessment of spills, their impact on the water environment and the effectiveness of legislation and policy

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Contents

Key findings, recommendations and further work

Key finding 1: There is no comprehensive, publicly available information on the scale and environmental impact of spills from storm overflows in Scotland. In 2023, data was publicly available for 8% of storm overflows and emergency overflows although Scottish Water is only required by licence to report the data to the Scottish Environment Protection Agency (SEPA) for 4%. Scottish Water is currently reviewing whether it has further monitoring data available. Scottish Water is also implementing plans to increase the number of event monitors. If completed by the end of 2024 as planned, Scottish Water expects this to cover at least 35% of storm overflows and emergency overflows. While the majority of spills are unlikely to lead to an environmental pollution incident (EPI) or licence non-compliance, more publicly available information on these topics is necessary. See paragraphs 5.1 to 5.23.

Recommendation 1: The Scottish Government, Scottish Water and SEPA must make data in relation to waste water spills, compliance with licences and environmental pollution incidents available to the public to provide a comprehensive and accessible picture of the scale of spills from storm overflows. This should include reporting where and when discharges occur, their scale and the reasons for any discharges, as well as more details on when these result in pollution incidents covering the source, reasons and links to licence compliance.

Recommendation 2: Scottish Water must complete installation of, and publish all data from, the more comprehensive network of monitors set out in its 'Improving Urban Waters Routemap'. It should conduct and publish the results of targeted monitoring to assess the accuracy of predicted spill rates from its hydraulic modelling and in response to locations where environmental pollution incidents have occurred. In addition, monitors should be installed at all locations where storm overflows have been assessed as unsatisfactory and it should ensure that monitors are installed and operational wherever required by licence.

Further work by ESS: Environmental Standards Scotland (ESS) has begun to conduct investigatory work on the existing system for identifying, reporting and classifying environmental pollution incidents. This work will also examine whether, and to what extent, there are effectiveness issues with the law and the way it is being implemented or applied by the relevant public bodies.

Key finding 2: The Scottish regulations controlling waste water treatment (the Urban Waste Water Treatment (Scotland) Regulations 1994) derive from the 1991 European Urban Waste Water Treatment Directive. The Regulations require Scottish Water to ensure that sewerage systems for areas with a population equivalent to over 2,000, including storm overflows, meet the requirements of BTKNEEC (best technical knowledge not entailing excessive costs) to limit pollution. In addition, the Regulations require that, under normal climatic conditions, and taking into account seasonal variation, all urban waste water is collected and treated, except in exceptional circumstances. The European Court of Justice has made clear that this may only be departed from in exceptional circumstances. The Scottish guidance on this was last updated in 1998 and ESS finds that it fails to reflect the requirement for spills from storm overflows to be exceptional. This has had consequences for Scottish Water's operations and SEPA's regulatory activity and limits effective implementation and application of the law (see paragraphs 7.1 – 7.12).

Key finding 3: ESS' analysis of the limited data available demonstrates that, while some storm overflows appear not to spill at all, others spill more frequently and for longer periods than can be considered exceptional. This can occur without breaching existing licence conditions (see paragraphs 9.1 – 9.26).

Key finding 4: Climate change will increase the occurrence of extreme rainfall and alter what may be defined as exceptional circumstances. This, together with population changes and behaviour, will further increase the pressure on sewerage systems and, without intervention, is likely to lead to increased frequency and/or volume of spills (see paragraphs 7.10 – 7.12).

Recommendation 3: The Scottish Government should as a matter of priority: (1) prepare and publish up-to-date, clear and specific guidance about the exceptional circumstances in which it is permissible for storm overflows to spill; (2) ensure this guidance takes into account predicted future climatic conditions (commissioning further research if required); and (3) provide up to date information on BTKNEEC requirements.

Recommendation 4: SEPA should review and update its authorisation regimes and associated regulatory and operational guidance to reflect the Scottish Government's revised guidance and ensure that it remains up-to-date, publicly available and is in line with best practice.

Key finding 5: A small number of storm overflows are at risk of spilling during dry weather. This should not happen. ESS' analysis of the limited available data suggests Scottish Water and SEPA may not have identified all of the storm overflows that appear to spill in dry weather (see paragraphs 10.1 – 10.3). Dry weather spills are of greatest concern since their environmental impact is less likely to be diluted.

Recommendation 5: Scottish Water and SEPA should more routinely assess available rainfall, flow and spill event data to identify all instances of overflows which appear to spill in dry weather and prioritise these for investigation and improvement as soon as possible.

Key finding 6: In April 2024, the European Parliament adopted a revised Urban Waste Water Treatment Directive. The Scottish Government will need to review the legislation relating to waste water management to meet its commitment to keep pace with developments in European policy and legislation (see paragraphs 4.1 – 4.4).

Key finding 7: Overall, there has been significant progress in reducing the number of water bodies subject to pressure from waste water. In 2008, waste water was a pressure in 208 surface water bodies (out of a total of 2,013) in the Scotland River Basin District (all of Scotland, except the Solway and Tweed catchments). In 2020, it was a pressure in 48 surface water bodies (out of 2,827), particularly in more urban locations. Contaminants in storm overflows and treated sewage pose a potential risk to human health and to the environment which increases near and following a sewage discharge. This may not be identified in the monitoring of the overall quality of a water body (see paragraphs 12.1 – 12.7).

Further work by ESS: Later in 2024, ESS will begin work on the wider topic of water quality and river basin management planning. This will include examining whether the monitoring undertaken to classify whole bodies of water is adequate to identify more localised impacts from storm overflows.

Key finding 8: Scottish Water and SEPA have identified a small number of storm overflows (24 out of 3,674) as requiring enhancements to improve water quality of the wider receiving water body. Scottish Water indicate that there are a further 883 intermittent discharges currently identified as being unsatisfactory, mainly due to sewage related debris. Scottish Water are prioritising these for improvement. The

scheduling of this improvement is subject to agreement with Scottish Ministers (see paragraphs 11.1 – 11.7).

Recommendation 6: Scottish Water should publish a comprehensive and accessible plan for all proposed improvement work specifying: (1) the locations of all these storm overflows; (2) the timetable when improvement work will take place; and (3) if the timetable for work has not been finalised, specify when a decision on whether to proceed will be made.

Glossary

BTKNEEC – best technical knowledge not entailing excessive cost.[10]

Biochemical oxygen demand (BOD) – "the amount of oxygen used for biochemical oxidation by a unit volume of water at a given temperature and for a given time. BOD is an index of the degree of organic pollution in water".[1]

Combined sewers – a sewer which "combines both waste water from our homes and businesses (toilets, sinks, showers, baths etc) and surface water from roofs and gutters".[2]

Combined sewer overflows (CSOs) – a release mechanism from a combined sewer "in order to prevent flooding or inundation of areas (including domestic property and commercial premises) with dilute sewage".[3]

Domestic waste water – "waste water from residential settlements and services which originates predominantly from the human metabolism and from household activities".[10,11]

Dry weather flow – "the total daily flow value that is exceeded by 80% of the total daily flow values in a period of twelve months".[4]

Emergency overflows (EOs) – "are designed to cater for mechanical and/or electrical failure, rising main failure or blockage in the downstream sewer".[3]

Environmental pollution incident (EPI) – an event "which has, or may have, an environmental impact".[107]

Final effluent – waste water after treatment has been undertaken at a sewage treatment works/waste water treatment works.

Industrial waste water – "any waste water which is discharged from the premises used for carrying on any trade or industry, other than domestic waste water and run-off rain water".[10,11]

Intermittent discharges – discharges from combined sewer overflows, settled storm sewage overflows, emergency overflows, surface water overflows and any other overflows which do not release a continuous flow of treated waste water.

Pass forward flow – the minimum flow which is passed forward for treatment before an overflow discharges to the environment.[5]

Population equivalent (p.e.) – a measure of the organic biodegradable load that is served by a treatment system. It gives an indication of the number of people that would produce the same polluting load. One p.e. "means the organic biodegradable load having a five-day biochemical oxygen demand (BOD5) of 60g of oxygen per day".[10] For reference, a standard three-bedroom house has a p.e. of five.

Settled storm sewage overflows (SSSOs) – overflows which discharge from storm tanks (on the sewer network or at a waste water treatment works) or primary tanks at waste water treatment works into surface waters.[6]

Sewage – "the part of waste water that is contaminated with faeces or urine but is often used to mean any waste water".[7]

Sewage treatment works (STW)/waste water treatment works (WWTW) – "infrastructure providing a series of treatment processes aiming to reduce the level of pollution of wastewater received to an acceptable level before discharge into the receiving waters".[8]

Sewerage system – "system of pipes, usually underground, for carrying waste water and human waste away from houses and other buildings, to a place where they can be safely got rid of".[9]

Storm overflows – combined sewer overflows and settled storm sewage overflows.

Urban waste water – "domestic waste water or the mixture of this industrial waste water and / or run-off rain water".[10,11]

1. About this report

1.1 Environmental Standards Scotland's (ESS) Strategic Plan identified a number of analytical priorities.[12] ESS identified sewage discharge into the aquatic environment as a priority for analysis because of:

- public concern about sewage discharges
- the lack of publicly available data on storm overflows in Scotland
- investigations into the issue in England

1.2 Section 20 of the UK Withdrawal from the European Union (Continuity) (Scotland) Act 2021 ('the 2021 Act') defines ESS' functions. ESS' remit is to:

- ensure public authorities, including the Scottish Government, public bodies and local authorities, comply with environmental law
- monitor and take action to improve the effectiveness of environmental law and its implementation

1.3 The analysis presented here focuses on the effectiveness of environmental law and how it is implemented and applied. Specifically, it focuses on the following legislation where they relate to storm overflows:

- the Urban Waste Water Treatment (Scotland) Regulations 1994 ('the 1994 Regulations')
- the Water Environment (Controlled Activities) (Scotland) Regulations 2011 ('the CAR regime')

1.4 In addition to defining ESS' functions, section 20 of the 2021 Act enables ESS to make recommendations to public bodies. ESS can also identify specific concerns that merit further investigation by it, or topics that will be prioritised for future analysis or ongoing monitoring.

1.5 This report:

- analyses the data and evidence on the frequency and duration of sewage discharges from storm overflows
- summarises a literature review focused on studies of continuous treated discharges and intermittent discharges

- examines the effectiveness of existing legislation and guidance including in light of future changes, such as climate change and the recently adopted recast European Urban Waste Water Treatment Directive

1.6 ESS' findings and recommendations are based on:

- its analysis of data available from official sources up to June 2024
- evidence gathered from a review of published documents
- information provided to us by, and discussions with, the Scottish Government, the Scottish Environment Protection Agency (SEPA) and Scottish Water

1.7 Water quality is a complex area of policy and legislation, with a range of drivers and pressures affecting the quality of water bodies. This work has focused in detail on sewage discharges from storm overflows. ESS will consider water quality in more detail in future analytical work on progress against river basin management planning (RBMP) objectives. This work will consider the much wider range of factors affecting the overall quality of Scotland's water bodies. ESS is also currently undertaking analysis of litter as a pressure on the marine environment which will include sewage related debris and discharge.

1.8 ESS asks the Scottish Government, the Scottish Environment Protection Agency and Scottish Water to respond to the recommendations in this report as soon as possible and within six months of publication. Nothing in this report, or the recommendations made within it, prejudices ESS' ability to make decisions about further scrutiny of the topics covered, for example, in response to representations made to ESS on related matters.

2. Storm overflows and the sewerage system

2.1 In 2022/23, Scottish households and businesses produced over a billion litres of waste water every day.[13] This waste water comes from toilets, sinks, baths, washing machines and other appliances, as well as industrial and commercial processes. It enters the sewer network via pipes which carry the waste water to the nearest underground sewer.

2.2 Scottish Water managed 54,220 km of sewer pipes in Scotland in 2022/23.[14] Most are combined sewers which combine waste water from homes and businesses with surface water from impermeable surfaces such as roofs, gutters, roads and paved areas. The total amount of waste water which reaches treatment works is therefore greater than that produced by households and businesses alone.

2.3 The sewerage system is designed such that the majority of the waste water should make its way through the network to treatment works where it is treated before being released into the environment in a continuous discharge.

2.4 The majority of sewers in Scotland are combined sewers. Since 2005, Scottish Building Standards[15] have stated that “these systems are not recommended today as they are more likely to surcharge during heavy rains”.[16] Scottish Water’s guidance for developers states that it is “recognised best practice to separate out foul sewage from surface water”. It provides an order of preference for dealing with surface water with drainage to a combined sewer being the least preferred option.[17]

2.5 When there is heavy rainfall, more water can enter combined sewers than they have capacity to carry to downstream treatment works. This leads to the risk of the sewer flooding homes and businesses. To mitigate this risk, there is a system of overflows in the sewage network and at treatment plants.[3]

2.6 These overflows include:

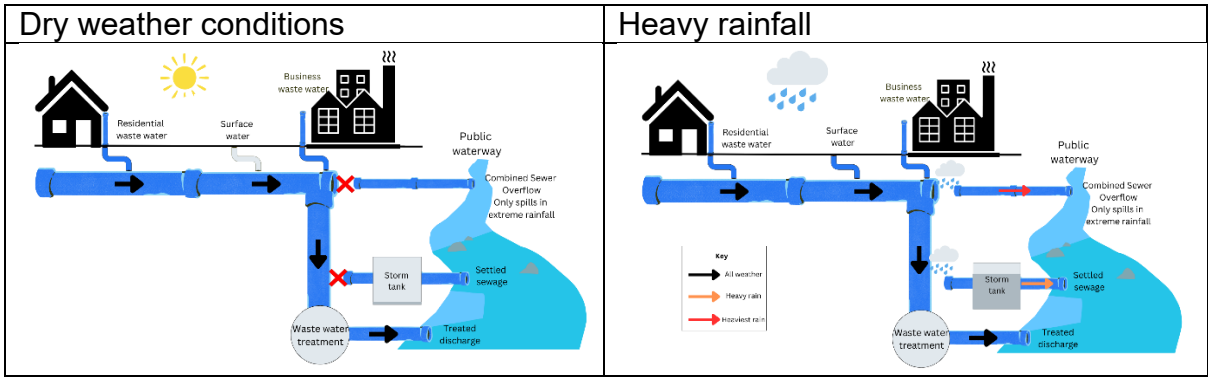
- combined sewer overflows (CSOs) which discharge directly from combined sewers to surface waters to prevent flooding or inundation of areas (including domestic property and commercial premises) with dilute sewage.[3] These can be on the sewer network, at a pumping station or on an inlet to a waste water treatment works.[18] CSOs should operate intermittently and only in response to rainfall events

- settled storm sewage overflows (SSSOs) where the waste water receives settlement (in storm tanks) or primary treatment (in primary tanks) before discharge to surface waters. They can be located on the sewer network or at sewage treatment works.[3,18] SSSOs should operate intermittently and only in response to rainfall events
- emergency overflows (EOs) are designed to operate in the case of mechanical and/or electrical failure of pumps, screens or flow control devices, rising main failure or blockage in the downstream sewer, rather than for rainfall and should therefore spill infrequently.[3] These failures and any resultant spills from the EO would be considered an environmental pollution incident and must be reported and classified according to severity (see chapter 13)

2.7 This report refers to CSOs and SSSOs as 'storm overflows'. If storm overflows are working as expected, the spilled waste water will be diluted by rainfall and therefore is unlikely to cause damage to the environment. Furthermore, in the case of SSSOs, waste water will have received some settlement before release.[2] In addition, some SSSOs are located after primary treatment has occurred in the treatment works. Screens may also be present on the storm overflow to protect the environment from sewage related debris.[3] However, for EOs, there may be no dilution before release to the water body.

2.8 SEPA provides the following example[i] of the operation of these overflows. "During normal dry weather conditions the only discharge should be the final effluent from the sewage treatment works. If the flows into the works increases past the hydraulic capacity of the sewage treatment works, i.e. during intense rain, some of the sewage is diverted to storm tanks. If the event is prolonged, and the storm tanks fill to capacity, they will start to discharge settled storm sewage. During higher intensity or prolonged rainfall events, the CSOs upstream of the storm tanks start to operate. The EO should only discharge if there is a malfunction at the pumping station, such as a choked rising main stopping any flows being passed forward to the STW or pump failure".[3]

Figure 1: Illustration of typical arrangement of storm overflows under dry weather conditions and heavy rainfall[i,ii]



2.9 Based on data provided to the Water Industry Commission for Scotland (WICS)[iii], Scottish Water reports that 3,674 storm overflows and emergency overflows existed in Scotland in 2022/23.[19] However, Scottish Water is working through a data cleansing exercise to update its asset inventory and expects this number to increase. Scottish Water expects that the majority of those to be added will be within the boundary of waste water treatment works rather than on the wider sewage network.

[i] It should be noted that this is an illustrative example and not all parts of the sewerage system will have all of these features e.g. not all waste water treatment works have storm tanks.

[ii] Some SSSOs are located after primary treatment has occurred in the WWTW.

[iii] WICS is the economic regulator of Scottish Water. Its role is to promote the interests of Scottish Water's customers and to determine the maximum amount Scottish Water can charge. This is set to reflect the lowest reasonable costs necessary for Scottish Water to deliver Scottish Ministers' objectives.

3. Legislation, policy and guidance

3.1 The main drivers of law and policy relating to water pollution controls in Scotland are European Union directives that have been transposed into Scottish legislation. The two key directives relating to controls on sewage discharge are the:

- Urban Waste Water Treatment Directive (91/271/EEC)[10]
- Water Framework Directive (2000/60/EU)[20]

3.2 The Urban Waste Water Treatment Directive aims to protect the environment from the adverse effects of urban waste water discharges. It set standards to be met in the collection and treatment of waste water for areas with a population equivalent to over 2,000, as well as the monitoring requirements for treated waste water discharges from such urban areas. The Directive is implemented in Scotland by the Urban Waste Water Treatment (Scotland) Regulations 1994 ('the 1994 Regulations')[11] and its associated 2003 amendments.

3.3 The 1994 Regulations impose duties on Scottish Water in relation to the provision and maintenance of sewer networks and treatment plants, treatment standards and discharge limits. There is provision in the 1994 Regulations for Scottish Ministers to take enforcement action against Scottish Water should it fail, or is likely to fail, to comply with the Regulations. In addition, the Sewerage (Scotland) Act 1968 also place duties on Scottish Water to drain, treat and deal effectively with domestic sewage, surface water and trade effluent.

3.4 The Water Framework Directive established a common framework for the sustainable management of Europe's water environment and is implemented in Scotland by the Water Environment and Water Services (Scotland) Act 2003 (WEWS).[21] WEWS makes specific provision for protection of the water environment by introducing a framework of river basin management planning (RBMP) requiring objectives to be set for every water body in terms of ecological and chemical status. It also gives Scottish Ministers powers to introduce regulations to control activities that can have an adverse effect on the water environment. Such controls have been put in place through the Water Environment (Controlled Activities) (Scotland) Regulations 2011 ('the CAR regime').[22]

3.5 The CAR regime gives the Scottish Environment Protection Agency (SEPA) powers to control a range of activities that may impact the water environment (known as ‘controlled activities’). There are three levels of authorisation required for controlled activities, intended to reflect relative environmental risk:

- general binding rules (GBRs)
- registrations
- licences

3.6 Discharges from waste water treatment works and sewer networks must have a licence under Regulation 8 of the CAR regime. The licence will contain conditions regulating activities at the site and will identify a ‘responsible person’ who must ensure compliance with the conditions of the licence. The overall duty to monitor and enforce the CAR regime, including monitoring compliance with any conditions of an authorisation granted, falls on SEPA.[iv]

3.7 In addition to the legislation noted above, there are a number of other pieces of legislation which, while not directly addressing urban waste water or sewage discharges, are relevant to the overall regulatory landscape. For example, the Bathing Water Directive and the Groundwater Directive, and their associated Scottish regulations, set water quality standards which may be affected by spills from storm overflows.

[iv] The imminent introduction of an integrated authorisation framework under section 18 of the Regulatory Reform (Scotland) Act 2014 (which is intended to integrate the authorisation, procedural and enforcement arrangements relating to water, waste and radioactive substances and pollution prevention and control) will replace existing legislation in due course, including CAR.

4. Revision of the Urban Waste Water Treatment Directive

4.1 The Urban Waste Water Treatment Directive is now over 30 years old.[23] Despite its success in improving European water quality, an evaluation found that some pressures could be further addressed, including surface water run-off and storm overflows.[24,25] Based on this evaluation and an impact assessment, a proposed revision to the Directive was published on 26 October 2022. Following amendments, this was formally adopted by the European Parliament on 10 April 2024.[26]

4.2 The revision includes requirements to:

- produce integrated urban waste water management plans for our largest urban areas and some other areas where there is environmental risk, to combat pollution from urban run-off and storm water overflows - these should be reviewed every six years
- assess the risks to the environment and human health of waste water discharge, including considering seasonal fluctuations and extreme events, by the end of 2027 - this should be aligned with RBMP processes
- monitor pollutants from urban run-off, storm water overflows and the outlets of sewage treatment works
- take all necessary measures (where technically feasible) to adapt collection and treatment infrastructure to address increased loads of domestic waste water
- address vulnerability to climate change when designing, constructing and operating plants and collection systems
- make easily accessible up-to-date information available online

4.3 In addition, the proposals extend collection and treatment requirements to smaller areas and tighten the required level of treatment at sewage treatment works. This includes introducing new limit values for micro-pollutants which will require additional quaternary treatment for the largest facilities and for some other facilities where there is a risk to the environment or public health.

4.4 The Scottish Government has committed to maintaining alignment with European Directives using the power in section 1(1) of the Withdrawal from the European Union (Continuity) (Scotland) Act 2021. It is currently assessing how it will align with

the proposed revisions to the Urban Waste Water Treatment Directive. Given the adoption of the revised direction, revision to Scottish Legislation will be necessary to maintain alignment. In November 2023, the Scottish Government launched a consultation on water, waste water and drainage services which included questions relating to storm overflows and which will be used to further develop policy.[27]

5. Availability of data on the scale and impact of spills from storm overflows

5.1 Data is publicly available for 8% of storm overflows and emergency overflows for 2023.[18,28] A further 11% are required by licence to have event monitors installed. However, no data is currently published for these and work is ongoing by Scottish Water to establish whether there is monitoring and data available. In contrast, in England, 100% of storm overflows and emergency overflows were monitored by the end of 2023[29] (the figure was 91% at the end of 2022[30]) and in Wales almost 100% are monitored.[31,32,33] The difference in levels of monitoring between countries reflects variation in policy on this topic. In Scotland, SEPA and Scottish Water indicate that the focus has been on identifying, investigating and addressing unsatisfactory storm overflows (as discussed in chapter 8) over comprehensive event monitoring.

5.2 In 2023, only 154 (4%) of the 3,674 storm overflows and emergency overflows were required by licence[19] to have event monitors installed and to report information on the frequency and duration of spills to SEPA.[18,v,vi] Other licences require permanent spill event monitors to be installed but do not require the information to be reported to SEPA unless requested. Based on the latest published data and information from Scottish Water, a further 440 (12%) were required by licence to have event monitors installed. However, data was only available for 60 of these. In addition, data was available for 74 storm overflows where monitoring was not a licence requirement but event monitors had been installed. Scottish Water has recognised the need to improve in the collection, collation and cleansing and

[v] Reporting of spill data is generally only required by the licences of waste water treatment works serving greater than or equal to 15,000 population equivalent. However, some other licences (for treatment works or sewer networks) will include this requirement if there is an environmental need such as low dilution or downstream designated sites. In some cases reporting to SEPA will be less frequent (e.g. every five years) or for specified time periods (e.g. during the bathing season).

[vi] In 2023, one waste water treatment works submitted combined data for its CSO, SSSO and EO while another combined data for two storm pumps at its CSO which had reported separately in earlier years.

publication of the spill data for all other monitored storm overflows and emergency overflows. It has indicated that “further review and assurance work is in progress to report for all”.[34]

5.3 Even where reporting to SEPA is required by licence, for some storm overflows (13 in 2023, approximately 8% of the overflows in the return to SEPA) data is not included in the annual publication of data by Scottish Water.[28] Scottish Water indicates that these instances would be investigated and actions taken to address with progress reviewed regularly. SEPA also notes that it assesses the data returned by Scottish Water annually as part of compliance assessment and any issues identified are investigated.

5.4 Where reporting is provided, Scottish Water has updated previous versions without making this clear on its website or highlighting what changes have been made. For example, the 2023 data for overflows where reporting to SEPA is not required was first published in March 2024, updated in June 2024 and subsequently in August 2024. This analysis considers the June 2024 version which updated the 2023 total number of spills from 6,371 to 9,820 with no indication on the website or spreadsheet that there had been changes and no explanation. The change appears to be due to Scottish Water including information for a further 31 storm overflows which had previously been recorded as having ‘no data’. Whilst it is welcome that Scottish Water are quality assuring and adding to the available data, releasing this in a managed and timely fashion with information on revisions made to previously published data would improve user confidence in the outputs.

5.5 The proportion of monitored storm overflows and emergency overflows may be lower still if Scottish Water’s current data cleansing identifies a higher total number of storm overflows. Scottish Water’s data also does not include sites operated under the Private Finance Initiative (PFI) which report direct to SEPA. In 2022, this represented nine storm overflows within the boundary of five waste water treatment works. SEPA should publish this information in a comparable format and with consistent definitions to the Scottish Water data to allow a more comprehensive picture to be presented.

5.6 In 2021, Scottish Water published its Improving Urban Waters Routemap (‘the routemap’),[35] a commitment from the 2021 to 2027 River Basin Management Plan for Scotland.[36] This includes plans to increase the number of event monitors

(installing a further 1,000 over 2023 and 2024) and to publish the associated data. During 2023, 230 monitors were installed, therefore a further 770 must be installed by the end of December 2024.[34] In addition, 53 further discharge monitors were installed at overflows as part of Waste Water Intelligent Networks. Scottish Water subsequently provided an update to ESS confirming that, as at 7 August 2024, 823 new monitors had been installed with the remaining expected to be in place by the end of the year.

5.7 As part of the routemap, Scottish Water also committed to publishing the reasons for spills "where possible". Providing this detail should allow greater public understanding of the circumstances in which spills occur. However, this is not yet included in any of the publicly available information.

5.8 The lack of both publicly available data and data in general has limited the analysis which ESS has been able to undertake. The data and evidence is published in different places, by different public bodies, and is not easy to access or interpret. For example, it is not currently possible to compare the available spill data with information from England and Wales. It is also not easy to relate the limited available data on spills[18,28] to other information (where available) on:

- environmental pollution incidents[37]
- licence compliance[38]
- the condition of individual water bodies[36]
- weather conditions

5.9 The existing data does not provide a comprehensive picture of the extent of spills and their impact in Scotland. ESS finds that more monitoring (including that planned in the Scottish Water routemap) and publication of data is needed to allow, for example, comparison of actual spills to hydraulic modelling, where environmental pollution incidents have occurred, where there is a risk of environmental harm and where storm overflows have been assessed as unsatisfactory (see chapter 8).

5.10 This lack of data, combined with the fact that the information from these monitors is presented differently to other countries, means that it is not possible to robustly compare performance with England and Wales or other jurisdictions. More publicly available data would allow further comparison, particularly if the data could be translated to a common metric.

5.11 Scottish Water has over 330 hydraulic models[vii] of different parts of the sewerage system, covering 97% of the Scottish population.[39] This covers a large number of storm overflows for which reporting of spills to SEPA is not currently required. In addition, Scottish Water has a wide range of data from environmental studies. Publishing this information would provide a much more comprehensive picture of predicted spill frequencies and environmental impact of spills from storm overflows. Scottish Water should summarise and make publicly available this evidence. To date, Scottish Water has indicated that it is reviewing the available data but is not yet in a position to provide summary information.

5.12 Flow monitors "provide information on whether pass forward flow are being maintained or dry weather flow are being exceeded and can also provide estimates of spill volumes".[3] Like event monitors, licences do not require permanent flow monitors to be installed for all storm overflows and where they are installed, Scottish Water is only required to report the information from a small proportion to SEPA. This is generally the case where the overflow is within the boundary of a treatment works serving over 15,000 population equivalent, or where there is an environmental need.[40,41]

5.13 In 2023, only 78 storm overflows[viii] (2%) were required to report on the volume of spills (combining event monitoring and flow monitoring data) to SEPA.[18] The data from other flow monitors installed should be available to SEPA on request to Scottish Water. However, none of this information is publicly available.

5.14 Scottish Water's latest update on the Improving Urban Waters Routemap indicates that it is undertaking a "Pass Forward Flow project" to "study those overflow discharge frequencies from waste water treatment works. This will allow us to identify and develop a programme of improvements".[34] The findings of this project should be published.

[vii] Simulations of the sewer network taking account of waste water volumes, physical characteristics and the flows and levels of receiving waters. These can be used to predict how frequently an overflow will operate.

[viii] In 2023, one waste water treatment works submitted combined data for its CSO, SSSO and EO.

5.15 SEPA is required, under Regulation 37 of the CAR regime, to maintain a public register of information in relation to authorised activities (including applications, granted authorisations, enforcement action and monitoring).[22] SEPA's maintenance of this register was compromised by the cyber-attack which it experienced in December 2020.[42] ESS has separately reached an informal resolution with SEPA on its plans to make relevant information progressively available, with the ultimate goal being a new, fully online and accessible public register.[43]

5.16 The latest available compliance data for waste water treatment works and sewer network licences relates to 2019.[38] This leaves a large gap in publicly available information about whether storm overflow performance is in line with licence requirements. There is only summary information available with a more limited dataset searchable on SEPA's website. The reasons for non-compliance are not clearly provided though there is some, more detailed commentary (though not in a consistent form). It is only possible to determine that a licence involving a storm overflow (which can only be currently known itself by requesting information from the public register or for the small proportion of overflows where data is published) is non-compliant rather than be sure whether the storm overflow contributed to the non-compliance.

5.17 SEPA notes that an updated compliance system was implemented in 2021 but that only a partial picture is available due to the gradual build-up of inspections being logged on the systems over time. Compliance status has, however, been communicated to authorisation holders. SEPA plans a consultation on a new Environmental Performance Assessment Scheme which its website indicates will take place during 2024/2025, including on a definition of major non-compliance.[44] Available compliance information should be published annually and made available in a more user-friendly format and with a broader range of information included, for example, providing clear and consistent reasons for non-compliance and the full range of enforcement activities undertaken linked to the licence number.

5.18 Scottish Water has published information on the 108 overflows identified and agreed these with SEPA as the highest priority for improvement.[45] However, no details are available on the larger number of lower priority sites which have also been identified as unsatisfactory. There is also no information available on the impact, if any, that these unsatisfactory overflows have had on licence compliance.

5.19 In addition, the published data previously provided details of the reasons why each overflow had been identified as being a high priority (e.g. whether affecting water quality or aesthetic issues or appearing to spill in dry weather or pollution incidents). However, in updating the information to provide details on progress, this has been removed. The information provided on progress is also very limited and in the majority of cases simply notes that a project has been initiated. Scottish Water and SEPA should provide regular and more detailed progress updates on overflow improvements and related policies (such as the Improving Urban Waters Routemap).

5.20 Only high-level information is publicly available on numbers and categories of environmental pollution incidents. This is mainly presented combining both water and waste water assets in recent years.[37] More publicly available information covering the sources of the incidents (including whether from a storm overflow), the reasons for the incident and links to licence compliance information would add to the understanding of the impact of spills from storm overflows.

5.21 The Urban Waste Water Treatment Directive requires situation reports and implementation reports to be published and provided to the European Commission by Member States every two years, with monitoring data made available to the European Commission on request (every two years to date). Prior to the UK's exit from the European Union, Scottish data was combined with information from the rest of the UK and submitted to the European Commission. This information was then scrutinised and published, both in raw form[46] and in summary implementation reports on the EU website.[47,48]

5.22 Since the UK left the European Union, the information is still prepared but is no longer made publicly available in Scotland. This contrasts with England where the latest information was published in December 2022.[49] Unpublished data for 2020 was shared with ESS as part of this project. The Scottish Government should publish this in a manner which allows comparison with other parts of the UK and Europe.

5.23 Greater availability of information across all of these topics would support the right of the public to access environmental information held by public bodies under the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters.[50]

6. Contaminants in discharges from storm overflows and treated sewage

6.1 Water quality is a complex issue. There are multiple sources of pollution and impacts vary according to type of water body, the ecosystems affected and use of the downstream water.[25] In addition, water quality is defined differently depending on the protection goals. For example, the legislative requirements for aquatic systems (Water Framework Directive), bathing water quality (Bathing Water Directive) and drinking water quality (Drinking Water Directive) are all different.[25]

6.2 As a result of the wide range of inputs to the sewer network, waste water may contain a wide range of contaminants. To understand the potential environmental and human health impacts, ESS undertook a literature review focused on studies of both continuous treated discharges (from sewage treatment works) and intermittent discharges (from storm overflows). The review concentrated on literature from the UK and EU or, where this was not available, countries (in Western Europe and North America) with similar sewerage systems to Scotland.

6.3 Waste water is not necessarily the only source of contaminants entering the water environment. Contaminants may also originate from other sources, such as agricultural run-off, and background levels in surface waters may vary. ESS also recognises that the level of pollution in the sewage discharges which reach the water environment is related to the quality of the waste water entering the sewerage system itself. There are a number of policies in place to address this.[ix]

6.4 The literature review undertaken has identified contaminants which are likely to be present at elevated levels following sewage discharges (from either storm overflows or treated sewage). Many of these could result in adverse effects to

[ix] For example, the One Health Breakthrough Partnership which aims to address pharmaceutical pollution (https://ohbp.org/our-work/pharmaceuticals-in-the-environment/).

ecosystems (including to fish, birds, mammals and humans) at concentrations above Environmental Quality Standards (EQS).[x]

- metals[51]
- hydrocarbons[51]
- pesticides[51]
- microplastics and the contaminants they release and which adsorb to them[52]
- organic contaminants (chemical compounds containing carbon)[51]
- pathogens (organisms causing disease)[53]
- pharmaceuticals and personal care products[54]
- hormones[55]
- organic matter and solids (matter produced by living organisms, or their remains)[56]
- nutrients[53]

6.5 These contaminants may come from the sewage itself, from the surface water run-off with which sewage mixes in the sewer network or from sediments eroded when there is increased flow in the sewer. Many contaminants are removed during treatment but not all are effectively separated from effluent. While most are not removed during overflow events, they will be diluted if storm overflows are working as expected.

6.6 In many of the studies reviewed,[51,57,58,59,60] the EQS for a range of contaminants (metals, phthalates and PAHs) were exceeded in and/or around and downstream of sewage discharges. The proposed EQS for diclofenac (an anti-inflammatory medicine) was also regularly exceeded.[54,61,62] Exceedances of the EQS attributed to sewage discharges have been observed in studies at distances of 800 metres downstream of the discharge point[63] (Italy) and negative effects attributed to

[x] Environmental Quality Standards are limits on the concentration of substances with harmful effects on biological quality that are discharged into the UK's water environment in large quantities. EQS have been determined based on a range of factors, one of which is how toxic they are to aquatic life. It is important to note that the list of contaminants is not static and further emerging pollutants may be added in future where research shows that they are a risk.

contaminants from sewage discharges have been observed in aquatic life eight kilometres downstream of the discharge point (Canada).[64]

6.7 Article 4 of the Water Framework Directive allows for exceedances of EQS in "mixing zones adjacent to points of discharge" "if they do not affect the compliance of the rest of the body of surface water with those standards". The studies reviewed did not explore whether these exceedances affected the compliance of the rest of the surface water body.

6.8 The exact impact of contaminants will vary according to factors such as the concentration, length of exposure and environment into which they spill. Fast-flowing, high-volume rivers or sea locations with high tidal influence will disperse more quickly than slow-moving, low-volume streams or coastal areas with low tidal influence like a cove or harbour.

6.9 Contaminants for which there is clear evidence of environmental impact connected to sewage discharges are excess phosphorus and nitrogen. Studies in Scotland found that, where there is excess phosphorus in a surface water, resulting algal blooms have a wide range of associated effects including death of fish and dogs, reductions in bird numbers and a reduction in biodiversity.[65,66] Blooms and their effects have been observed in Scottish lochs and rivers. The studies, including recent work in Loch Leven,[53,67] found that the largest introduction of nutrients to surface and groundwater was from agriculture, with sewage discharges being the second biggest source, accounting for 12% of the nutrient load in Loch Leven.[67] This trend was also observed in global studies. In terms of sources, CSOs were found to contribute lower amounts of these nutrients than continuous discharges from waste water treatment works.[68]

6.10 Contaminants from sewage discharges also impact the marine environment, either through direct discharges to sea or via input from rivers. Sewage-related debris is routinely recorded during beach clean surveys across Scotland[69,70] and the UK,[71,72] and comprises larger plastic items, such as wrongly disposed wet wipes and sanitary products. Sewage discharges (either treated sewage or storm overflows) have been identified as potentially one of the largest sources of microplastics entering the marine environment.[73]

6.11 The ecological effects of microplastics in the marine environment are now well evidenced. Such impacts include reduced body conditions, impacts on growth[52] and feeding rates,[74] build-up of ingestible matter (i.e. bioaccumulation) in species,[75,76] and wider ecosystem impacts.[52]

6.12 In terms of impact on human health, exposure to pathogens, introduced to the water environment by storm overflows, during swimming was the main risk identified. In a study in Denmark, illness rates from swimming in contaminated waters the day after heavy rain were 42% compared to 8% in the same water when no sewage overflows had occurred.[77] In a UK study, 54% of swimmers at an event held after a storm suffered gastrointestinal illness.[78] Studies from the UK and Australia found that humans regularly entering surface waters have been found to be colonised by higher numbers of pathogens demonstrating antimicrobial resistance than the general population, and levels of antibiotic resistant genes appear to increase around sewage discharges.[79,80] Illness has also been linked to shellfish harvested from areas affected by sewage in Wales.[81]

6.13 This review has identified that sewage discharges are a source for a wide range of contaminants, some of which pose a risk to human health and to the environment at the levels identified around and downstream of sewage discharge points. However, most of the studies did not explore how much this affected the wider body of surface water. ESS also finds an evidence gap with very few studies specifically considering contaminant levels around overflows in Scotland and their resultant impact. Given the precautionary principle and the requirement for protective measures to be taken ahead of environmental harm materialising, ESS considers that more research in this area would be helpful.

7. Guidance on spills in exceptional circumstances

7.1 The Urban Waste Water Treatment Directive and 1994 Regulations require that:

- treatment plants are built, “constructed, operated and maintained to ensure sufficient performance under all normal local climatic conditions”
- the design, construction and maintenance of collecting systems should limit the “pollution of receiving waters due to storm water overflows” in line with “best technical knowledge not entailing excessive costs” (BTKNEEC)
- “the points of discharge of urban waste water shall be chosen, as far as possible, so as to minimise the effects on receiving waters”[10,20]

7.2 The overarching objective of the Urban Waste Water Treatment Directive is to protect the environment from the negative effects of urban waste water discharges. To meet this objective, the starting point is that all urban waste water (from areas with more than 2,000 population equivalent) should be collected and treated. There is however an acknowledgement, in a footnote in Annex I of the Directive, that situations exist in which this may not always be possible. The footnote states “given that it is not possible in practice to construct collecting systems and treatment plants in a way such that all waste water can be treated during situations such as unusually heavy rainfall, Member States shall decide on measures to limit pollution from storm water overflows”.

7.3 While a number of concepts, including “sufficient performance”, “unusually heavy rainfall”,[25] “‘normal local climatic conditions” and BTKNEEC, are not precisely defined in the Directive, some have since been clarified by the European Court of Justice (ECJ).[82] In particular, for a treatment plant to be considered to be performing sufficiently, all urban waste water should be collected and treated under usual climatic conditions and taking account of seasonal variations. The only situations in which this may be departed from is in response to an exceptional event. It should be noted that, while the footnote in Annex I makes specific reference to ‘unusually heavy rainfall’, this is by way of illustration only, and a failure to collect or treat waste water may also be tolerated in other circumstances, provided these are exceptional.

7.4 The Urban Waste Water Directive and the 1994 Regulations require sewerage systems to be designed, constructed and maintained in accordance with

BTKNEEC.[83,84] This principle applies to all aspects of sewerage systems, including storm overflows, and must be demonstrated as a requirement of the permitting of any intermittent discharge. Similar concepts can be found in other regimes such as the Industrial Emissions Directive and associated Scottish regulations through best available technology (or techniques) (BAT).

7.5 While the 1994 Regulations do not make explicit reference to the caveat contained in the Annex I footnote, Regulation 4(3) places an obligation on Scottish Water to ensure that treatment plants are "constructed, operated and maintained to ensure sufficient performance under all normal local climatic conditions". The ECJ has been clear that "sufficient performance" in this context requires that all urban waste water be collected and treated under usual climatic conditions and that this may only be departed from when climatic conditions are exceptional or unforeseeable. Therefore the 1994 Regulations, when read together with the objectives of the Directive and the principles in the ECJ cases, require that discharges from storm overflows should only occur in response to an exceptional event. If this is not the case, it must be demonstrated that BTKNEEC has been applied to limit pollution.

7.6 Scottish Office guidance issued in 1998 provides details of the measures which should be employed to minimise pollution from storm overflows.[85] This includes design criteria for new overflows as well as criteria for identifying where existing overflows are unsatisfactory and where licences should be reviewed to drive improvements. This guidance is still in operation.

7.7 The 1998 'Scottish Office' guidance, SEPA guidance and licences do not make it clear that discharges from storm overflows should only occur in exceptional circumstances as described above. The 1998 guidance states that the "Directive acknowledges the impracticality of constructing collection systems and treatment works such as to treat all waste water during situations such as heavy rainfall".[85] In fact the example used within the Directive is "unusually heavy rainfall". Similarly, SEPA's guidance notes that CSOs should only operate "in response to rainfall events"[3] while licences state that for CSOs and SSSOs, "discharges shall only occur as a consequence of rainfall and / or snow melt within the drainage area". There is no indication in the guidance material of how exceptional the rainfall event must be to allow the storm overflow to spill nor how this may be affected by climate change,

which is already leading to more frequent and higher intensity rainfall events.[87] It is clear, however, that environmental impact is a key factor.

7.8 ESS finds that there has been a failure by Scottish Government to clearly articulate the position as regards discharges from storm overflows linked to exceptional events. This has resulted in regulatory activity which allows storm overflows to operate outwith exceptional circumstances, provided no other licence conditions, such as the general descriptive conditions to limit pollution, are breached. This concurs with a recent assessment from the Office for Environmental Protection (OEP) which considered a similar issue in England and found that "there may have been misinterpretations of some key points of law" with "consequences for the regulatory activity that follows".[86]

7.9 ESS finds that the Scottish Government should publish up-to-date guidance to provide clarity on the exceptional conditions under which it is permissible for storm overflows to spill. In particular, it should be clear that allowing untreated waste water to be discharged regularly, or during normal rainfall, would amount to a breach of the 1994 Regulations, unless it can be demonstrated that BTKNEEC applies. SEPA and Scottish Water in turn should then update their regulatory and operational guidance and permitting regimes to reflect the most up-to-date position. Where overflows are permitted to spill more frequently than might be considered exceptional, SEPA and Scottish Water should publish their rationale for why BTKNEEC applies.

7.10 The reality of climate change heightens the need for the guidance on what represents exceptional to be clarified. Over the period 2010 to 2019 winters were 19% wetter than the 1961 to 1990 average and the proportion of rainfall resulting from heavy rainfall events has increased.[87,88]

7.11 The Met Office's 2018 UK Climate Projections indicate Scotland's summers are projected to be warmer and drier, with winters milder and wetter, and intense, heavy rainfall events increasing throughout the year.[87] The intensity of winter rainfall is projected to "increase by as much as 25%".[87] The total volume of rainfall and the number of wet days are expected to increase in winter with the increases being larger in the west of Scotland than the east.[87,89,90]

7.12 Storm overflow events and/or volume of discharge are expected to increase in the future as a result of an increased number of heavy rainfall events. This generates

the potential for an increase in pollutant loads entering the water environment through untreated waste water.[91,92] Modelling of CSO discharges in the north east of England by United Utilities predicts an increase in the number of events of up to 26% and an increase in discharge duration of up to 34% by 2050.[93] Scottish Water's Climate Change Adaptation Plan indicates that the volume discharged by storm overflows is projected to increase "by around 20% by 2050, with fewer, larger discharges as a consequence of increased storm intensity".[94] It is therefore essential to plan now for the future impact of climate change on the sewerage system.

8. Licencing of storm overflows

8.1 The 1998 guidance, together with the Urban Pollution Management Manual,[95] forms the basis for current SEPA regulatory methods and supporting guidance, including in relation to the granting of authorisations and setting of licence conditions involving storm overflows.[3,96,97] Storm overflows may be included in Municipal Sewage Treatment Works Licences (covering all overflows in the treatment works boundary) or Sewer Network Licences (covering all overflows upstream of the boundary of sewage treatment works). The majority of sewer network licences cover between one and five overflows, however, a small number cover over 100.[97]

8.2 The Controlled Activities Regulations (the CAR regime) replaced the Control of Pollution Act 1974 (CoPA). Under CoPA, activities had been authorised through the granting of consents, which contained conditions to ensure protection of the water environment. A transitional period to manage the transfer from CoPA to the CAR regime existed between April 2005 and March 2006, during which relevant consents were reviewed, conditions updated (if necessary) and transferred to a CAR authorisation. For other consents, including storm overflows, the transfer was made "as is"[3] and existing conditions were retained.

8.3 SEPA's 2015 guidance on compliance monitoring for sewer network licences acknowledged that some of the CoPA licences were very old and contained errors and omissions.[97] The first planned compliance assessment under the CAR regime was then used to ensure the licence information relating to storm overflows was "correct and fit for purpose and all known overflows included".[97]

8.4 An existing overflow would only require improvement if it was found to be unsatisfactory, defined, according to both the original 'Scottish Office' guidance and the current SEPA guidance, as where it:

- "causes significant visual or aesthetic impact due to solids or fungus or has a history of justified public complaint
- causes or makes a significant contribution to a deterioration in river chemical or biological class
- causes or makes a significant contribution to a failure to comply with Bathing Water Quality Standards for identified bathing waters
- operates in dry weather conditions

- operates in breach of consent conditions provided that they are still appropriate
- causes a breach of water quality standards (EQS) and other EC Directives”

8.5 Accordingly, an existing overflow would only be considered unsatisfactory and in need of improvement where it was operating during dry weather, in breach of a consent condition or where significant environmental impacts were evident.

8.6 Methods currently employed to minimise pollution from storm overflows include design settings based on formula A or on detailed sewer modelling and impact assessment if this indicates that a lower capacity will not cause adverse environmental impact.

Equation 1: Formula A[5]

The default pass forward flow setting for combined sewer overflows on the sewer network and at the inlet to waste water treatment works.

Formula A (litres per day – l/d) = DWF + 1360P + 2E

Where:

DWF = total dry weather flow (l/d) calculated from PG + I + E. This is the average daily flow during a period without rain.

P = population served (number)

G = water consumption per head per day (l/head/d), typically 150 litres

I = infiltration (l/d)

E = effluent trade flow (l/d)

Formula A is normally equivalent to approximately seven times DWF.[Error! Bookmark not defined.]

8.7 For new storm overflows, formula A is the current default pass forward flow setting for a CSO or SSSO.[3,96] However the guidance notes that formula A “may be overly conservative in some cases”[96] and therefore it is “usually preferable to base the design of a CSO on the output of sewer hydraulic modelling and water quality

impact models".[3] These design flows aim to ensure that waste water remains in the sewer until the flow in the receiving water has increased to cope with the discharge of sewage. Some licences explicitly state the expected minimum pass forward rate at first spill. Should a lower threshold be used, this is likely to lead to more spills than if formula A had applied.

8.8 Whilst these are the design settings which currently apply, many sewage assets were built prior to the introduction of the guidance and Scottish Water advises that these will have been designed to spill at different rates, some of which are a higher threshold than formula A.

9. Spills outside exceptional circumstances

9.1 Storm overflows are intended to spill by design. Scottish Water notes that an increasing number spill with a high frequency including a number that spill more than once per day on average.[35] This can be due to hydraulic overloading from increased flows since the sewer was originally designed (e.g. climate change, network issues such as siltation and infiltration, housing/business growth or paving over of permeable areas) and blockages caused by unflushable items that the public put into sewers and the deterioration and collapse of sewers.[91] Climate change is also expected to contribute to more frequent and/or higher volume discharges in the future due to projected increased frequency of intense, heavy rainfall.[87]

9.2 Under the requirements of their licences, Scottish Water returned information from 142 storm overflows[xi] and emergency overflows (4%) to SEPA on the frequency and duration with which they spilled during 2023. These recorded 15,289 spills for a total of 5,836 days' worth of discharge.[18] The data covers 36 CSOs on the sewerage network, 37 CSOs within the boundary of a waste water treatment works, 45 SSSOs, 23 emergency overflows and one instance of combined reporting for a CSO and SSSO at a WWTW.

9.3 It is important to note that these overflows may not be representative of the other 96% found in Scotland, since monitoring as a licence requirement indicates that these are associated with larger waste water treatment works and / or are associated with environmental need.[3,4]

9.4 In addition, even for the 142 storm overflows and emergency overflows covered, the data is likely to be an undercount. This reflects the fact that a full year's worth of data is not available for every overflow. The detail of this is not available for every year although it is indicated in comments in the Scottish Water published data. However, for 2023, we can see that only 56% of these overflows returned a full 365 days' of data. This rises to 87% having at least 90% of the year available.

[xi] In 2023, one waste water treatment works submitted combined data for its CSO, SSSO and EO while another combined data for two storm pumps at its CSO which had reported separately in earlier years.

9.5 For the purposes of understanding the potential impact, we estimated the number of spills that each site may have returned in 2023 had they submitted data for all 365 days.[xii] This suggested that the 2023 total for the 142 overflows could be 7% higher, with a possible 1,000 additional spills. However, this is provided as an indication only and takes no account of the weather or other factors which may affect spills in the missing periods of data.

9.6 For this reason the remainder of the analysis uses the raw data published by Scottish Water. This is appropriate to give an indication of whether examples exist of spills occurring outside exceptional circumstances. The data is presented in terms of histograms and means with medians also provided in the explanatory text. This is to demonstrate the shape of the data which, in all years, is skewed towards less frequent spills and duration.

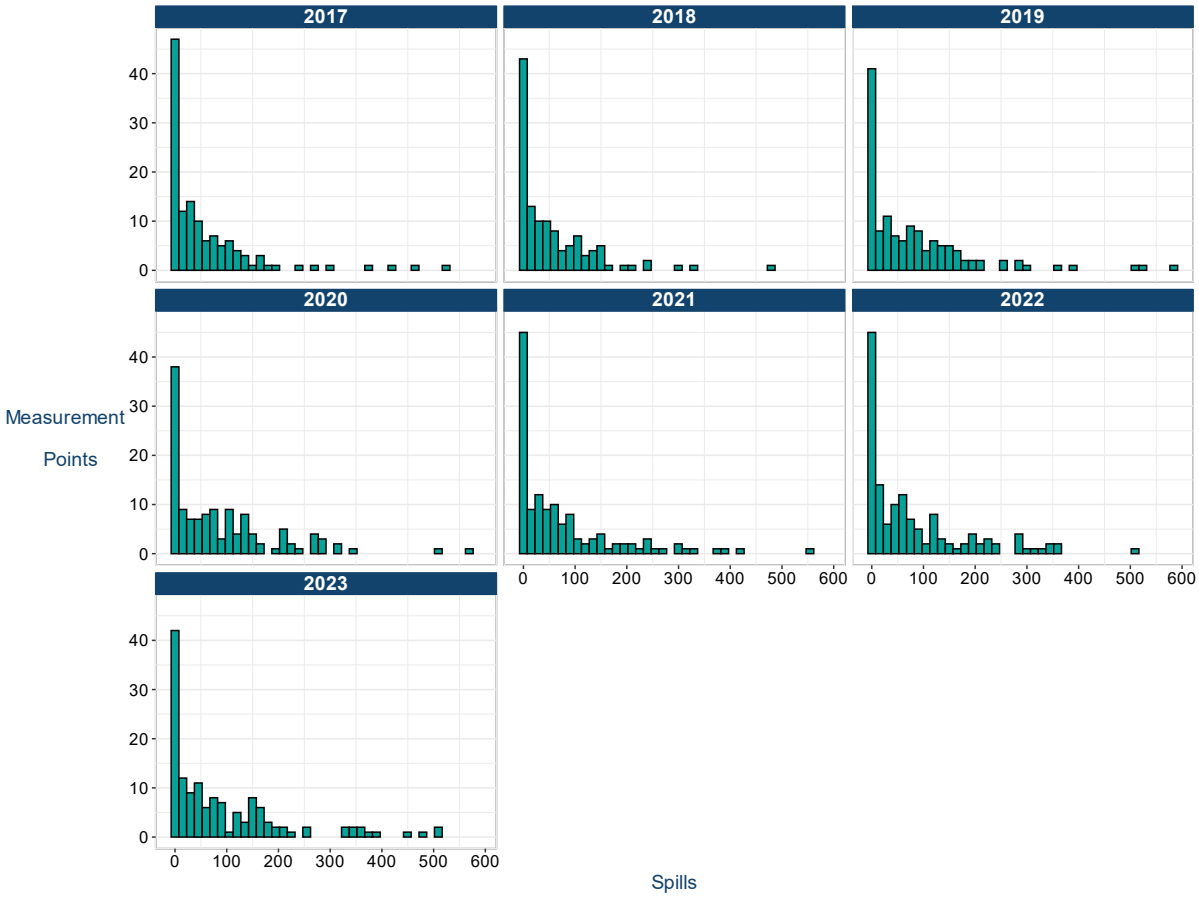
9.7 Data is provided for 2017 to 2023 and it is important to note that different storm overflows may be included in different years. For example, the number of overflows with data ranges from 123 in 2018 to 144 in 2022. Therefore the analysis also does not attempt to make any comment on trends over time. The number, duration and volume of spills will be impacted by which overflows report each year as well as wider factors such as rainfall with years of greater rainfall likely to result in more spills. Multiple years of data are provided to illustrate the point that, despite this variation, there are examples every year of overflows which spill more often or for longer than might be considered exceptional.

9.8 As noted previously, there is no clear definition of the number and duration of spills which would be considered acceptable and in line with the Urban Waste Water Treatment Directive. Figure 2 demonstrates that, while many of the reporting overflows spill infrequently (18% had no spills in 2023), some spill much more often. In 2023, 49% spilled over 50 times, 32% over 100 times and there were four that spilled more than 500 times, though the length of each spill can vary. There are no

[xii] Estimated by dividing each site's spill count by the number of days where data was supplied and then multiplying by 365.

reasons provided for these spills,[xiii] nor is there any indication in the published data of whether or not the spills are compliant with licence conditions.

Figure 2: Number of spills recorded per storm overflow and emergency overflow for which data was reported to SEPA (including no events), 2017 to 2023[xiv,18]



9.9 There is no publicly available licence compliance information for 2023. However, compliance data available for 2019 shows that, of the 23 storm overflows which spilled more than 150 times in that year, 15 were part of a licence rated excellent, one was at risk, two were poor and three were very poor while the remaining two had no publicly available compliance information. For one of those rated poor, this related to “some issues with storm tank operation during the year, although improvements had been made by the end of the year”. For another, this included issues “in relation to storm sewage storage provision” and, again, improvements

[xiii] Scottish Water intends to provide more information, where possible, on reasons for spills in future publications of this data.

[xiv] This chart excludes 15 instances where overflows recorded more than 600 spills a year.

were made. For the remaining four, rated poor, very poor or at risk, there was no indication of a link to the storm overflow or it was not clear whether the overflow was involved.[18,38]

9.10 Scottish Water's routemap[35] includes a commitment to "use spill trigger levels to drive investigations at monitored network CSOs to determine cause, scale of need and scope for improvement". The trigger levels are noted as being those "specified in the Environment Agency Storm Overflow Assessment Framework". ESS has applied these to the published data and finds that, of the 36 network CSOs which reported data in 2023, 11 would be above these thresholds, thereby meriting investigation.[xv]

9.11 In support of our recommendations on greater transparency of data and information, Scottish Water should provide more detail on how it intends to use these triggers, including where modelling and investigations have already taken place and this has determined that there is no environmental impact. Scottish Water indicates that, in light of the investigative work already undertaken (see chapter 11) the need for further assessment is likely to be decided on a case-by-case basis.

9.12 The data that does exist demonstrates that some storm overflows are spilling more frequently than can be considered as exceptional circumstances. However, on average SSSOs spill more frequently (a mean of 178 spills in 2023 and a median of 130) than CSOs (a mean of 95 spills in 2023 and a median of 37) which is what would be expected from the design of the sewerage system.[18] All of the SSSOs which reported data in the period 2017 to 2023 had at least one spill. These overflows should also be at least partially settled and therefore less polluting than the discharge from CSOs. Emergency overflows spill very infrequently (mean and median of 0 spills in 2023).

9.13 In addition, those CSOs on the sewage network spill less frequently (a mean of 75 and median of 20.5 in 2023) than those in the boundary of a waste water treatment works (a mean of 114 and median of 75 in 2023).

9.14 Spill count is not particularly informative as a measure on its own since it provides no detail on the severity of the spills. To fully understand that, information

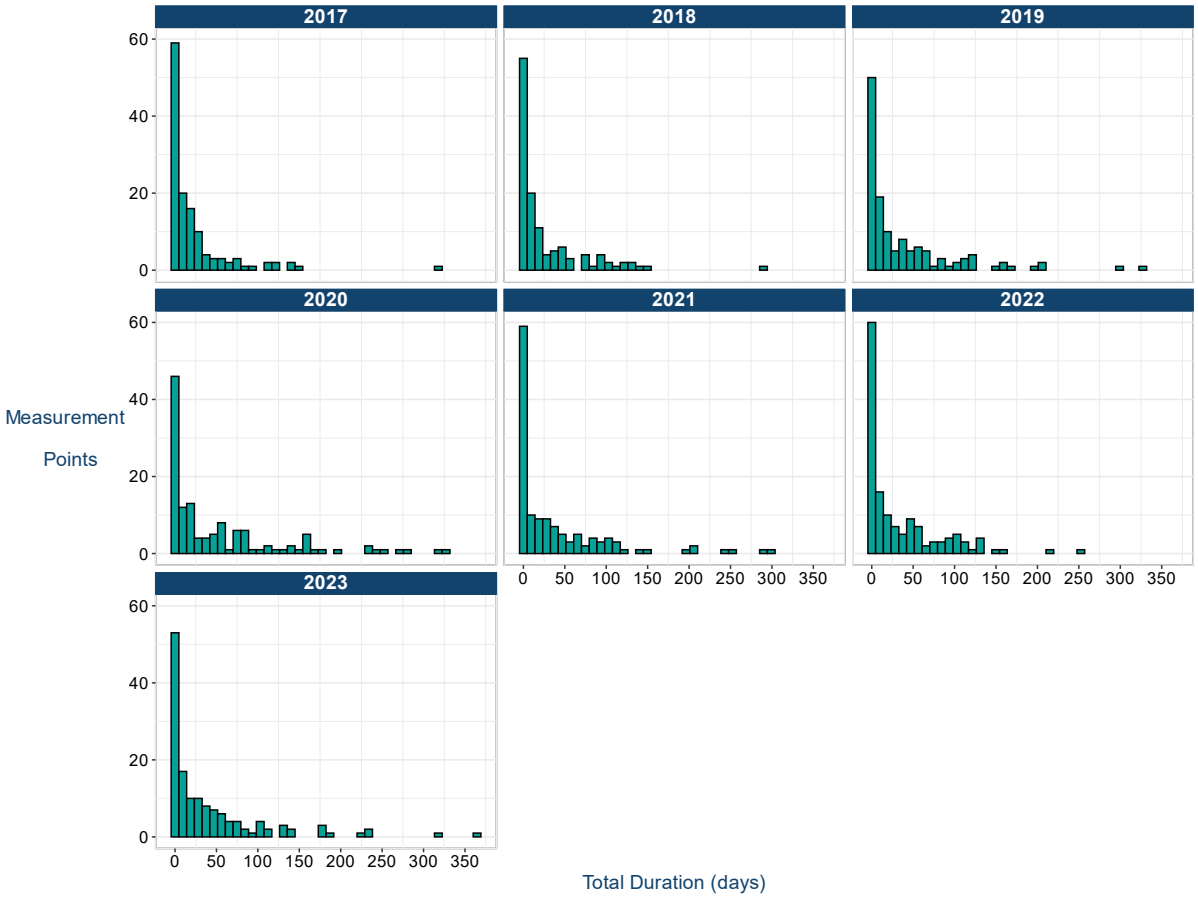
[xv] Based on translating the Scottish data into the counting methodology used by DEFRA to which the Environment Agency spill trigger levels apply.

would be required on the concentration of pollutants, volume and duration of the spills over time as well as about the environment into which the spills discharge. No publicly available information exists on potency of spills in terms of their impact on the environment, and very limited information exists on the volume of spills. However, information on duration is available for most of the spills reported.

9.15 The most frequent duration of any single spill is one to two hours. However, each year there are a small proportion of spills (6% in 2023) lasting 24 hours or more. The longest single spill in 2023 was 178.6 days from the CSO at the Tor Na Dee pumping station in Dunoon which spilled in total for 230 days.[18]

9.16 Figure 3 illustrates that each year, many overflows spill for the equivalent of less than 10 days in total over the course of the year. However each year, there are some which spill for the equivalent of 100 days or more.

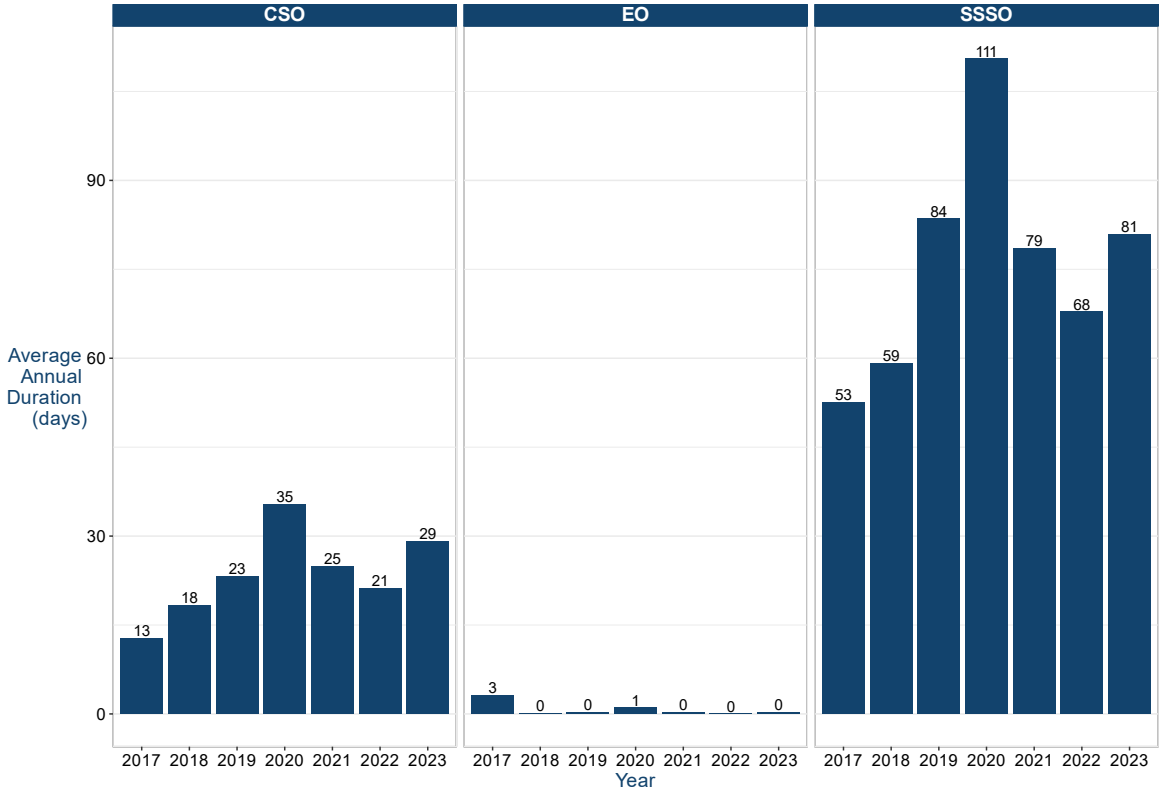
Figure 3: Total annual duration (days) of spills per storm overflow and emergency overflow for which data was reported to SEPA (including no events), 2017 to 2023[18]



9.17 Figure 4 shows that in 2023 each CSO spilled for around 29 days on average (median of nine days) while each SSSO spilled for around 81 days on average

(median of 67 days).[xvi] CSOs on the network had a slightly lower average total duration (mean of 28 days and median of 4 days in 2023) than those within the boundary of a waste water treatment works (mean of 32 days and median of 17 days in 2023.

Figure 4: Average (mean) annual duration (days) storm overflows and emergency overflows spilled, by CSO, EO and SSSO, 2017 to 2023[18,xvii]



9.18 In terms of volume, fewer overflows are required to report this information to SEPA than are required to provide frequency and duration data and these are all within the boundary of waste water treatment works. In 2023, Scottish Water was required to provide volume data to SEPA for 78 storm overflows. Of these, Scottish Water provided no data for 24 and for three provided a single combined return. There was therefore data available for 52 storm overflows (19 CSOs, 25 SSSOs and

[xvi] In 2022, duration data is based on 142 storm overflows despite 144 providing information on frequency of spills. This is because Fort William waste water treatment works' CSO provided no duration data for its spills and the Fort William SSSO provided only partial duration information and has therefore also been excluded from the analysis.

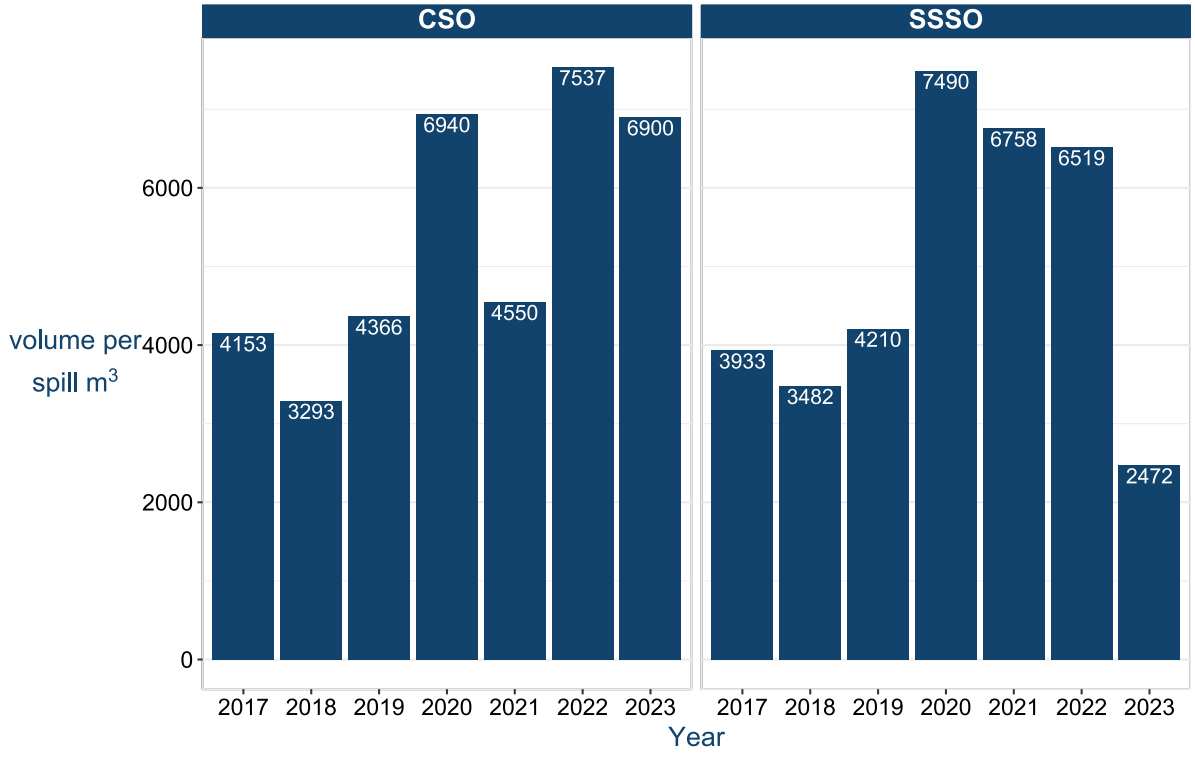
[xvii] For a small proportion of records duration was missing and could not be derived.

1 combined reporting) and emergency overflows (7), spilling a total of 31,323,904 cubic metres (m^3).

9.19 Figure 5 shows that, on average, reporting CSOs each spilled 6,900 m^3 of waste water per spill in 2023 while reporting SSSOs each spilled 2,472 m^3 per spill. This pattern is not consistent across prior years with variation with some years CSO spills having greater volume on average and in others SSSO spills.

9.20 Since no reasons for spills are provided in the published data, it is not possible to determine whether these are by design, due to exceptional events, or the result of operational failures such as pump failures or blockages caused by the flushing of inappropriate items.

Figure 5: Average volume per spill (m^3) by whether CSO or SSSO, 2017 to 2023[18]



9.21 In December 2023, Scottish Water published additional information for 2022 for those overflows which are required by licence to have event duration monitors installed but which are not required to return this to SEPA annually[28] and for overflows which had no licence condition but for which event monitors were installed. The same data for 2023 was then released in March 2024 and updated in June. This covered 544 storm overflows although data was only available for 134 (up from 103 in 2022). Since the data was only available for 2 years it has not been combined with the existing data above.

9.22 Considering only those where data was available, the dataset contained a slightly lower proportion of SSSOs (28% compared to 32%), a higher proportion of CSOs (67% compared to 52%) and a lower proportion of EOs (5% compared to 15%) than the existing published data for 2022 and 2023. The new dataset was also more likely to contain storm overflows within the boundary of a waste water treatment works than those on the wider sewer network (although the proportion on the network increased between 2022 and 2023 as more records with data were made available).

9.23 A smaller proportion had a full 365 days of data than in the dataset reported to SEPA (13% compared to 56%). However, there is a closer match for the proportion with at least 90% of the year having data available (81% compared to 87%). Like for the reported dataset, we estimated that spills could be 7% higher (an additional 700) if full reporting was available.

9.24 The 134 storm overflows for which there was data available, spilled a total of 9,820 times in 2023 for a total of 4,263 days. As in the dataset of storm overflows required to report to SEPA, CSOs (mean of 65 spills and median of 36 spills per overflow) spilled less frequently than SSSOs (mean of 106 spills and median of 55 spills). Network CSOs and those in the boundary of a WWTW had similar means (63 and 67 respectively) but the median for network CSOs was higher (43.5 and 33 respectively) suggesting that the data for those in the boundary of a WWTW is more skewed by a small number of high spilling storm overflows.

9.25 In this data, in both 2022 and 2023, storm overflows spilled less frequently than for the previously published overflows which report to SEPA (median of 33 spills per overflow for WWTW CSOs compared to 75; and median of 55 per SSSO compared to 130; although network CSOs spilled more often than in the reported dataset with a median of 43.5 compared to 20.5).

9.26 However, on average, individual spills were longer (driven by a higher duration per spill amongst WWTW storm overflows whilst the duration per overflow amongst network overflows was lower) and the average duration per overflow was similar across the datasets (mean of 17 days compared to 21 days for CSOs and 68 days compared to 67 days for SSSOs; median of 10 days compared to 9 days for CSOs and 49 days compared to 67 for SSSOs).[28]

10. Dry weather spills

10.1 Spills from overflows in dry weather may have a greater environmental impact as the discharges will not be diluted by rainfall. Scottish Water and SEPA have identified 12 storm overflows which are at risk of operating in dry weather.[45] ESS' analysis suggests that this is an underestimate. The analysis did not set out to identify every potential instance of dry weather spilling. Instead, it aimed to explore whether it is likely that these events are occurring more generally.

10.2 There are challenges in identifying dry weather spills, for example due to a lag in water from a hilltop or outflow reaching a treatment plant or overflow or due to the length of a river catchment. Scottish Water notes that there is no recognised approach to defining a dry weather spill and it currently identifies these through modelling or through investigation of pollution incidents. It is currently piloting intelligent waste water networks[xviii] and it is expected that this will include sounding an alarm when the flow in the sewer during dry weather is outwith an expected range which can then be further investigated.

10.3 ESS' analysis of the frequency and duration of spills combined with an initial examination of rainfall data[98] indicates that there are likely to be other overflows which operate in dry conditions. For example, the CSO at the Ardnadam sewage pumping station in Dunoon spilled 207 times in 2023, for a total duration of 187 days over 277 individual days.[18] Met Office data indicates that, in 2023, the Scotland West district had 198 days of rainfall over one millimetre (mm).[99] In 2023, 31 of the Ardnadam CSO's spills occurred on days where that day and the previous day were dry (i.e. had less than 0.25 mm of rain) in the five kilometre locality of the overflow. Although there is no data on compliance for 2023, the CSO was part of a licence which received an excellent compliance assessment in 2019.[38] Scottish Water should more routinely assess flow, spill and rainfall data to identify and address dry weather spill occurrences.

[xviii] Described by Scottish Water as a network of sensors, transmitting data on sewer network performance to Scottish Water's Intelligent Control Centre and allowing near real-time insights to be generated.

11. Unsatisfactory storm overflows

11.1 The 1994 Regulations implemented the Urban Waste Water Treatment Directive and began a programme of work to meet the requirements to collect and treat urban waste water. In the 1990s, some areas of Scotland (e.g. Kilmarnock/Irvine) had no waste water treatment and other areas had limited treatment (e.g. Dundee).[100] Therefore, the initial priority was to invest in new treatment works to meet the legislative requirements.

11.2 Once the new treatment works were in place, policy in Scotland moved on to the sewer networks with programmes to identify and improve unsatisfactory storm overflows. Scottish Water improved 150 unsatisfactory intermittent discharges between 2010 and 2015 (4% of total number of storm overflows and emergency overflows reported in 2022/23) with a further 129 between 2015 and 2021 (a further 4%).[101] These were mainly storm overflows on the sewer network.

11.3 Across the European Union Member States, the implementation of the Directive has been found to have contributed to improvements in water quality with success "in reducing loads of targeted pollutants from urban point sources".[25] In the Scotland River Basin District, the proportion of surface waters with an ecological status of good or better increased from 55% in 2007 to 64% in 2022,[102] the proportion with a good or better water quality status increased from 81% in 2008[35] to 87% in 2022[35] and bathing waters rated poor decreased from 18% in 2015 to 2% in 2022.[103]

11.4 Between 2015 and 2021, Scottish Water undertook a programme of studies into every water body below good status in 2015 to determine whether there was a link to discharges from Scottish Water's assets. Where a link was made, Scottish Water carried out 128[104] studies covering 200 overflows to assess whether there were any potential impacts from storm overflows. This work identified 24 overflows where improvements were needed to improve water quality. These have been included in a list of 108 high priority intermittent discharges[xix] to be prioritised for investment and addressed by 2027. The full list includes others which appear to operate in dry weather and/or which have significant sewage related debris impact. By August

[xix] Including six surface water outflows, one dual manhole and 101 storm overflows.

2023, Scottish Water reported that work on four[xx] of the 108 was complete. In one case the overflow was upgraded, in another network interventions were made, and in the other two no improvements were required on the basis of further studies undertaken.[45] In addition, 40 waste water treatment works were identified where improvements are to be delivered to address impacts on water quality where necessary.

11.5 In addition to the high priority overflows above, Scottish Water have identified around 799 further intermittent discharges as having unsatisfactory sewage debris. This was established through aesthetic surveys for all overflows where hydraulic modelling predicted that spills would occur more than once every five years and where screening was not already present or was thought to be inadequate. These overflows will be prioritised for future investment.

11.6 The long-term programme of studies and investment in storm overflows is welcome. Scottish Water should publish more information on the outcomes of its studies, the work completed to date and the plans for future work.

11.7 Scottish Water's initial focus was on identifying unsatisfactory overflows where the ecological status of the water body was less than good. Scottish Water should now consider whether the localised impact of unsatisfactory overflows are adequately identified where the quality of the receiving water body is currently good or better.

[xx] Including one surface water outflow.

12. Waste water as a pressure

12.1 While much of the public concern about storm overflows relates to the impact at the discharge point itself or immediately downstream, the focus of water quality legislation is on the status of whole bodies of water. Localised and aesthetic (e.g. sewage related debris) impacts may not be fully recognised in water-body based assessments.

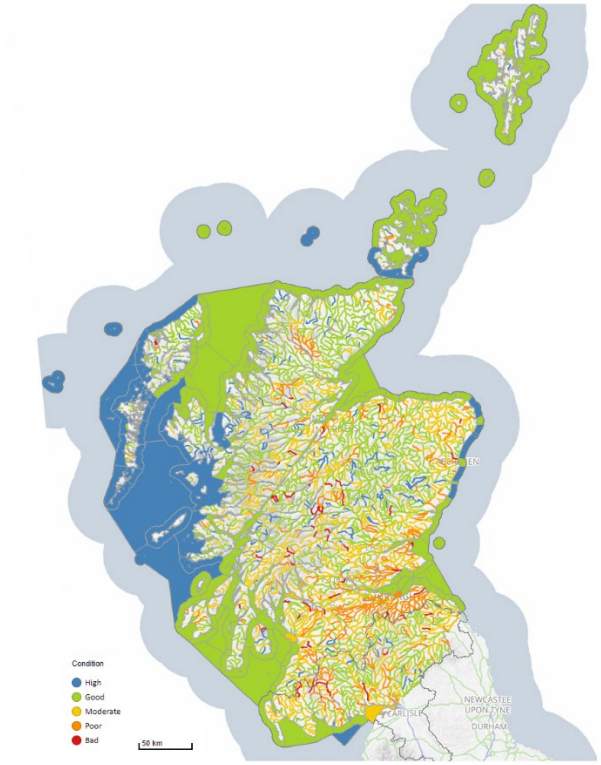
12.2 In 2022, 64% of Scotland's surface waters (including the Scotland river basin district and the Scottish parts of the Solway Tweed river basin district) were rated good or better overall and 86% for water quality in 2022.[xxi,102] However, data indicates that those water bodies rated below good are predominantly found in more urban areas. For example, the Highland Council area has almost a third (32%) of all Scottish surface water bodies 1,051/3,249 but only 3% of these are rated below good for water quality. City of Edinburgh, Glasgow City, Fife and Renfrewshire Council areas have just 130 surface water bodies (either wholly or partially in their areas) but 57% of those are rated below good for water quality. The large proportion of Scotland's water bodies which are in less-populated, rural areas may therefore be contributing to the overall high proportion of water bodies having good water quality.

12.3 River basin management planning data includes information on the significant pressures which have been identified for bodies of surface water. These are pressures which "have contributed to a breach of an environmental standard for good" or "are contributing to a risk that an environmental standard will be breached".[105]

12.4 The most recent available information relates to 2020 and multiple pressures may affect the same water body. In 2020, the most common pressure in the Scotland river basin district (RBD) and Scottish parts of the Solway Tweed RBD was rural diffuse pollution, affecting 330 surface water bodies of the 3,249 total (10%).

[xxi] SEPA's RBMP reporting provides overall classification and a breakdown to water quality, physical condition, flows and levels and fish migration. Where waste water pressures are identified, these are recorded as affecting water quality.

Figure 6: Water quality condition of Scottish surface water bodies, 2022[xxii]



12.5 The theme of “wastewater discharges” was ninth most common in 2020, with only 48 (1%) of surface water bodies being affected by “wastewater discharges” pressures. This is a reduction from 81 in 2014[36] and from 208 in 2008.[106] The data does not distinguish between pressures from storm overflows and pressures from continuous discharges of treated effluent or other sources such as septic tanks.

12.6 These 48 surface water bodies are spread across a range of council areas. However, a higher proportion of water bodies in some urban authorities are affected by this pressure. For example, eight of West Lothian’s 17 surface water bodies (47%) have this pressure. SEPA’s water classification hub[102] provides more detailed information on this topic.

12.7 The majority (89%) of these 48 surface water bodies are currently rated “moderate” for water quality but most are anticipated to achieve “good” status in the longer term through programmes of measures set out in the current River Basin

[xxii] © Crown Copyright, SEPA licence number 100016991 (2015)

Management Programme which runs until 2027. Eight water bodies are not expected to achieve “good” status. In most of these cases, water quality alone was not the cause of a rating below good in the overall classification in 2020. Many also had pressures affecting them (most commonly, physical condition of the water body or fish migration) and many had additional water quality pressures (most commonly rural diffuse pollution, followed by legacy pollution).

13. Environmental pollution incidents

13.1 Environmental Pollution Incidents (EPIs) are events which have, or may have, an environmental impact.[107] In relation to sewage discharge, an EPI is an unlicensed or non-compliant discharge from the waste water network into the water environment, such as a river or the sea. All such instances must be reported to SEPA for investigation. EPIs are then classified according to severity, with 1 being major, 2 being significant and 3 being minor, while 4 represents other incidents.[108,xxiii]

13.2 EPIs can be identified and reported in multiple ways. Scottish Water can self-report EPIs. SEPA can identify them as part of its environmental monitoring work. Members of the public can report them to SEPA or to Scottish Water. The expansion in the monitoring of storm overflows in the future may lead to more instances being reported. It is difficult to reconcile the data on pollution incidents reported by Scottish Water with the summary information published by SEPA (up to 2019), including as a result of differences in reporting periods.

13.3 SEPA and Scottish Water have a process of review to agree the appropriate category of an EPI. This process has not been the focus of this analytical project.

13.4 According to Scottish Water's data, there was a large reduction in category 1 to 3 EPIs from sewerage and water supply (category 1 and 2 only) assets (including PFI assets) between 2010/11 (824) and 2013/14 (265). Since then numbers have fluctuated between a low of 191 in 2017/18 and a high of 282 in 2021/22 (from which point category 3 water supply assets were also included). Scottish Water reports that the effects of the COVID-19 pandemic have contributed to 2021/22 having an unusually high number of incidents. In 2023/24 there were 196 incidents.[37,xxiv]

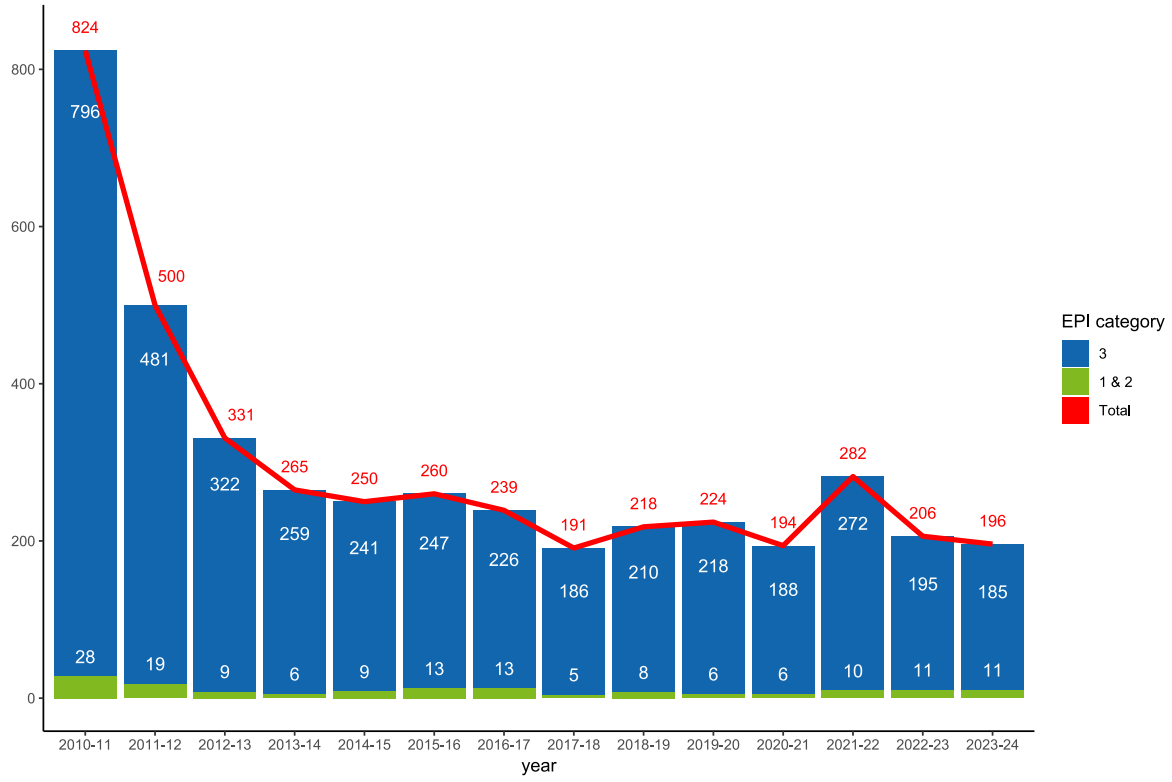
13.5 In each year, the vast majority of category 1 to 3 incidents are classified as category 3 (around 95%). In 2023/24, the more serious category 1 and 2 incidents were described as mainly associated with waste water networks, "notably due to

[xxiii] Full details of the classification can be found in Scottish Water's Annual Report and Accounts 2022/23 (P36).

[xxiv] This data excludes any incidents which were deemed "compliant with licence" or where the source of the pollution was traced to a third party e.g. from an industrial premises.

sewer blockages which are more likely during extreme weather events such as prolonged and heavy rainfall which we are experiencing more often" (Figure 7).

Figure 7: Water and waste water Category 1 to 3 EPIs, 2010/11 to 2022/23[xxv]

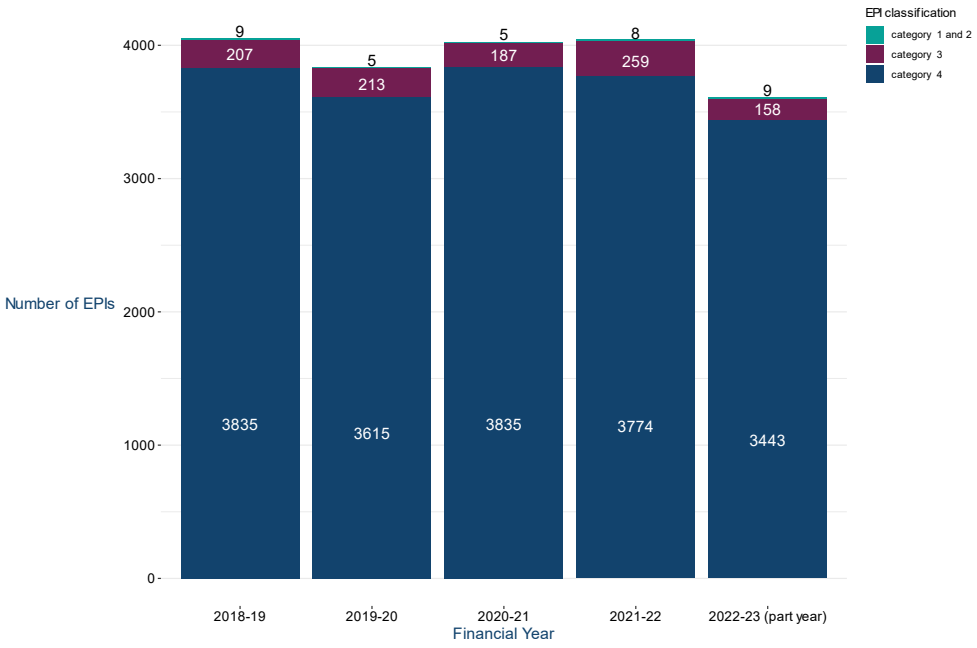


13.6 Additional summary data was supplied by Scottish Water (figure 8) and demonstrates that Category 4 incidents represent the majority of the total. Such incidents are defined as having no visible evidence of pollution and no impact on amenities, no noticeable damage to the ecosystem and no damage to agricultural or other commercial activities. They may include instances where it has not been possible to locate or substantiate the reported event.

[xxv] Chart sourced from Scottish Water 2023/24 Annual Report. Categories 1 and 2 include water EPIs in all years, category 3 includes waste water EPIs only until 2020/21 and then also included water EPIs from 2021/22. There are some reporting differences in the data reported by Scottish Water and SEPA. For example, Scottish Water reports 224 incidents in 2019/20 whereas SEPA refers to 273 public (water and waste water) incidents in 2019 which may reflect the fact that SEPA data includes water category 3s in that year and the fiscal year compared to calendar year reporting.

13.7 This data also showed that there had been no category 1 or 2 incidents attributed to CSOs in the five years from 2018/19 to 2022/23. The proportion of all category 1 to 3 incidents related to CSOs has varied between 9% and 13% in the same period. Foul sewers are the most common source of category 1 to 3 pollution incidents, representing a half to three quarters of these incidents each year. Foul sewers are the pipes which carry sewage from one point to another rather than a storm overflow. Issues affecting the performance of foul sewers can be blockages or a sewer collapse resulting in pollution to the water environment.

Figure 8: Waste Water Category 1 to 4 EPIs, 2018/19 to 2022/23[xxvi]



[xxvi] Chart based on summary data supplied by Scottish Water. This data was provided prior to the publication of the 2022/23 annual report and as such does not reflect the final data for that year. There are small differences in the data provided by Scottish Water and that published in its annual report. In addition, the published data includes water category 3s from 2021/22, whereas this chart focuses on the waste water category only. We have not explored how closely this matches data held by SEPA. The chart is provided to offer a sense of the relative severity of pollution incidents.

13.8 The published Scottish Water data indicates that there were 36 category 1 to 3 water and waste water incidents per 10,000 kilometres of sewer in Scotland in 2023/24.[xxvii]

13.9 Comparisons with England and Wales need to be treated with caution since the data for Scotland is presented by financial year compared to by calendar year in the other countries and there may be some differences in counting and reporting. Nonetheless, this figure of 36 category 1 to 3 incidents per 10,000 kilometres for 2023/24 is lower than the English water company average (41 per 10,000 kilometres) for 2023 for incidents concerning water and waste water assets.[109,xxviii] It is higher than the Dŵr Cymru average (30 per 10,000 kilometres)[32] for 2023 although that data concerns sewerage assets only.

13.10 However, the most recent year does not reflect prior trends where, over the period 2017/18 (2017 for England) to 2021/22 (2021 for England) Scotland had higher rates than the English average before reaching a similar rate in 2022/23 (2022 for England) (Figure 9). The Scottish rate has been higher than Dwr Cymru in all years, including those where both count only sewerage assets in category 3.

13.11 The roll-out of intelligent networks[110] should enable Scottish Water to take early, rapid action to prevent blockages and pollution incidents and contribute to the understanding of the weather conditions in which spills occur. To date, Scottish Water reports that intelligent networks have been installed in 4 catchments and Scottish Water aims to extend this to 16 catchments covering over a quarter of the Scottish population by the end of 2024.[34]

13.12 However, making transparent the reasons behind pollution incidents (for example, weather or quality and maintenance of infrastructure) and setting out any further actions which could be taken to reduce incidents is also needed. SEPA and

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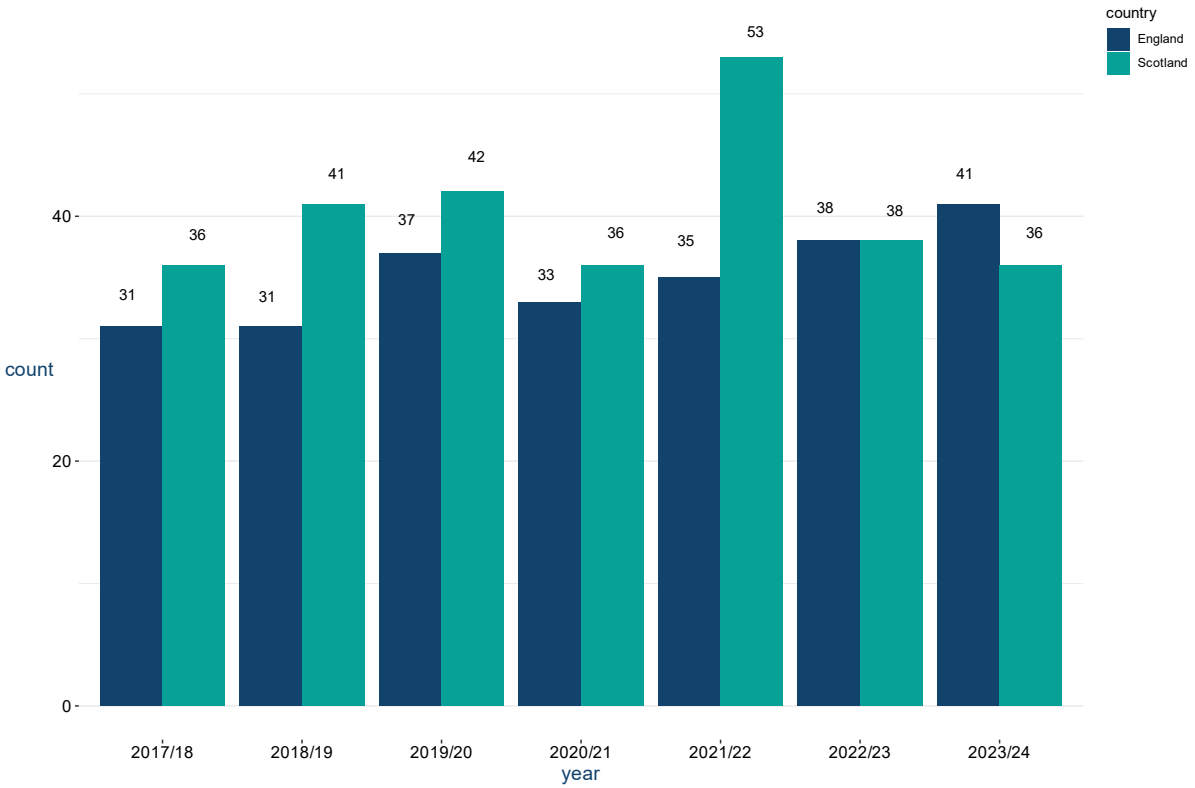
[xxvii] Based on the EPI data for 2023/24 and the 2022/23 information on km of sewers from 2022-23 Annual Return to Water Industry Commission for Scotland: D Tables (endnote 14). The 2023-24 return has not yet been published.

[xxviii] This figure is higher than the sector average published in the report since that concerns incidents relating to sewerage assets only. Incidents relating to water assets have been included here to match the data presented by Scottish Water in this year.

Scottish Water should publish more transparent and detailed data on EPIs to allow for greater scrutiny.

13.13 As a result of the analysis in this report, ESS has begun to conduct investigatory work on the existing system for identifying, reporting and classifying environmental pollution incidents. This work will also examine whether, and to what extent, there are effectiveness issues with the law and the way it is being implemented or applied by the relevant public bodies.

Figure 9: Number of category 1 to 3 environmental pollution incidents from water and waste water assets per 10,000 kilometres of sewer, 2017/18 (2017) to 2023/24 (2023)[xxix,109]



[xxix] Data is published on the basis of different reporting periods for different countries with Scotland using financial year and England using calendar year. In this chart, financial years are stated but it should be noted that this relates to the calendar year for England. So data for 2017/18 for Scotland is presented alongside data for 2017 for England. In addition, the data includes category 1-3 incidents for sewerage and water supply assets for 2021/22 (2021) onwards. For 2019/20 (2019) and 2020/21 (2020), the data includes category 1-2 incidents for sewerage and water supply assets and category 3 incidents for sewerage assets. For prior years the data includes category 1-3 incidents for sewerage assets for England and Wales but category 1-2 incidents for sewerage and water supply assets and category 3 incidents for sewerage assets for Scotland. As a result some caution in the comparison is required and the evidence is presented to illustrate the potential for higher rates of EPIs in Scotland.

14. Conclusion

14.1 This report presents the findings of our:

- analysis of the data and evidence on the frequency and duration of sewage discharges from storm overflows
- literature review focused on studies of the impact on the environment and human health of continuous treated discharges and intermittent discharges
- examination of the effectiveness of existing legislation and guidance including in light of future changes, such as climate change and the proposed revisions to the European Urban Waste Water Treatment Directive

14.2 ESS has made a number of recommendations to improve the effectiveness of how environmental law is implemented and applied.

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Standards Scotland
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CONTACT

Environmental Standards Scotland
Thistle House
91 Haymarket Terrace
Edinburgh
Scotland
EH12 5HD

E-mail: enquiries@environmentalstandards.scot

Telephone: 0808 1964000