Department
for Environment
Food & Rural Affairs

Storm Overflows Discharge Reduction Plan

Date: 26 August 2022

Department
for Environment
Food & Rural Affairs

Storm Overflows Discharge Reduction Plan and report on feasibility of elimination of discharges from storm overflows

Presented to Parliament pursuant to section 141A(8) of the Water Industry Act 1991 and section 84(3) of the Environment Act 2021

We are the Department for Environment, Food and Rural Affairs. We're responsible for improving and protecting the environment, growing the green economy, sustaining thriving rural communities and supporting our world-class food, farming and fishing industries.

We work closely with our 33 agencies and arm's length bodies on our ambition to make our air purer, our water cleaner, our land greener and our food more sustainable. Our mission is to restore and enhance the environment for the next generation, and to leave the environment in a better state than we found it.

This publication is available at www.gov.uk/official-documents.

Any enquiries regarding this publication should be sent to us at defra.helpline@defra.gov.uk

PB 14762

ISBN 978-1-5286-3671-1

E 02787705 09/22

Printed on paper containing 40% recycled fibre content minimum

Printed in the UK by HH Associates Ltd. on behalf of the Controller of Her Majesty's Stationery Office

Contents

Foreword

Improving water quality is not only vital to protect the people who enjoy our waters– from wild swimmers to kayakers, anglers and surfers – but it is also a key part of delivering our goals to recover nature. We have been clear that regulators and water companies must prioritise improving the water environment, from our Strategic Policy Statement to Ofwat, through to the raft of measures in the landmark Environment Act.

The Victorians introduced storm overflows as a safety valve for combined sewage systems. Now, under pressure from climate change and population growth, water companies use them far too often. This harms the environment, wildlife, and everyone who enjoys our seas and rivers. That's why this plan sets out a mandatory £56bn investment programme to sort the problem out.

This plan is the largest infrastructure project to restore the environment in water company history. Whilst we're demanding water companies invest more than ever before, we also know that, with rising pressure on the cost of living, we need to be careful of our impact on water bills. If we can go faster, we will, with a mandatory review in 2027 to see if we can go further.

We are committed to tackling the impacts of storm overflows. This is the first plan, by any government to take action to do so.

Rt Hon George Eustice MP
Secretary of State for Environment, Food and Rural Affairs

Chapter 1: Introduction

1.1 What are storm overflows?

Storm overflows are a result of Victorian sewer infrastructure, operating as safety valves built into the combined sewer system. They discharge excess sewage and rainwater to rivers, lakes, or the sea when the sewer system is under strain. This protects properties from flooding and prevents sewage backing up into streets and homes during heavy storm events. A growing population, an increase in impermeable surfaces and more frequent and heavier storms because of climate change have increased pressure on the system.

1.2 Why is this plan necessary?

There are around 15,000 storm overflows in England. They discharge at different rates depending on local conditions including climate, rainfall and the type of sewerage system. In 2021, 90% of storm overflows discharged at least once, with 5% discharging more than 100 times, including in high priority nature sites such as Sites of Special Scientific Interest. Bathers and other water users are impacted by the 8% of storm overflows that discharge near a designated bathing water.

High levels of sewage discharges present two main types of harm:

Harm to public health

Discharges from storm overflows contain raw sewage, which can contain high levels of harmful pathogens, such as viruses and bacteria. This can pose health risks to people who use our water bodies for recreation.

Harm to the environment

Storm overflows can also lead to ecological harm due to their impact on water chemistry. Discharges of raw sewage can contain organic pollutants, microplastics, pharmaceuticals, nutrients, and heavy metals, as well as visible litter that is flushed down toilets. The impact of sewage discharges on ecology varies depending on the pollutants it carries, their concentration, and the nature of the receiving water body. The smaller and more dilute the sewage discharge, and the larger and faster flowing the receiving river, the lower the ecological impact.

This plan sets, for the first time, clear and specific targets for water companies, regulators and the Government, to work towards the long-term ambition of eliminating the harm from storm overflows.

Water companies will be required to meet the targets set out in this plan. The Government expects Ofwat and the Environment Agency to support and challenge water companies to

meet these targets. Ofwat is legally required to act in accordance with the Strategic Policy Statement, and with their duties under the Water Industry Act 1991. The Government expects Ofwat to enable appropriate investment for companies to meet these targets. The targets will be underpinned by changes to the conditions in Environment Agency permits issued to water companies. The Environment Agency will assess compliance with these permits, making use of monitoring data that will also be available to the public, and where necessary take enforcement action.

1.3 Developing this Plan

Nearly 22,000 responses were submitted to the public consultation on proposals for the Storm Overflows Reduction Plan (referred to as 'the Plan') highlighting the public interest in this issue.

In developing the final Plan, we have considered feedback from the public and stakeholders. A summary of those responses and the Government position is outlined in the Government response to the consultation, published alongside this Plan.[1] We have also published the Storm Overflows Elimination Report and an Impact Assessment on the key targets proposed within this Plan.[2][3]

[1] Defra (2022) *Government Response to Consultation on Government's Storm Overflow Discharge Reduction Plan,* Available at: Consultation on the Government's Storm Overflow Discharge Reduction Plan - Defra - Citizen Space

[2] Stantec (2021) *Storm Overflows Evidence Project* Available at https://www.gov.uk/government/publications/storm-overflows-evidence-project

[3] Defra (2022) *Impact Assessment: Storm Overflows Discharge Reduction Plan* Available at: https://www.gov.uk/government/publications/storm-overflows-discharge-reduction-plan

Chapter 2: Actions for Water Companies

2.1 Overview

The Government and regulators have been clear to water companies that the current use of storm overflows is unacceptable. Last year, the Government placed a legally binding duty on water companies in the Environment Act 2021 to progressively reduce the adverse impacts of discharges from storm overflows. This is in addition to the legal duties on water companies under the Urban Wastewater Treatment Regulations 1994, and under the Water Industry Act 1991 to effectually drain their areas.

Work to reduce sewage discharges from storm overflows has already started. By 2025, water companies will have reduced overflows discharges from 2020 levels by around 25%.[4]

In this Plan, we are setting new targets which will revolutionise our sewer system and generate the most significant investment and delivery programme ever undertaken by water companies to protect people and the environment:

- By 2035, water companies will have: improved **all** overflows discharging into or near every designated bathing water; and improved **75%** of overflows discharging to high priority sites.
- By 2050, no storm overflows will be permitted to operate outside of unusually heavy rainfall or to cause any adverse ecological harm.

In addition to these specific targets, the Plan also sets out our wider expectations for the water industry. We expect water companies to ensure their infrastructure keeps pace with increasing external pressures, such as urban growth and climate change, without these pressures leading to greater numbers of discharges.

We have strengthened the monitoring requirements on water companies to ensure we have a comprehensive picture of the use and impact of storm overflows. The new duties in the Environment Act 2021 (Annex 3) will give us and regulators the tools we need to hold water companies to account and take enforcement action where water companies are not meeting their legal obligations.

[4] This is estimated based on the water company commitments set out in Annex 4

2.2 Targets for water companies

This Plan outlines specific and time-bound targets that water companies will deliver, as a minimum.

1. Protecting the environment:

Headline target: Water companies will only be permitted to discharge from a storm overflow where they can demonstrate that there is no local adverse ecological impact.

Sub-targets:

1. The headline target must be achieved for most (at least 75%) of storm overflows discharging in or close to high priority sites (as defined in Annex 1) by 2035.

- It must be achieved for all (100%) storm overflows discharging in or close to high priority sites by 2045.
- Water companies must achieve this target for all remaining storm overflows sites by 2050.

What will these targets achieve?

This target will ensure storm overflows are only permitted to discharge where water companies can demonstrate there is no local adverse ecological impact. This target will ensure that no water body in England should fail to achieve good ecological status due to storm overflow discharges.

The target ensures there is no wider local impact, rather than just considering the impact at a sampling point which can be far away from a storm overflow as has been done in the past. The local impact will be assessed by water quality monitors near the overflows (Section 3.1). This target protects biodiversity at both a local and national scale and will result in the complete elimination of ecological harm from storm overflows.

The sub-targets outline specific milestones for companies. This will help Government and regulators assess progress in line with this Plan's expectations at each subsequent review point (Section 2.3).

2. Protecting public health in designated bathing waters

Headline Target: Water companies must significantly reduce harmful pathogens from storm overflows discharging into and near designated bathing waters, by either: applying disinfection; or reducing the frequency of discharges to meet Environment Agency spill standards by 2035.

What will this target achieve?

This target will address the harm to human health from storm overflow discharges in designated bathing waters, where people are most likely to use water bodies for recreation. This target applies to both inland and coastal areas. It will require all storm overflows near to existing, or any newly designated, bathing areas to comply with a rigorous standard for bathing, which sets a limit of 3 or fewer discharges per bathing season, with some bathing waters having tighter limits (Annex 1).

8% of overflows are close to designated bathing waters. We expect this target to reduce discharges from overflows close to designated bathing waters by over 70% during the bathing season and for reductions to also occur outside of the bathing season.

These first two targets (ecology and public health) and their sub-targets will ensure that the overflows causing the most harm, to public health or the environment, are addressed first.

This target will also be supported by the Government's work to promote the designation of more bathing waters and rivers (Section 3.4), and ensure that users are informed in near-real time of any overflow activity or impacts on water quality in bathing waters (Section 3.1).

3. Ensuring storm overflows operate only in unusually heavy rainfall events

Headline Target: Storm overflows will not be permitted to discharge above an average of 10 rainfall events per year by 2050.

This target acts as the backstop target to all other targets outlined in this Plan. For example, if an overflow is improved to meet the ecology or bathing water target during the next water company planning cycle, it must also meet the rainfall target, so the targets are achieved without requiring multiple improvements to the same overflows.

What will this target achieve?

Storm overflows were originally designed and intended to only operate in unusually heavy rainfall events. However, they are being used significantly beyond their original purpose. To limit pollution, this target ensures that storm overflows would only be used in the rare

case of unusually heavy rainfall, if at all. This will also help to reduce the general harm caused by overflows as heavy rainfall helps to dilute any discharges and reduces the impact they cause.

This target is key in protecting public health and the amenity value of sites which are not designated bathing waters.

Application of this target:

This target applies to all storm overflows discharging to inland waters, to all designated bathing waters (both inland and coastal) and in addition to the targets for Protecting the Environment and for Protecting Public Health.

Screening Requirements for storm overflows

Water companies will be required to ensure all storm overflows have screening controls.

Water companies must ensure all inland and coastal storm overflows have screening controls. These controls are screens that avoid pollution by limiting the discharge of persistent inorganic material (as well as faecal and organic solids).

This requirement should be delivered together with all the targets and sub-targets outlined in the Plan. So, for example, any overflows improved by 2030 to meet the bathing water or ecological standards, also need to meet the screening requirement.

2.3 Reviewing Delivery and Costs

Managing impacts and review

Government will review the targets in 2027

Under the Environment Act 2021, the Government must produce a report in 2025 on implementation of the plan and the effect of any progress. Subsequent reports will be published every five years.

Water company investment operates on a five yearly cycle to protect customer bills and create checks and balances on investments. Water companies are in the process of business planning for the next Price Review cycle (PR24, covering 2025 to 2030). Companies will assess projects for delivery, costs, and the associated impacts on bills. Regulators will support and challenge companies through this process.

The Environment Agency will assess whether the plans put forward by companies meet the environmental and public health requirements. Ofwat sets the framework for the Price Review, in line with priorities set by the UK and Welsh Governments. Ofwat will assess

companies' plans for efficiency and ensure water company proposals deliver best value for their customers and the environment.

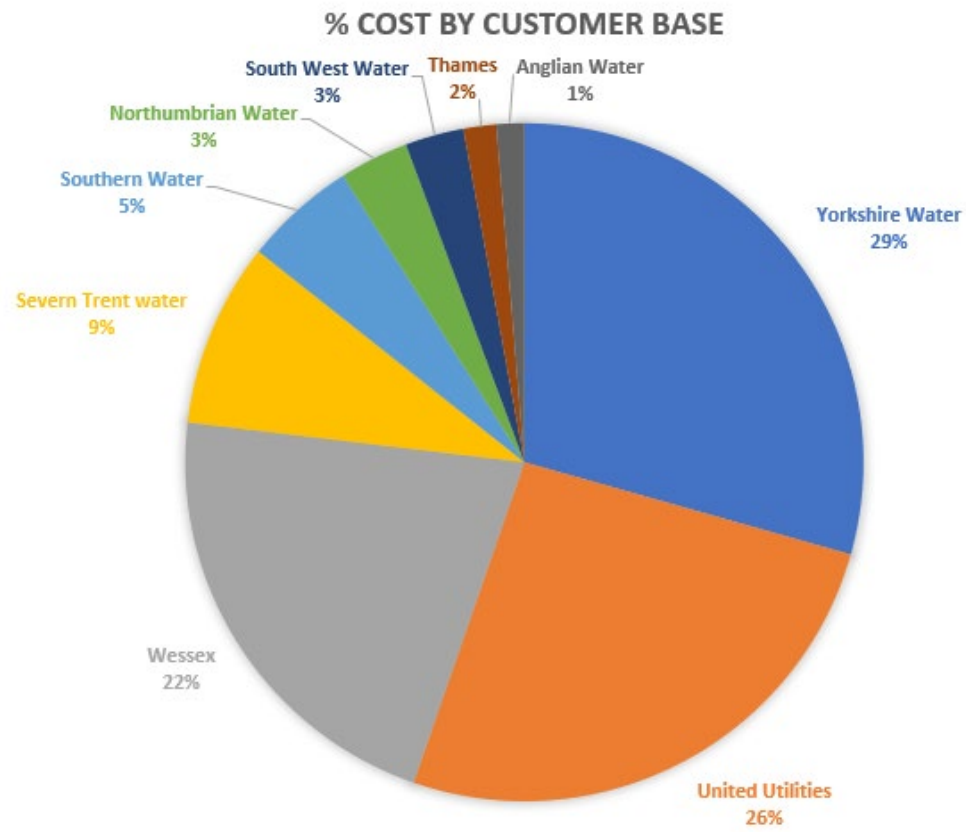
We do not have the evidence, at this stage, to fully predict whether individual water companies can go faster to achieve the targets in the 2030s and beyond. These upgrades will require significant increases in supply chain capacity, from skills to equipment. We also want to assess whether the plan incentivises the right investments, including what's best for people and the environment and the appropriate balance between grey and green infrastructure. It is also the case that current global circumstances are impacting the cost of living, and we must continue to keep this, and water bill increases, under close review. We will ensure that investment remains affordable.

The Government is clear that improving water quality is a priority and the use of storm overflows must be addressed. Therefore, the Government is committing to review the targets in the plan in 2027, ahead of the 2029-2034 water company planning cycle (PR29) once new information, including from companies' business plans, is available. We will be able to establish if companies can go further and faster to achieve the storm overflow targets in this Plan without having a disproportionate impact on consumers bills. This will also feed into broader reporting mechanisms under the Environment Act 2021, such as through the Environmental Improvement Plan, to monitor and assess how this and other actions are contributing to the broader recovery of river and water habitats.

Distributional Impacts

The cost of delivering the storm overflow targets does not fall evenly across England. The number of storm overflows, and the modelled cost of improvements, varies regionally.

Figure 1 shows the proportion of the modelled cost by water bill payer for each water company in England.



As Figure 1 shows, the scale of the modelled improvements required fall unevenly through the country. The three most impacted companies (Yorkshire Water, United Utilities and Wessex Water) account for over three quarters of the investment required relative to their consumer base. The Government expects all water companies to deliver the targets set out in this Plan as fast as possible and by the target end dates at the latest. Companies with a smaller share of costs relative to their customer base are therefore well placed to deliver targets ahead of schedule. Ofwat will work with Defra and the EA to ensure that incentives for water companies take into account the challenges faced by each company. The Government will continue to work with Ofwat and the Environment Agency to ensure investment is spread appropriately across the delivery period.

Ofwat will also continue to carefully scrutinise the efficiency of all investments to ensure that customers do not have to pay more than they should have to.

Costs

The review point in 2027 will allow the Government to assess national targets to ensure they remain ambitious, affordable, deliverable and represent best value for the environment, communities and billpayers. This is in line with the responses to the consultation that called for limiting impacts on water bill payers, as well as for delivery timelines to be accelerated.

Based on the modelled costs provided in the Impact Assessment, it is anticipated that annual water bills averaged over the whole period to 2050 would eventually rise by £42 p.a. compared to current prices. There will be no bill impacts until 2025. The modelled bill increases will start in 2025 and would average £12 between 2025 and 2030. These figures are averages across England. We expect there to be significant variations across years and water company regions, with bill impacts for water company regions with the largest overflow programmes up to 3 times the national average and for those with the smallest programmes lower than a seventh of the national average. This will be considered further when the targets are reviewed in 2027.

The government will continue to monitor water affordability and take further action if needed, and will consult on a new affordability scheme to help less well-off households.

There is uncertainty about future changes in water bills. Actual costs may be lower than modelled where companies are able to find lower cost solutions locally, and this will be considered further in the 2027 review. The review will also consider how water companies' affordability measures are continuing to support households that are unable to afford their water bills, and to ensure bill increases do not have disproportionate impacts.

Ofwat, the economic regulator of the water sector, will assess the water company business plans to ensure the targets are delivered as efficiently as possible, to provide best value to customers and the environment, challenging companies to keep bill increases manageable for consumers.

2.4 Timelines for delivery

The Government has pushed water companies to urgently take actions to tackle storm overflows, resulting in £3.1 billion of water company investment in storm overflows between 2020 and 2025. Annex 2 shows the work that is underway.

From 2025, the targets outlined in this plan are expected to lead to an 80% reduction in the number of annual discharges from storm overflows by 2050, which is an anticipated reduction of over 300,000 storm overflow discharges per year.

The table below gives an indicative trajectory of improvements and the spill reductions that should be achieved by the targets from a 2020 baseline. Greater detail will be available in final water company business plans in 2024.

Year	2030	2035	2040	2045	2050
% of high priority site storm overflows improved	38%	75%	87%	100%	100%
% of total storm overflows improved	14%	28%	52%	76%	100%
Indicative spill reductions per year[2]	44,000	84,000	160,000	240,000	320,000

We are frontloading action in the most urgent areas. We expect water companies to tackle the worst polluting and most harmful overflows discharging to high priority sites by 2035.

By 2035, 84,000 storm overflows spills per year will have been prevented, over a quarter of the reductions we expect to be delivered by the plan. Initial work will be targeted at high priority sites and will therefore deliver most benefit to the environment and the public. These storm overflows are anticipated to be the most challenging and costly to address given the scale of the improvements required. Between 2035 and 2050, water companies should focus on tackling the harm caused by the remaining high priority sites and other overflows.

In addition to these targets, water companies have responded to the Government and regulators' challenge to go further in tackling storm overflows in the short term. Ofwat has engaged with water companies and secured public commitments for discharge reductions that companies will achieve by 2025 and beyond. These are set out in Annex 4.

2.5 Achieving the targets

Water companies will need to look for the best value solutions for people and the environment to achieve the targets at a local level.

Water companies must plan to achieve all relevant targets when developing solutions. For example, where analysis shows that the ecological harm can be eliminated but storm overflows are still being used too frequently, both the environmental and rainfall targets should be achieved.

The Government also expects water companies to adhere to the following principles when achieving the targets:

Complying with regulations

1. ***Water companies must comply with all their existing regulatory obligations and duties, including permits issued by the Environment Agency.***

Water companies need to maintain and upgrade their wastewater systems to ensure they meet their statutory service obligations and keep pace with all the pressures that add surface water to the combined sewer network. Before implementing infrastructure upgrades, water companies must ensure all their wastewater and drainage assets are working as intended, are not limiting capacity of their sewage system, and are compliant with all relevant legislation and permits. This includes (but is not limited to) proactive management and adequate maintenance of assets, with timely replacements, upgrades, or repairs of assets as appropriate. Upgrades as a result of non-compliance do not fall within the scope of this plan.

If water companies are found not to comply with their legal responsibilities, Ofwat and EA can take robust action. This may result in, for example:

- Fines for water companies responsible for serious and deliberate pollution incidents, to be taken from water company profits, and
- Potential prison sentences following successful prosecution for Chief Executives and Board members whose companies are responsible for the most serious incidents.

Planning and forward look

2. ***The Government expects water companies to have maps of their sewer networks, and understand where properties with separate rainwater pipes are connected to their combined sewer network.***
3. ***Water companies will clearly set out how they will meet their storm overflow targets in their Drainage and Wastewater Management Plans.***
4. ***In developing the best solutions, water companies should base their decisions on robust evidence and explore ways in which they can maximise wider benefits where solutions can address multiple issues, delivering best value for people and the environment.***

The requirements on water companies to undertake comprehensive long-term planning with regard to the capacity and resilience of the sewage network shall form part of water companies' Drainage and Wastewater Management Plan objectives. Proper planning and mapping will enable water companies to act when separation of surface water is the best solution to achieve sustainable reductions in sewage discharges. Water companies must prioritise removing existing surface water connections from the combined sewer network over building additional storage, wherever this achieves the best outcome for people and the environment.

Drainage and Wastewater Management Plans allow water companies to deliver the storm overflow targets in an integrated way. Water companies will be required to clearly set out how they will meet their storm overflow targets in these plans. Given the importance of the local context, water companies will work closely with local partners, such as local councils, highway authorities, drainage asset owners and managers, to ensure that their plans strategically link to other local plans, such as local flood risk management strategies. Projects proposed as a result of Drainage and Wastewater Management Plans will be reviewed by the Environment Agency and Ofwat as part of the business planning process. The Environment Act 2021 allows the Drainage and Wastewater Management Plans to be made statutory.[5] The Government will implement the relevant provisions during the next Drainage and Wastewater Management planning cycle (2023-2028).

Driving better solutions:

5. ***We expect water companies to achieve year on year reductions in the amount of surface water that is connected to their combined sewer network.***

Water companies must remove rainwater from the combined sewer system as part of effectually draining their areas. This should include limiting any new connections of surface water to the combined sewer network, and any new connections should be offset by disconnecting a greater volume of surface water elsewhere within the network.

6. ***We expect water companies to prioritise a natural capital approach, considering carbon reduction and biodiversity net gain, as well as catchment-level and nature-based solutions in their planning.***

Traditional solutions to reduce discharges, such as increasing storage capacity, are carbon intensive. The costs and benefits of such interventions must be considered in decision-making. Solutions should be effective over the long-term and account for future pressures.

Green infrastructure and other nature-based solutions are an effective option to reduce the harm caused by storm overflows and can provide multiple co-benefits for the environment and society. For example, separating surface water so that it doesn't mix with sewage and

[5] Section 79 of the Environment Act 2021 amends the Water Industry Act 1991. New sections 94A, 94B, 94C and 94D and 94E of the Water Industry Act 1991 relate to the statutory provisions for Drainage and Wastewater Management Plans (known in the Act as Drainage and Sewerage Management Plans). Section 94A of the Water Industry Act 1991 sets out what a drainage and sewerage management plan must contain. Section 94A(3)(e) gives Ministers a power to make directions requiring that the plan address any other matters specified. Section 94C gives Ministers powers to make regulations about the procedure for preparing and publishing a plan.

is diverted to water gardens or wetlands improves water quality, creates new habitats for species and acts as a carbon sink.

In addition to the targets on storm overflows set out in this Plan, the Government has committed to halt the decline in species abundance by 2030 in the Environment Act, and committed to net zero by 2050 in the Climate Change Act.[6] The government has also committed to raise at least £500 million in private finance for nature's recovery every year by 2027 and more than £1 billion a year by 2030. These objectives, focussed on protecting our natural environment must be approached in a cohesive way. The Environment Agency and Ofwat will actively encourage companies to consider green infrastructure in their proposals to achieve the targets set out in this plan, and wider government priorities set out in the Government's Strategic Policy Statement to Ofwat. As set out in our Strategic Policy Statement to Ofwat, we expect companies to operate in partnerships across catchments maximising co-funding and green finance opportunities, wherever appropriate, including through market mechanisms.

We are aware that green infrastructure enhancements often have longer delivery timelines than traditional concrete solutions and may therefore be seen as riskier investments by water companies. For that reason, the Environment Agency and Ofwat will work to ensure assessment processes promote and incentivise the use of nature-based solution in favour of more carbon intensive alternatives.

To promote sustainable solutions, green infrastructure projects started before 2027 and delivered as quickly as possible will count towards completion of the targets, subject to review. This will be the case even when the full environmental impact of these projects has not yet been realised by the target end date.

7. We expect water companies to consider treatment of sewage discharges as an alternative solution where appropriate.

Water companies need to significantly reduce their untreated sewage discharges from storm overflows. In some cases, it may be better to treat discharges, rather than to reduce their frequency. In these instances, water companies may consider treatment of sewage discharges as an alternative way to eliminate public harm, rather than reducing their frequency. For example, this may be the case for highly diluted overflow discharges caused by groundwater infiltrating pipes which are difficult to repair. Where treatment is used, there will be checks to ensure compliance with the required standards.

[6] Environment Act 2021 (legislation.gov.uk); Climate Change Act 2008 (legislation.gov.uk).

Better management of our rainwater by water companies

We will expect water companies to value rainwater as a resource which benefits people and the environment, and to protect the natural water cycles that maintain biodiversity and full flowing rivers. Rainwater should be managed following these two principles:

- ***Rainwater should be treated as a resource to be valued for the benefit of people and the environment, not mixed with sewage or other contaminants.***
- ***Rainwater should be discharged back to the environment as close as possible to where it lands or channelled to a close watercourse without first mixing it with sewage.***

Water companies should prevent additional rainwater from entering the combined sewer network and remove existing rainwater connections where it is the best value solution.

Chapter 3: Actions for the Government

The Government has already taken significant action to tackle storm overflows. This is further detailed in Annex 3.

3.1 Transparency

The Government has taken action to ensure all water companies have a complete picture of when each of their overflows is operating. This is the first step to address companies discharging sewage from storm overflows too often and without sufficient monitoring and oversight. We want to ensure regulators and the public can hold water companies to account.

The Government will:

1. **Bring forward secondary legislation to implement Section 81 of the Environment Act in 2023.**

   There are event duration monitors on almost 90% of the sewerage network. By the end of 2023, there will be 100% coverage. This will provide a complete picture of when, and for how long, each storm overflow operates.

   The Environment Act 2021 introduced new requirements for water companies to publish this information annually, and for the Environment Agency to publish an annual summary report for all the water companies in England. All water companies must provide data about the frequency and duration of storm overflow discharges for all overflows in near real time and make this available to the public no later than 2025 (by the start of Price Review 24).

2. **Bring forward secondary legislation to implement section 82 of the Environment Act in 2023.**

   Under section 82 of the Environment Act 2021, water companies must monitor the water quality impact of their assets that discharge sewage, including storm overflows and continuous discharges from wastewater treatment works. This will provide continuous data and will significantly increase our understanding of the water quality of our rivers.

   This information will allow us to measure water companies' progress to achieve the targets detailed in this Plan and other objectives. This duty shall apply to inland watercourses.

   Defra and the Environment Agency will provide joint technical guidance to water companies on implementation of this duty by Autumn 2022.

3. **Encourage innovation to continuously monitor complex sites:**

The scope of the statutory duty under section 82 of the Environment Act 2021 is limited to river systems. We appreciate that there will be increased interest in monitoring overflows that discharge to other water bodies such as lakes, groundwater and coasts, and the impacts they have on ecology and public health. However, these sites present unique monitoring difficulties, such as difficulties in monitoring of large bodies of water, failure of sensors due to salinity of coastal waters and the difference in parameters for good water quality for different types of water body.

We will work with the Environment Agency and the water industry to pilot approaches, and encourage water companies to bring forward monitoring at complex sites where it is clear they have consumer support to do so to improve transparency of all overflow operations.

3.2 Better management of our rainwater

Better rainwater management is key to achieving a reduction in sewage discharges from storm overflows, reducing flood risk and improving water scarcity to ensure a healthy environment. Buildings and impermeable surfaces concentrate rainwater, which runs off into our sewage and other drainage systems rather than being naturally absorbed into the ground and rivers.

In order to achieve better rainwater management, the Government will:

4. **Publish the review and decision regarding implementation of Schedule 3 to the Flood and Water Management Act 2010 in Autumn 2022.**

If implemented, this schedule would:

- Introduce standards for new sustainable drainage systems (SuDS);
- Introduce an ‘approving body’, and;
- Remove the automatic right to connect to the public sewer system, to prevent new developments adding more surface water to the combined sewer network when it rains.

SuDS use features such as ponds and grass, as well as tanks and pipes, to reduce the amount of water being added to the sewer network, reducing the risk of surface water flooding, improving water quality and benefiting biodiversity.

5. **The Government will continue to work with water companies and relevant stakeholders on implementing the findings of the Storm Overflows Taskforce to better manage rainwater.**

The Storm Overflows Taskforce reviewed legislation on rainwater drainage and set out several recommendations. The Government will assess the feasibility, effectiveness, and sustainability of these recommendations.

i. **Giving water companies the right to repair defective drains on private property.** The total length of privately owned drains is greater than that owned by water companies. Many of these private drains are old or poorly maintained. As a result, groundwater seeps into the system, increasing the volume in the combined sewer network and increasing the risk of storm overflow discharges. Water companies would need new powers to repair defective pipes on private properties, with suitable protection for property owners.

ii. **Giving water companies the right to alter drainage systems on private property to reduce impermeable areas connected to the combined sewer network.** There are local soakaway solutions, such as rain gardens or water butts, that can be used to reduce rainwater entering the sewage system from individual properties or groups of properties, for example from roofs and patios. Currently, water companies have limited powers to carry out drainage separation work on private property.

iii. **Giving water companies the right to discharge rainwater to water courses.** Water companies need to discharge new and existing single rainwater drainage systems to the nearest water course. Currently they have no rights to do this, and so riparian owners can either prevent or demand extremely high fees for discharges. This makes separation of rainwater from combined sewage systems a costly or impossible option.

iv. **Assessing the role of highway drainage as a rainwater drainage system.** Planning Practice Guidance sets out a hierarchy of drainage options to discharge surface runoff, with discharge of surface water to highway drainage preferrable to discharge to combined sewers. In practice however, highway authorities often refuse to allow connection to their systems and there is no legal obligation for them to do so. This forces developers to connect to the combined sewer.

3.3 Reducing flooding risk

6. **The Government will continue to work with stakeholders, including the Environment Agency and local authorities, to deliver the Surface Water Management Action Plan, and will have delivered over 60% by the end of 2022.**

Effective management of surface water is required to both mitigate flood risk and tackle sewage discharges. This requires action from multiple partners. Management of a functional drainage network is an essential element to reducing the risk of harm from surface water flooding.

Flood risk management is a top priority for the Government. In July 2021, we published our surface water management update providing an update on progress in delivering the Surface Water Management Action Plan and a full response to the independent Jenkins Review into drainage.

In addition, the Government is working with local authorities in our Flood and Coastal Resilience Innovation Programme to achieve better surface water management in urban areas through blue-green infrastructure and share best practice (permeable road surfacing, green roofs, natural vegetation, etc).[7]

The Government has also commissioned the National Infrastructure Commission, to report by November 2022 on the effective management of surface water flooding in England. This will assess the current approaches to managing surface water and consider the role of a range of interventions including both traditional built infrastructure and nature-based solutions.

3.4 Further protection for our bathing waters

7. **The Government is reviewing the Bathing Water Regulations 2013. We will consult on policy options in 2023 and aim to complete the review in 2024.**

The Bathing Water Regulations 2013 have led to significant improvements in bathing water quality. We have over 400 bathing waters in England. 99% of bathing waters in England meet at least the minimum standard, and over 70% meet the highest possible standard of 'excellent'. However, we recognise that further improvements to protect bathers and other recreational water users is necessary. We also want to see more bathing waters and rivers designated.

Following discussions with key stakeholders it has become clear that the Bathing Water Regulations 2013 should be reviewed, to ensure they reflect changes in how and where people use bathing waters. We will consult on policy options in 2023 and aim to complete the review in 2024.

8. **The Government will revise its existing guidance on applying for new bathing water designations by February 2023.**

Previously most bathing water status applications came from local authorities. Increasingly we are seeing applications from community groups, and this has highlighted that parts of the guidance could be clearer.[8] The Government will revise the guidance to make it easier for applicants to understand the criteria for bathing water status. The outcome of this should be an increase in the number of successful applications.

9. **Improve transparency of Bathing Water quality.**

[7] https://www.gov.uk/guidance/flood-and-coastal-resilience-innovation-programme.

[8] https://www.gov.uk/guidance/bathing-waters-apply-for-designation-or-de-designation

The Government will consider what further steps can be taken to improve the timeliness and usefulness of information that the public are given about bathing water quality, including through the monitoring measures in the Environment Act.

Bathers are currently informed of the water quality through signs which display the annual classification of a bathing water, alongside other information. The Environment Agency also issue daily pollution risk forecasts during the bathing season at over 170 of bathing waters.

We will consider what further steps we can take so the public can make informed choices before they enter the water.

3.5 Protection for our shellfish waters

10. **The Government is prioritising action to improve the water quality of the largest shellfish waters in England by 2030.**

Special consideration is given to areas of shellfish production to support shellfish life and to contribute to the high quality of shellfish products suitable for human consumption. The Government has designated 101 shellfish water protected areas in England where water quality is monitored for harmful bacteria and action taken to meet the strict microbial standard.

The Government and the Environment Agency have identified waters which can achieve compliance with the microbial standard by 2030, and where there is significant economic production of shellfish and where action is needed to prevent deterioration.

The Environment Agency will require water companies to explore the need for action (improvement, prevention of deterioration or investigation) at 63 shellfish waters (63%) between 2025-2030. This will lead to reductions in sewage discharges from storm overflows and disinfection of treated sewage.

3.6 Action on antimicrobial resistance

Sewage discharges can contribute to antimicrobial resistance given up to 80% of consumed antibiotics are excreted. Antimicrobial resistance is when bacteria, viruses, fungi and parasites no longer respond to medicines, making infections harder to treat.

To mitigate the spread of antimicrobial resistance we are working with water companies to understand the possible contribution of water industry discharges and sludge. The Government has recently established a new cross-departmental project, Pathogen Surveillance in Agriculture, Foods and the Environment (PATH-SAFE). It contains a workstream focused on antimicrobial resistance prevalence in two river catchments, which will monitor for antimicrobial resistance across a range of environmental sources, including surface water, wastewater, agricultural areas, shellfish and bathing waters. The project will

run until March 2023 and will strengthen our understanding of antimicrobial resistance in the environment, including the relative importance of different sources, transmission routes and the implications are for people, animals, food and ecosystems.

3.7 Regulating the water industry:

Environment Agency

Within England, the Environment Agency is responsible for issuing permits and regulating all discharges from storm overflows. This is done by issuing permits for individual storm overflows that outline when they can operate and under what circumstances, as well as how they should be monitored and maintained.

To support this Plan, the Environment Agency will focus regulatory and enforcement action:

- ***On activities that cause the greatest risk of serious environmental damage;***
- ***Where the risks are least well controlled;***
- ***Where a breach undermines a regulatory framework; and***
- ***Where they suspect deliberate or organised offending.***

The additional information on storm overflow discharges from the new monitoring and reporting requirements will improve the ability of the Environment Agency to enforce unlawful storm overflow discharges and permit breaches.

The Environment Agency has a range of enforcement actions it can apply when permits are breached. The Environment Agency can also prosecute a water company in line with its Enforcement & Sanctions Policy. In deciding how to take enforcement decisions, the Environment Agency considers all the facts and circumstances, testing the evidence against the interests of the public. The Environment Agency acts proportionally when they apply the law and will take account of, and balance, impacts on the environment, people, and business.

Ofwat

Ofwat is the independent economic regulator for the water and sewerage companies in England and Wales. Ofwat is responsible for making sure that the regulated companies provide consumers with a resilient and efficient service at a fair price. To support this Plan, Ofwat will:

- ***Challenge, support and enable water companies to meet the targets set out in the Plan;***
- ***Enable investment to follow investigations as quickly as possible without waiting for the next 5-yearly water company planning cycle;***

- ***Incentivise companies to meet these targets as quickly as possible and go beyond these targets if this is supported by customers, provides best value and is affordable;***
- ***Challenge companies to meet their public commitments;***
- ***Actively support companies in the use of green infrastructure where it is the most appropriate and best value approach***

Ofwat has a range of enforcement powers that it can use to ensure companies comply with their statutory obligations to provide and maintain a sewer system in relation to storm overflows. These include enforcement orders to ensure water companies take all appropriate steps to ensure compliance. Ofwat can also impose financial penalties on water companies to a maximum of 10% of their turnover (in a relevant year) if they are in breach of their relevant statutory duties or licence conditions. All financial penalties are borne by shareholders rather than customers. The new monitoring and reporting framework will support Ofwat's ability to decide when to take enforcement action as it will be clear to all when storm overflow discharges exceed the legal limits.

Chapter 4: Actions we can all take to make a difference

There are actions that we can all take to reduce the amount of rainwater entering our sewers and keep them flowing freely.

To support the long term aims of the plan, the public can:

Use permeable surfaces and alternatives for drainage. Construction of impermeable surfaces like patios or plastic grass in our gardens concentrates rainwater in the drainage system and prevents its natural drainage. Using permeable surfaces, such as grass, and alternatives for drainage, such as soakaways and rain gardens, helps to reduce the problem. Permeable surfaces can prevent sewage systems from being overwhelmed and help to protect homes and business from flooding.[9]

The Government will review the case for implementing Schedule 3 of the Flood and Water Management Act 2010, in the Autumn.[10] This would introduce standards for and adoption of most new drainage systems and would make it compulsory that systems are approved before any construction work commences. We encourage property owners to make sustainable changes to their own existing properties as good practice regardless of any decision to implement Schedule 3.

Good use of drains. Misuse of drains and sewers by disposing of fats, oils, greases, wet wipes and nappies down sinks and toilets can cause pollution and flooding as they can build up in sewer networks and limit or even block the flow in the pipes. Water UK research has identified that wet wipes flushed down the toilet are a frequent cause of sewer blockages.[11] Wet wipes, mostly comprising baby wipes, make up 93% of the material that causes sewer blockages, which cost the water industry in England and Wales £100 million a year to fix.[12]

Reducing use of wet wipes. We are currently exploring options to address the issues caused by wet wipes and ensure that consumers dispose of them appropriately. In November 2021, the Government launched a call for evidence on commonly littered and problematic plastic items which explored future policy action on wet wipes. A summary of

---

[9] Guidance on the Permeable Surfacing of Front Gardens: pavingfrontgardens.pdf (publishing.service.gov.uk).

[10] Flood and Water Management Act 2010 (legislation.gov.uk).

[11] Water UK. Wipes in Sewer Blockage Study: Final Report. 2017. Available at: https://www.water.org.uk/publication/wipes-in-sewer-blockage-study-final-report/

[12] https://www.water.org.uk/news-item/new-proof-that-flushing-wipes-is-a-major-cause-of-sewer-blockages/

responses to this call for evidence will be published in due course. The Government is now undertaking a research project on wet wipes to better inform future policy proposals, including the scope of any potential ban. The research project will consider the effect of wet wipes on the sewage system, whilst also considering the effects of plastic pollution from them. The outcomes of the project will be published and inform next steps.

Annex 1: Technical Definitions and Further Details:

Assessing ecological impacts: For the purposes of this plan, '*no local adverse ecological impact'* means achieving the Urban Pollution Management Fundamental Intermittent Standards (FIS) or 99 percentile standards for Ammonia and Dissolved Oxygen downstream of the discharge point.[13]

The Environment Act 2021 requires the water industry to measure the water quality both up and downstream of these assets. This monitoring framework will give clear evidence to the public on whether improvement schemes are achieving the required outcomes, and where further upgrades may be required. The Government is clear that monitoring should be a verification step and should not hold up the planning or delivery of improvement works.

The Urban Pollution Manual Standards are the best currently available measure of the environmental impact of storm overflows in relation to ecological harm. However, we are aware that there are emerging pollutants and areas where pollution from storm overflows may be outside of this manual. This includes emerging areas such as microplastics and anti-microbial resistance. As monitoring techniques are developed, consideration should be given as to whether new parameters should be brought into scope.

Defining 'High Priority' sites: High priority sites include Sites of Special Scientific Interest (SSSIs), Special Areas of Conservation (SAC), Urban Wastewater Treatment Regulations sensitive areas, chalk streams and waters currently failing our ecological standards due to storm overflows. There are approximately 5,500 overflows that discharge to high priority sites across England.

Good Ecological Status (GES): is defined in The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

Bathing Water Target:

Bathing water standards: The Environment Agency sets Environmental Quality Standards (EQS) for bathing water classifications.[14] This sets out the standard for faecal indicator organisms that determine the status of bathing waters. The acceptable level of storm overflow discharges is determined from these standards.

[13] UPM Manual Version 3 (fwr.org)

[14] Water companies: environmental permits for storm overflows and emergency overflows - GOV.UK (www.gov.uk)

Environment Agency spill standards: These are the standards all overflows at bathing waters must be designed to achieve in order to reach EQS. These will be relevant for the assessment of whether the target has been achieved for each storm overflow discharging into a bathing water.

For coastal waters and lakes, storm overflows at or near to a designated bathing water must be designed to achieve on average three discharges per bathing season for 'good' and two for 'excellent' bathing waters.

Storm overflows 'near' designated bathing waters are defined as those:

- 5km upstream of the upper limit of the inland bathing water reach.
- 1km upstream of the coastal bathing water.

The Environment Agency will publish the new standards for rivers before the end of 2022 and we expect that the spill standard will be less than two per bathing season. Currently, this standard is only applied to those storm overflows close enough to affect a single monitoring point for each bathing water.

Screening requirements: screens must be designed and well maintained so that they achieve the solid separation and flow rates that they were designed for.

Rainfall Target

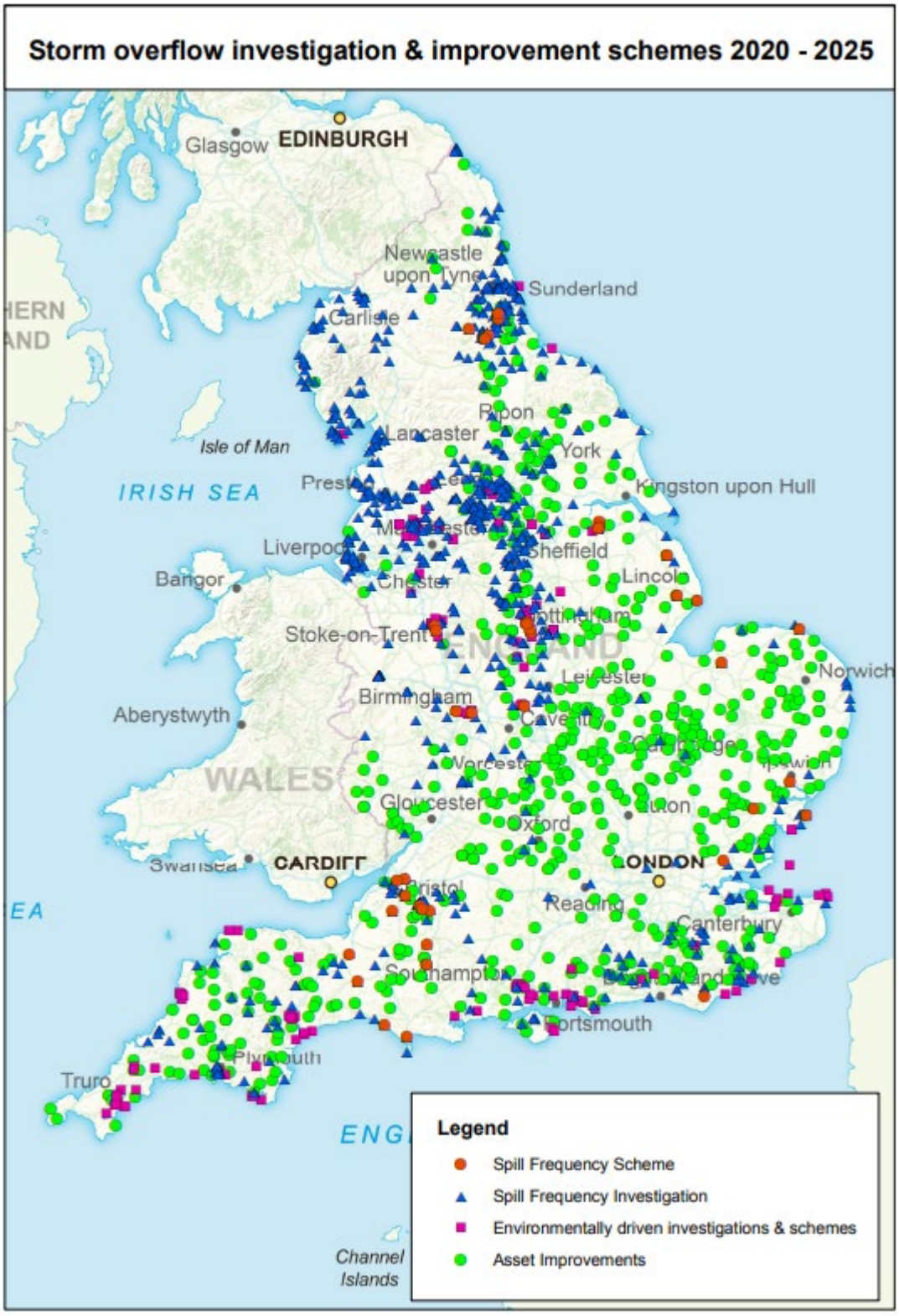
Definition of rainfall event:

A maximum of 12 hours rainfall will be classed as 1 rainfall event. Longer rainfall events will count as multiple events.

When the Government consulted on this target, it was stated that one rainfall event would be classed as 12 hours rainfall. We received several stakeholders' queries on this definition and how such a rainfall event would be regulated by the Environment Agency.

To clarify, the Environment Agency will apply an industry standard measure to translate rainfall events to discharges from Storm Overflows. This means that any discharge from a Storm Overflow within a maximum of 12 hours will be counted as related to one rainfall event for the purposes of the target. For long duration discharges that occur beyond the initial 12-hour period, it will be counted as an additional rainfall event for the subsequent 24 hours and each 24 hours after that for the purposes of the target. When an overflow has ceased to discharge for a 24-hour period, the counting mechanism will reset.

Annex 2: Map of storm overflow investigations and improvements 2020 to 2025



Annex 3: Government Legislative Action

The landmark **Environment Act** contains a suite of measures to tackle the harms that storm overflows cause and significantly improve the transparency of their operation:

1. **A duty on water companies to secure a progressive reduction in the adverse impacts of discharges from storm overflows.**

Historically, water companies have been permitted to discharge untreated wastewater to the water environment to prevent it backing up into houses or through drains. The permits contain the conditions for when discharges are permissible.

However, as pressure on the sewage network has increased from population growth and climate change, upgrades from water companies have not kept pace. This new duty creates a clear requirement that storm overflows should not be used as a matter of standard practice. Water companies will now have to not simply halt the increase in discharges but reverse the current trend and secure a progressive reduction in the impacts of discharges from storm overflows. This Plan sets out the specific and time-bound reductions water companies will achieve as a minimum.

2. **A duty directly on water companies and the Environment Agency to publish data on storm overflow operation on an annual basis.**
3. **A duty directly on water companies to publish near real time information on the operation of storm overflows.**
4. **A duty directly on water companies to monitor the water quality upstream and downstream of storm overflows and sewage disposal works.**

For too long water companies have been able to discharge raw sewage without appropriate scrutiny due to a lack of monitoring data and an incomplete picture of the full impact of storm overflows on the water environment. These new duties on monitoring will increase transparency and provide the Government, regulators and the public with the information to take action and hold the industry to account.

5. **A duty on water companies to produce comprehensive statutory Drainage and Sewerage Management Plans (also known as Drainage and Wastewater Management Plans) setting out how they will manage and develop their drainage and sewer systems over a minimum 25-year planning horizon, including how storm overflows will be addressed through these plans.**
6. **The Environment Act also gives a power of direction for the Government to direct water companies in relation to the actions in these Drainage and Sewerage Management Plans.**

The Environment Act made the drainage and sewerage management planning process statutory. This will enable sewerage companies to fully assess network capacity, short and long-term infrastructure needs and the impact of their activities on the environment.

7. **A requirement for the Government to produce a report setting out the actions that would be needed to eliminate discharges from storm overflows in England, and the costs and benefits of those actions.**

In developing options to reduce the use of storm overflows, it is clear that there are gaps in the available research and policy. We have therefore published a report setting out what it would take to eliminate the harm caused by storm overflows, exposing the costs and benefits of different courses of action. This will allow for evidence-based debate on the feasibility of options to reduce the harm caused by storm overflows.

8. **A duty on the Government to produce a statutory plan to reduce discharges from storm overflows and their adverse impact, and report to Parliament on progress.**

This Plan meets the legal requirement in the Act. It sets out the largest programme of action in history to tackle storm sewage discharges. It will revolutionise how water companies reduce discharges from storm overflows, in response to insufficient and in some cases illegal action from water companies and the public's desire to see a cleaner, healthier water environment.

To support the regulatory measures in the Environment Act, the Government has set out clearly to Ofwat their expectation that the regulator must challenge water companies to improve their day-to-day environmental performance. Ofwat must challenge water companies to demonstrate the actions they will take to meet the targets set out in this plan.

Annex 4: Commitments by water companies

Water companies have committed to achieve the following reductions in sewage discharges:

Water company	2025 Commitments	River water quality commitments
Anglian Water	Reducing discharges to an average of 20 per year	Ensure storm overflows and sewage treatment works do not harm rivers by 2030
Northumbrian Water	Reducing discharges to an average of 20 per year	Have plans in place to eliminate all impediments to rivers achieving good ecological status caused by operations
Severn Trent Water	Reducing discharges to an average of 20 per year	Ensure storm overflows and sewage treatment works do not harm rivers by 2030
South West Water	Reducing discharges to an average of 20 per year	33% reduction in impact on rivers by 2025, and plan to target zero harm by 2030
Southern Water	Reducing discharges to an average of 18 per year	80% reduction in storm overflow spills by 2030
Thames Water	14% reduction in duration of discharges against a 2020 baseline	50% reduction in storm overflow spills by 2030 against 2020 baseline
United Utilities	33% reduction in discharges against a 2020 baseline	Aim to deliver a significant reduction in impact caused by storm overflows and sewage treatment works by 2030
Wessex Water	25% reduction in duration of discharges against 2020 baseline	Aim to deliver a significant reduction in impact caused by storm overflows and sewage treatment works by 2030
Yorkshire Water	20% reduction in average number of discharges against a 2021 baseline	Aim to deliver a significant reduction in impact caused by storm overflows and sewage treatment works by 2030

Annex 5: Report on feasibility of elimination of discharges from storm overflows

Executive summary

The Environment Act 2021 places a requirement on the Secretary of State to prepare a report on the actions that would be needed to eliminate discharges from the storm overflows of sewerage undertakers whose areas are wholly or mainly in England, and the costs and benefits of those actions.[15]

This report explores the different approaches that could be used on a national scale to achieve complete elimination. The costs and benefits of each approach have been compared to determine whether elimination is feasible.

Part 1: Background and scope

Background

Storm overflows act as relief valves, designed to discharge excess storm water combined with untreated sewage directly into waterbodies during heavy or prolonged rainfall, to prevent sewage from backing up into homes and amenities. In England there are around 15,000 storm overflows.

A growing population, an increase in hard, impermeable surfaces, and a changing climate have slowly increased the volume of rainwater and wastewater entering the network, causing storm overflows to operate far too frequently. Sewage discharges can cause harm to the environment and public health, and therefore some are calling for the complete elimination of storm overflows.

Scope

Complete elimination could be interpreted as:

A. removing the relief valves from the sewage network so that storm overflows no longer form part of sewage infrastructure; or

[15] Environment Act 2021, Part 5, Storm Overflows, Section 84 (2021).

B. reducing the frequency of sewage discharges from storm overflows to zero without removing the infrastructure itself.

For the purposes of the report, 'complete elimination' will be defined as reducing the frequency of sewage discharges to zero discharges on an average year. This definition allows for comparison between different approaches to eliminate sewage discharges, including removing overflows from the network entirely, and reducing spills.

The report draws on published case studies, the Government's arm's length bodies, stakeholders, and researchers in the water industry that provide examples of water companies' successfully eliminating overflows on an individual or localised basis.

The report also draws on the Storm Overflows Evidence Project which considers the costs and benefits of complete elimination across England.[16] This project was published in November 2021 and was the first comprehensive piece of research of its kind.

This government has been clear that it does not consider complete elimination to be the most constructive approach to tackle harm from storm overflows. This is why the Government published the Storm Overflows Discharge Reduction Plan, which sets out expectations on water companies to reduce storm overflow discharges and eliminate their harm. This report considers options that could achieve complete elimination of storm overflows, and where they might be feasible.

Part 2: Achieving complete elimination in England

Options for complete elimination

Storm overflows operate when the total volume of rainwater and sewage entering the combined sewer system exceeds the capacity of the network. Therefore, to remove the need to discharge sewage, we must either:

- **Reduce the volume** of rainwater and sewage entering the sewage network, so that even in times of heavy rainfall, the capacity of the network is not exceeded, or
- **Increase capacity** of the sewage network so all wastewater and surface water is treated, even in times of heavy rainfall.

We have considered four options which incorporate one or both of the above approaches:

[16] Stantec (2021), 'Storm Overflows Evidence Project'

1. **Complete separation of the combined sewer network** – This option involves redesigning the sewer system, so that wastewater and storm water do not combine.
2. **Construction of additional storage** – This option tackles the symptoms of the issue, by increasing the capacity of the network to keep pace with higher volume.
3. **Use of Sustainable Drainage Systems (SuDS)** – This option deals with some of the causes of increased pressure on the sewer system, such as large impermeable surfaces, and run-off from roofs. This option must be combined with increasing storage capacity in order to achieve complete elimination.
4. **Alternative measures to reduce sewage discharges and remove inefficiencies in the network** – This option tackles a mixture of the causes of increased pressure on the sewer system. This option must also be combined with other options in order to achieve complete elimination.

Overall benefits of complete elimination

There are shared ecological, public health and societal benefits of the elimination of sewage discharges from storm overflows.

Ecological

Discharges of raw sewage can contain organic pollutants, microplastics, pharmaceuticals, nutrients, and heavy metals, as well as visible litter that is flushed down toilets. Nutrients and excess organic matter in our waterbodies can cause intermittently low levels of dissolved oxygen, and high levels of ammonia, which harm aquatic life. The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 sets metrics to assess the ecological and chemical health of waterbodies.[17] According to the 2019 classification results, 7% of waterbodies are failing to achieve good ecological status due to the impact of storm overflows.[18] Elimination of storm overflow sewage discharges would improve the ecology of waterbodies and stop waterbodies failing to achieve 'Good Ecological Status' as a result of sewage discharges.[19]

Public health

Sewage discharges from storm overflows can introduce pathogens and bacteria into waterbodies that can harm public health if water bodies are used recreationally. Complete

[17] Defra (2019), 'Classifications data for England'.
[18] Defra (2019), 'Classifications data for England'.
[19] Stantec (2021), 'Storm Overflows Evidence Project'.

elimination would reduce this risk to public health, providing greater opportunities for recreational use of waterbodies.[20]

Society

Discharges can introduce unpleasant visible debris, such as wipes and sanitary waste into water bodies. Eliminating discharges to water courses would reduce litter and debris in the water environment, improving waterbodies aesthetically and reducing pollution incidents.[21]

Some methods of elimination (particularly those which reduce the volume of water entering the sewer system) can also confer additional benefits to the economy, environment, and society. Some SuDS increase infiltration to groundwater which helps to improve natural hydrology. This increases the volume of water available for abstraction and for the environment, improving nature's resilience to climate change. Nature-based solutions such as wetlands and raingardens can have a positive impact on biodiversity net gain, increasing the biodiversity that is essential for our ecosystems. Uptake of water efficient measures within households could also reduce energy usage, with associated carbon emission savings. These will be considered individually against the options set out below.

Overall costs of complete elimination

Complete elimination of storm overflow sewage discharges poses environmental, financial, and societal costs. Specific costs associated with individual approaches are outlined in the discussion of each option.

Environmental

In combined sewers, run-off from roofs and roads is treated at wastewater treatment works. This run-off can contain organic material from tyre wear and brake wear, and other contaminants which pose risks to aquatic life. Option 1 eliminates rainwater and run-off entering the sewage network, and Option 3 decreases the proportion of rainwater and run-off entering the sewage network. Therefore, both options increase the likelihood of untreated water containing a higher concentration of harmful pollutants entering the freshwater ecosystems. Waterbodies are particularly vulnerable to the effects of road run-off when it rains following long periods of dry weather, such as following the 2018 drought in London. These 'first flush' events occur when chemicals such as hydrocarbons and organic material build up on our roads, wash into rivers during rainfall, and cause oxygen

[20] Stantec (2021), 'Storm Overflows Evidence Project'.
[21] Stantec (2021), 'Storm Overflows Evidence Project'.

levels to crash.[22] This risk would need to be managed through SuDS or other treatment processes.

All engineering approaches that could be used to achieve complete elimination have a high carbon footprint.

There are also limitations to the environmental benefit that complete elimination could bring. There are more significant reasons for waterbodies not achieving 'good ecological status' that would not be addressed by complete elimination, such as run-off from agriculture. Therefore, it is possible that following elimination of storm overflow sewage discharges, water bodies would not immediately display the anticipated positive impact.[23] Sediment in waterbodies may also require further treatment to tackle years of nutrient build up, to prevent eutrophication.[24]

Financial

The financial costs of achieving zero storm overflow spills on an average year varies depending on the engineering approach considered. Achieving complete elimination using the storage-only option would cost between £120 billion and £190 billion. Alternatively, achieving complete elimination via the complete-separation approach would require an overhaul of the current sewerage network, and therefore the Storm Overflows Evidence Project has calculated a lower estimate of £338 billion and an upper estimate of £593 billion.[25] These costs would drive significant increases in water bills, which vary across elimination options There may be other more cost beneficial activities that would deliver greater environmental benefits at much lower cost to the public.

Reducing the flow of water passing through the sewer system via options 1, 3 and 4 could also increase maintenance costs of sewer systems which rely on high flow events to achieve self-cleansing, removing blockages and build-up of solid material.[26]

Societal

[22] Thames 21, *Road run-off*.
[23] Rafferty, S.D., Lybrook, J., Kaczmarek, K.M. *et al. (2013)* Assessing changes in the Presque Isle Bay watershed fish community using a modified index of biotic integrity: before and after the elimination of combined sewer overflows. *Environ Monit Assess* 185**,** 10459–10471
[24] H Caspers; Predicted Changes in Water Quality after Elimination of Storm Runoff into the Urban Lake and Canals of Hamburg. *Water Sci Technol* 1 April 1982; 14 (4-5): 315–322.
[25] Stantec (2021), 'Storm Overflows Evidence Project'.
[26] Defra (2011) Annex B of National Build Standards, Design and Construction of new gravity foul sewers and lateral drains.

Options 1, 2 and 3 would require a significant overhaul of existing wastewater infrastructure, causing widespread disruption to public life e.g., roads dug up. Options 3 and 4 would require a change in consumer habits, such as fitting SuDS onto private properties. This may be difficult to achieve and lack widespread public support.

Option 1 - Complete separation of the combined sewer network

Approach

Separating the combined sewer network, so that wastewater (sewage from homes and amenities), is treated, and rainwater is redirected back into the natural environment, would reduce the total volume of water entering sewage treatment works. This would remove the need to spill, even during times of heavy rainfall.

This option would require the construction of new sewers which would be used exclusively for wastewater. These would run parallel to the current system, which would remain in place and be used only for rainwater. There are already around 100,000 kilometres of combined sewers in England, enough pipework to go two and a half times around the Earth. This fundamental overhaul of current infrastructure would be a significant undertaking.

Benefits

Option 1 ensures that capacity of the sewage network is unaffected by changing weather conditions. It would build resilience into the sewage system, protecting against extreme weather events caused by climate change and additional run off from new development. Complete separation of the sewage network would also create a more predictable and consistent flow of wastewater, simplifying water company planning.

Costs

Financial

The following table outlines the costs of Option 1. The Storm Overflows Evidence Project calculated lower and upper estimates of CAPEX (capital expenditure). The Storm Overflows Evidence Project does not estimate the annual costs of operating this new infrastructure (OPEX), which would increase the total financial cost of this option.

The Storm Overflows Evidence Project acknowledges that there were some uncertainties in deriving cost estimates, and that the water sector could benefit from further analysis at both a local and national level to identify more efficient solutions to reduce harm from storm overflows.

Estimate	CAPEX (£billion)
Low	338
High	593

The estimated bill impacts for each of the options has been calculated using the Stantec data and an internal Defra assessment to show the average bill impact across a 25-year time horizon. The figures below show the estimated increase in the average annual water bill relative to the current baseline once investment and construction begins and shows both the central estimate and the uncertainty range for the complete separation option using the total capital investment figures provided by Stantec. This calculation is a preliminary estimate of equivalent bill amounts and therefore figures are not directly comparable with those shown for the investment programme analysed in the Impact Assessment for the final Storm Overflow Discharge Reduction Plan.

	2025 - 2029	2030 - 2034	2035 - 2039	2040 - 2044	2045 - 2049
Central Estimate	£122	£317	£497	£664	£817
Low-High Range	£89 - 156	£230 - 403	£361 - 634	£482 - £846	£593 - 1040

Environmental

There is a high risk of environmental harm from the restructuring of sewage infrastructure in this way. Years of construction of new systems are likely to contribute to habitat loss and would have a significant carbon footprint.[27] There would also be an increase in pollutants reaching rivers from untreated urban and road run-off and a risk that

[27] The Storm Overflows Evidence Project does not quantify embedded carbon for the complete separation scenario.

misconnections could lead to sewage and wastewater from some properties being directed permanently to rivers without treatment, rather than just during storm events.[28]

Public and society

This overhaul of infrastructure would cause years of significant disruption to public life, including noise, dust and erosion related to construction, disruption to business, and possibly disruption to the sewer service.[29] This option would require such significant effort that it is likely to limit the water industry's ability to make progress on other environmental issues.

The Storm Overflows Evidence Project did not calculate a cost benefit ratio for this option.

Option 2 - Construction of additional storage

Approach

The water industry already relies heavily on the use of storage tanks to store rainwater and wastewater. In order to achieve zero discharges in an average year, water companies would need to significantly expand network storage to accommodate all rainwater, through the expansion of sewage treatment works, increasing the size of pipes or constructing storage tanks. According to the Storm Overflows Evidence Project, water companies would need access to an additional 118.43 million m^3 of storage to achieve this. This is equivalent 40,000 Olympic sized swimming pools.

Benefits

The construction of new network storage remains a reliable solution to increase capacity and reduce the use of storm overflows. This option has been used for several years.

There is also scope for developers to deliver additional benefits to the public and society in local areas where storage tanks are constructed. For example, the Thames Tideway Tunnel is currently under construction, and is designed to capture and store sewage and rainwater underground. On the ground above the new tunnel, developers are using this period of construction as an opportunity to rejuvenate London's landscape. The Tideway

[28] J.B. Ellis, D. Butler, 2015, Surface water sewer misconnections in England and Wales: Pollution sources and impacts, *Science of The Total Environment* (526), pp 98-109,
[29] United States Environmental Protection Agency (1999), 'Combined Sewer Overflow Management Fact Sheet, Sewer Separation', *Office of Water Washington D.C*

team have constructed several new parks as part of the project and provided space for artists to display their creations in these new public areas.[30]

On a local or catchment basis, storage tanks have proven to be an effective method of achieving a significant reduction in sewage discharges. The MDC Hartford Clean Water Project in the USA launched a similar initiative to the Tideway Tunnel project, constructing the 4 mile-long South Hartford Conveyance and Storage Tunnel, designed to limit the use of storm overflows.[31] On a local or catchment basis, adding network storage into the system has proven to be an effective method of achieving a significant reduction in sewage discharges.

Costs

Financial

The estimated costs of increasing network storage to achieve complete elimination are significant. The Storm Overflows Evidence Project predicts the following capital expenditure (CAPEX) and annual costs of operating the system (OPEX). The project also recommends that costs set out below could be inflated by 30%, because approximately 70% of known overflows were included in calculations, but it is likely that the overflows not included are less significant in terms of volume and frequency. The following table outlines the costs of Option 2:

Estimate	CAPEX (£billion)	OPEX (£million per year)
Low	121.2	21
High	187.9	

The following table outlines the estimated bill impacts of Option 2 utilising the same methodology as that explained under Option 1, but for the construction of additional storage option. As previously, these figures are relative to the current baseline:

[30] Tideway (2017), 'Reconnecting London with the River Thames, delivering a lasting legacy'.
[31] V. Nasri, C. E. Haynes (2015), 'New tunnel system to eliminate sanitary sewer overflows and control combined sewer overflows in Hartford, Connecticut'. *Water Practice and Technology* 1 June 2015; 10 (2): 282–290.

	2025 - 2029	2030 - 2034	2035 - 2039	2040 - 2044	2045 - 2049
Central Estimate	£41	£105	£165	£220	£271
Low-High Range	£32 - 49	£82 - 128	£129 - 201	£173 - 268	£213 - 330

Environmental

The Storm Overflows Evidence Project makes estimates for the carbon footprint of Options 2 and 3, by estimating embedded carbon. Embedded carbon is the total carbon dioxide emissions associated with the construction of a project, including extraction of raw materials, manufacturing, transportation, and on-site activity.

The Storm Overflows Evidence Project estimates the embedded carbon for Option 2 to be 19.29 million tons. This is approximately 20 times the embedded carbon estimated to result from the construction of HS2, the rail line between London and Birmingham, at 1.2 million tons.[32]

While some additional storage can be constructed below ground, such as the Thames Tideway Tunnel, expanding sewage treatment works or building storage tanks requires land. When making policy decisions, government must consider trade-offs between competing uses for land, such as food production.

Public and Societal

Quantifying disruption to public life in a useful and accurate way is challenging but looking at similar large scale storage construction projects can provide an estimate. For example, the construction of the Thames Tideway Tunnel will take 9 years, with construction affecting the flow of traffic, and closing some pedestrian walkways.[33]

Benefit-cost ratio

The Storm Overflows Evidence Project compared the estimated costs and benefits for the network-storage only scenario and came up with a benefit cost ratio. Further detail on the methodology used to calculate this figure can be found in the Storm Overflows Evidence

[32] Rail Professional, *Will HS2 reduce the UK's carbon emissions*.
[33] Thames Water, *Thames Tideway Tunnel*.

Project.[34] A scenario that is cost beneficial would have a cost benefit ratio of at least 1. The Storm Overflows Evidence Project calculated an upper estimate of 0.05 (using an upper estimate for benefits and lower estimate for cost) for achieving complete elimination by increasing network storage only. It follows that for this scenario, the costs of elimination far outweigh the benefits.[35]

Limitations

This approach may not be as successful in eliminating storm overflow discharges compared to Option 1. This is because storm overflows could still be operational, even if technically discharging zero times in an average year. An exceptional rainfall event that exceeded the capacity of all storage options could still cause a storm overflow to discharge, with implications for public health and ecology. Therefore, the permitting of storm overflows would still be required, in preparation for a storm event even bigger than planned for.

It is also important to consider that bigger assets have a capacity design life. When pressures exceed the design life of the asset, due to heavier storms from climate change, a growing population or increased impermeable surfaces following urbanisation, these assets will need to be upsized.

For example, the Thames Tideway Tunnel is not predicted to eliminate sewage discharges completely.[36] It is estimated that sewage entering the Thames will be reduced by at least 94% by the time of its operation.[37] Developers predict that the tunnel will be effective at tackling sewage pollution in London for the next 100 years, after which time new solutions may need to be considered to continue to achieve the same frequency of sewage discharges.[38]

The added cost of achieving complete elimination via increasing network storage, compared to achieving a spill limit of 10 spills a year, for example, is very significant, with very little added benefit. The SOEP estimates that to achieve an average of 10 spills per year using storage tanks would cost between £20bn and £33bn. Achieving an average of 0 would cost over £100bn more. The SOEP predicts that at a spill limit of 10, 75% of waterbodies would achieve moderate or better ecological status.[39]

---

[34] Stantec (2021), 'Storm Overflows Evidence Project'.
[35] Stantec (2021), 'Storm Overflows Evidence Project'.
[36] Tideway (2020), 'Climate related financial disclosure 2020/2021'.
[37] Thames Water, *Thames Tideway Tunnel*.
[38] Tideway, *The Story*.
[39] Stantec, 'Storm Overflows Evidence Project'.

Option 3 - Use of sustainable drainage systems (SuDS)

Approach

Sustainable Drainage Systems (SuDS) can improve rainwater management by slowly filtering rainwater back into the natural environment through groundwater or into waterbodies. This diverts rainwater from the sewer network and can be used to reduce the total volume of water entering the sewage system, alleviating pressure on the network.

The Storm Overflows Evidence Project concludes that SuDS alone would not be able to redirect enough rainwater to achieve zero discharges in an average year. Therefore, SuDS must be combined with storage tanks to achieve elimination.

The Storm Overflows Evidence Project models two scenarios of SuDS use:

i. **Scenario with a high uptake of SuDS (S50):** Where runoff from 50% of impermeable area is controlled through SuDS. This is roughly equivalent to preventing all highway runoff entering combined sewers in a fully combined catchment.
ii. **Scenario with a low uptake of SuDS (S10)**: Where runoff from 10% of impermeable area is controlled through SuDS.

These scenarios are modelled upon the implementation of a range of systems at both public and property level to redirect rainwater away from the combined sewer system, including:

- Trees in pits, to reduce run-off from roads entering the sewage network
- Street side rain gardens and swales (ditches that run water away from sewage network)
- Storage basins
- Water butts for properties
- Property rain gardens
- Property level planters

Benefits

SuDS have a range of associated benefits that enhance the local environment, in addition to the benefits that complete elimination of storm overflow sewage discharges brings. SuDS can increase infiltration to groundwater, helping to maintain natural hydrology and increasing water available for abstraction. Some nature-based solutions such as wetlands, can help reduce the load from pollutants such as microplastics, metals, hydrocarbons, and nutrients from water bodies.

While ‘grey’ infrastructure has a limited life span, SuDS are designed for longevity, and continue working. Green infrastructure also provides new habitats, bringing improvements

to biodiversity, the environment and ecology. Green space also has a positive impact on society, by providing space for education, improved health outcomes, recreational benefits, and the creation of green jobs to support the economy. These benefits have been quantified in the Storm Overflows Evidence Project, assuming a 'typical' mix of the above SuDS.

SuDS can also help protect properties and homes from surface water flooding, by increasing permeable surface area and reducing the amount of water being added to the sewer network.

Costs

Financial

The up-front costs and operating costs of using SuDS are higher than storage tanks (Option 2). The S50 scenario, which relies on a higher uptake of SuDS, results in higher costs to water companies and bill payers.

The Storm Overflows Evidence Project acknowledges that there is some uncertainty surrounding the cost estimates for the SuDS scenarios. For example, in dense urban areas with heavily trafficked streets costs may be higher than in suburban space. The cost of purchasing land or space to introduce SuDS has also not been accounted for. As the supply chain in the UK for SuDS is in its early stages, unit costs are difficult to estimate accurately, but it is expected that costs will fall once these chains are established.[40] Therefore, these cost estimates present less certainty than estimates for the storage only option (Option 2). The following table outlines the costs of Option 3:

Scenario	Estimate	CAPEX (£billion)	OPEX (£million per year)
S50	Low	141.6	455
	High	215.8	
S10	Low	126.6	107

[40] Stantec (2021), 'Storm Overflows Evidence Project'.

	High	195.5	

The following table outlines the estimated bill impacts for Option 3, again using the methodology laid out under Option 1 showing an increase above the current baseline, but adjusted for using SuDs options to achieve zero discharges in an average year:

	2025 - 2029	2030 - 2034	2035 - 2039	2040 - 2044	2045 - 2049
Central Estimate (S10)	£42	£110	£172	£230	£282
Low-High Range (S10	£33-51	£86-133	£135-209	£181-279	£222-343
Central Estimate (S50)	£47	£122	£191	£255	£314
Low- High Range (S50)	£37-57	£96-147	£151-231	£202-308	£248-379

Environmental

The Storm Overflows Evidence Project estimates the embedded carbon (total carbon dioxide emissions associated with the construction of a project) as 19.31 million carbon tons for the S10 scenario and 18.3 million carbon tons for the S50 scenario.

For SuDS to operate efficiently, they must be connected and joined up to effectively create a new drainage network. This explains the relatively large carbon estimation for scenarios including SuDS, which is broadly equivalent to Option 2.

Benefit-cost ratio

The Storm Overflows Evidence Project compared the estimated costs and benefits for both SuDS scenarios and came up with a benefit cost ratio.

For scenario S50, the Project calculated an upper estimate of 0.28 for achieving complete elimination. For scenario S10, the Project calculated an upper estimate of 0.1. A higher uptake of SuDS is more economically advantageous as they deliver additional benefits.

However, the S50 scenario comes at a higher cost to consumers via water bills, that are unlikely to be acceptable to bill payers.

Limitations

There is limited evidence on the use of SuDS to completely eliminate sewage discharges nationally. This is partly due to variations in how easy it is to retrofit SuDS: they may be an appropriate and feasible solution in rural areas, but they require large permeable surfaces, which are unavailable many dense urban environments. It is also likely that those living in dense urban areas would receive the proportionately greatest additional societal benefit from SuDS, because they increase green and blue spaces in cities where they are typically less prevalent.

The Storm Overflows Evidence Project concludes that SuDS cannot be used on a national scale to achieve complete elimination on their own. Assessments of whether SuDS could address discharges in urban contexts reaches similar conclusions. For example, a study looking at areas within the Thames Tideway catchment of London that provide favourable conditions for SuDS concluded that while a high uptake of SuDS is technically possible, it would be practicably difficult.[41] Even at a local scale, SuDS are unlikely to able to achieve complete elimination without supplemented capacity from increasing network storage.[42]

Constructed wetlands in rural areas can be less expensive to build than comparable grey infrastructure, however, while they are effective in storm overflow treatment, they are not a solution that can achieve complete elimination.[43] [44]

The current regulatory environment in the UK poses challenges to the implementation of SuDS, as incentives for these stakeholders are not fully recognised. For example, the Government will commit to review the case for implementing Schedule 3 of the Flood and Water Management Act 2010. If implemented, it would introduce standards for new sustainable drainage systems (SuDS) and would remove the automatic right to connect to the public sewer system. Implementing this legislation will require collaboration across

[41] Stovin, V.R., and others (2013), 'The potential to retrofit sustainable drainage systems to address combined sewer overflow discharges in the Thames Tideway catchment', *Water and Environment Journal*, 27 (2). 216 - 228.
[42] Stovin, V.R., and others (2013), 'The potential to retrofit sustainable drainage systems to address combined sewer overflow discharges in the Thames Tideway catchment', *Water and Environment Journal*, 27 (2). 216 - 228.
[43] A. Rizzo, K. Tondera, T.G. Pálfy, and others (2020), 'Constructed wetlands for combined sewer overflow treatment: A state-of-the-art review', *Science of The Total Environment*, Volume 727.
[44] Tao, Wendong, and others, (2014), "Constructed Wetlands for Treatment of Combined Sewer Overflow in the US: A Review of Design Challenges and Application Status" *Water* 6, no. 11: 3362-3385.

government departments, regulators and industries. Currently water companies offer customers a discount on their bills if they disconnect their property from the surface water sewer, of approximately £36 per year. In the future, similar incentives could encourage the uptake of soakaways in gardens, for example, which cost approximately £750.[45]

Option 4 - Alternative measures to sewage discharges and their harm, and remove inefficiencies in the network

Approach

Our sewage system is not operating at maximum efficiency. Addressing weaknesses in the current system could reduce pressure on the sewage network. There are several local interventions that could be introduced by water companies, local authorities or individuals that would help reduce pressure on the sewage system. These measures alone would not relieve enough pressure to achieve complete elimination but could be used alongside options outlined above as part of a solution to achieve a target of zero spills in an average year:

1. **Reduce groundwater infiltration** - Groundwater enters the sewage system through pipes, manholes, defects, and natural joints. Lining pipes or cracks in pipes and sealing manholes to prevent groundwater infiltration would reduce the volume of water entering the sewage system and reduce the need to discharge.
2. **Good asset maintenance** – Blockages in pipes can cause storm overflows to spill. Ensuring that water companies are maintaining their assets properly, and that they are proactive in anticipating issues would reduce blockages, reducing spills from storm overflows.
3. **Reduce misconnections** - New developments have separate wastewater and surface water drainage systems, so that surface water can be returned into the natural water environment. However, some surface water pipes are reconnected back to the combined system. Preventing misconnections and ensuring surface water pipes do not reconnect to the sewage system will also reduce pressure on the network.
4. **Changing consumer habits -** On an individual and consumer level, there are many actions that can be taken to reduce pressure on the sewage network. Analysis has shown that changing public water consumption habits alone can

[45] Defra (2022) 'Quantifying the Impact of Water Habits', Bespoke analysis for Defra, *(pers. commun)*.

potentially improve storm overflow spill performance by up to 69% in terms of volume and cause a 39% reduction in duration.[46] These actions include using water meters, reducing shower duration, applying pressure reduction valves to reduce water usage, switching to low water use washing machines and dishwashers and disconnecting roof run off by using water butts. Studies have shown that we typically consume water in a 'double hump' pattern, whereby consumption peaks in the morning and evening, reflecting typical work patterns. Flattening this curve alone can reduce spill volume of sewage discharges by up to 4%.[47] Pouring fats and oils down sinks and flushing wet wipes and other sanitary products down toilets can cause blockages within the sewer network. Making households more aware of the impact of their use of the sewage network would reduce blockages and reduce spills from storm overflows.

Benefits

The approaches outlined in Option 4 do not require extensive or significant overhauls of current infrastructure and are all actions that can be adopted at local catchment and individual level.

Lower water consumption ensures that less water is abstracted from the ground, leaving more in our water environment. Private property level SuDS return rainfall that has landed on roofs and in gardens to the ground too, further improving natural hydrology. These two household-level interventions will improve climate change resilience, particularly in preparation for periods of low rainfall. They can also reduce localised flooding risk by slowing and holding storm water during periods of heavy rainfall.

Lower public water consumption reduces household energy usage and associated carbon emissions as well as the cost of water bills. Water treatment works are also energy intensive, therefore lower treatment volumes incur lower energy and carbon use.

Costs

To completely disconnect any rainfall related runoff from entering the system would require SuDS at a property level, however property-level SuDS not be a viable investment for most households. The average surface water fixed charge for metered customers is £36.43 per year. A 'small' simple soakaway SuDS feature could cost around £750. If a household disconnects from the surface water drainage system, and invests in the soakaway, it can make a £36.43 annual saving on its water bill. It follows that this investment will take over 20 years to start feeling the benefit. Wastewater pipes in homes

[46] Defra (2022) 'Quantifying the Impact of Water Habits', Bespoke analysis for Defra, *(pers. commun)*.
[47] Defra (2022) 'Quantifying the Impact of Water Habits', Bespoke analysis for Defra, *(pers. commun)*.

and amenities rely upon a steady rate of flow to cleanse themselves and reduce risk of blockages forming. Reducing water consumption significantly could see a 25% reduction in assets achieving sufficient velocity under dry weather conditions to cleanse themselves, thus increasing the likelihood of blockages.[48]

Lining all pipes to prevent groundwater infiltration has been shown to not be a cost beneficial approach to achieve a reduction in spills.[49] Instead, for example, Thames Water have adopted a 'find and fix' approach, to tackle pipes most vulnerable to groundwater infiltration. [50]

Further research will be required to estimate bill impacts, and an associated cost benefit ratio for this option.

Part 3: Conclusion

Achieving complete elimination of storm overflows would bring benefits to the ecology of rivers, improvements to the natural environment, and protect public health where waterbodies are used recreationally. However, the benefits of implementing new policy must be considered against the costs they bring to the consumer, local residents, industry, and environment.

Large scale projects undertaken by water and sewerage companies are funded by investment from shareholders, borrowing and through customer bills. Therefore, a proportion of the costs would be passed onto water bill payers. These costs may not necessarily be spread equally across water company providers due to regional variation. Against the backdrop of increasing living costs, the anticipated bill increases of upwards of £200 per year for each option are unlikely to be acceptable to the public and would have a significant societal impact. According to Water UK, the average household water bill was £413.33 in 2020.[51]

The embedded carbon involved in Options 2 and 3 is around 20 million tons of CO_2e, and the SOEP does not account for operational carbon. This would create challenges for the Government's commitment to reduce carbon emissions and move towards Net Zero by 2050. These costs are quantified in monetary terms in the Storm Overflows Evidence Project.

---

[48] Defra (2022) 'Quantifying the Impact of Water Habits', Bespoke analysis for Defra, *(pers. commun)*.
[49] Thames Water (2021), 'Groundwater Infiltration System Management Plan Bentley System'
[50] Thames Water (2021), 'Groundwater Infiltration System Management Plan Bentley System'.
[51] Water UK (2020), *Average water and sewerage bills for England and Wales to fall by £17 in 2020/21*.

The Storm Overflows Evidence Project was the first project of its kind to explore the costs and benefits of complete elimination on a national scale. It is clear from its cost benefit analysis, and the evidence from this report, that applying a policy of complete elimination nationally is not feasible, or within the public interest, due to the financial and environmental costs.

However, it is feasible to apply one, or a combination of, options 2, 3 and 4 at a local or catchment basis to reduce discharges and eliminate ecological harm. For example, the targeted use of storage tanks to reduce the frequency and volume of sewage discharges in local catchment areas is a practical and reliable solution. SuDS may be an appropriate solution to achieve significant reductions in discharges, particularly in rural areas. Evidence has also shown that even at a consumer level, changes in our water habits can impact water management and storm overflow operation. Increased public awareness of the value of water, and how personal water habits affect the sewer system, could help reduce the frequency of sewage discharges.

Innovation in the water industry will continue to drive cheaper and more effective solutions, particularly at catchment level.[52] For example, engineers have developed 'peaker flow', a new technology which remains idle most of the time but treats excess flow when needed.[53]

Applying treatment to sewage discharges would not achieve 'complete elimination of sewage discharges' but would contribute to the elimination of *untreated* sewage discharges. Treatment can be introduced on a localised basis, to tackle harm specific to that area. For example, treatment to reduce harmful pathogens where waterbodies are used for swimming, or treatment to tackle harm from road run-off in urban environments with large impermeable areas.

In summary, the Government has outlined ambitious proposals to reduce the frequency and duration of storm overflow discharges in the Storm Overflows Discharge Reduction Plan. This plan will revolutionise how water companies tackle the number of discharges of untreated sewage. The targets outlined in the Storm Overflows Discharge Reduction Plan aim to strike the right balance between the scale and pace of ambition, and the increase in consumer bills. Water companies will face strict limits on when they can use storm overflows and must completely eliminate the harm any sewage discharge causes to the environment by 2050. This will be the largest programme to tackle storm sewage discharges in history.

---

[52] Botturi, A and others (2021), "Combined sewer overflows: A critical review on best practice and innovative solutions to mitigate impacts on environment and human health", *Critical Reviews in Environmental Science and Technology*, 51:15, 1585-161.

[53] Peters, PE, Zitomer, DH. Current and future approaches to wet weather flow management: A review. *Water Environ Res*. 2021; 93: 1179– 1193.

Bibliography

Botturi, A and others (2021), “Combined sewer overflows: A critical review on best practice and innovative solutions to mitigate impacts on environment and human health”, *Critical Reviews in Environmental Science and Technology*, 51:15, 1585-161.

Caspers, H (1982), “Predicted Changes in Water Quality after Elimination of Storm Runoff into the Urban Lake and Canals of Hamburg”, *Water Sci Technol* 1 April 1982; 14 (4-5): 315–322.

Cools, J. and others (2016), “Assessment of impact of storm water overflows from combined waste water collecting systems on water bodies (including the marine environment) in the 28 EU Member States”. Available at: https://circabc.europa.eu/sd/a/f3c0cbde-3f4a-4b6f-8953-0eaec6a6ffd0/Task%203%20Occurrence%20of%20storm%20water%20over%20flows%20in%20the%20EU.pdf (Last accessed 19.07.22)

Defra (2022), ‘Consultation on the Government’s Storm Overflows Discharge Reduction Plan’. Available at: https://consult.defra.gov.uk/water-industry/storm-overflows-discharge-reduction-plan/ (Last accessed 19.07.22).

Defra (2022) ‘

of Water Habits’, Bespoke analysis for Defra, *(pers. commun)*.

Defra (2019), ‘Classifications data for England’. Available at: https://environment.data.gov.uk/catchment-planning/England/print (Last accessed: 19.07.22)

Environment Agency, Chief Scientist’s Group (2021), ‘The state of the environment: the urban environment’. Available at: https://www.gov.uk/government/publications/state-of-the-environment/the-state-of-the-environment-the-urban-environment (Last accessed 19.07.22).

Nasri, V, and Haynes, C.E. (2015), “New tunnel system to eliminate sanitary sewer overflows and control combined sewer overflows in Hartford, Connecticut”. *Water Practice and Technology* 1 June 2015; 10 (2): 282–290.

National Audit Office (2021), Understanding storm overflows: Exploratory analysis of Environment Agency data’. Available at: https://www.nao.org.uk/report/understanding-storm-overflows-exploratory-analysis-of-environment-agency-data/ (Last accessed 19.07.22).

Peters, PE, Zitomer, DH (2021), “Current and future approaches to wet weather flow management: A review”. *Water Environ Res*. 2021; 93: 1179– 1193.

Rafferty, S.D., and others (2013), ‘Assessing changes in the Presque Isle Bay watershed fish community using a modified index of biotic integrity: before and after the elimination of combined sewer overflows’, *Environ Monit Assess* 185, 10459–10471.

Rail Professional, *Will HS2 reduce the UK’s carbon emissions*. Available at: https://www.railpro.co.uk/railpro-magazine/magazine-archives/will-hs2-reduce-the-uks-carbon-emissions#:~:text=Operation%20of%20the%20first%20phase%20of%20HS2%2C%20between,that%20will%20result%20from%20construction%20of%20the%20line. (Last accessed 22.07.22)

Rizzo, A., and others (2020), ‘Constructed wetlands for combined sewer overflow treatment: A state-of-the-art review’, *Science of The Total Environment*, Volume 727.

Stantec (2021), ‘Storm Overflows Evidence Project’. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1030980/storm-overflows-evidence-project.pdf (Last accessed 19.07.22)

Stovin, V.R., and others (2013), 'The potential to retrofit sustainable drainage systems to address combined sewer overflow discharges in the Thames Tideway catchment’, *Water and Environment Journal*, 27 (2). 216 - 228.

Wendong, T., and others, (2014), "Constructed Wetlands for Treatment of Combined Sewer Overflow in the US: A Review of Design Challenges and Application Status" *Water* 6, no. 11: 3362-3385.

Thames 21, *Road run off*. Available at: https://www.thames21.org.uk/improving-rivers/road-run-off/#:~:text=The%20long%20term%20impacts%20of%20road%20run-off%20pollutants,as%20seen%20in%20the%202018%20drought%20in%20London. (Last accessed 19.07.22).

Thames Water, *Thames Tideway Tunnel*. Available at: https://www.thameswater.co.uk/about-us/investing-in-our-region/thames-tideway-tunnel . (Last accessed 19.07.22).

Thames Water (2021), ‘Groundwater Infiltration System Management Plan Bentley System’. Available at: https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-reports/groundwater-infiltration-management-plans/bentley-groundwater-infiltration-management-plan.pdf (Last accessed 19.07.22).

Tideway (2017), ‘Reconnecting London with the River Thames, delivering a lasting legacy’. Available at: https://www.tideway.london/media/1953/tideway-legacy-brochure_2017.pdf (Last accessed 19.07.22).

Tideway (2020), ‘Climate related financial disclosure 2020/2021’. Available at: https://www.tideway.london/media/5098/j0114_-climate-related-financial-disclosure-report-vis5-2.pdf (Last accessed 19.07.22).

Tideway, *The Story*. Available at: https://www.tideway.london/the-tunnel/the-story/#:~:text=25km%20long%20and%207.2%20metres%20in%20diameter%2C%20it,river%20for%20at%20least%20the%20next%20100%20years (Last accessed 22.07.22).

United States Environmental Protection Agency (1999), 'Combined Sewer Overflow Management Fact Sheet, Sewer Separation', *Office of Water Washington D.C.* Available at: https://www3.epa.gov/npdes/pubs/sepa.pdf#:~:text=In%20addition%2C%20complete%20separation%20of%20sanitary%20and%20storm,structures%2C%20sump%20pumps%2C%20and%20roof%20and%20footer%20drains. (Last accessed 25.07.22).

Water UK (2020), *Average water and sewerage bills for England and Wales to fall by £17 in 2020/21*. Available at: https://www.water.org.uk/news-item/average-water-and-sewerage-bills-for-england-and-wales-to-fall-by-17-in-2020-21/ (Last accessed 19.07.22)

E02787705

978-1-5286-3671-1