Improving river health in the River Thames catchment

May 2024

Foreword from Chris Weston

This is the third annual edition of our River Health Action Plan and the first for which I take responsibility, having joined Thames Water in January 2024.

Thames Water faces many challenges in providing an essential service to 16 million people, one of which is improving the health of our rivers. We rely on our rivers, and the groundwater sources that provide much of their flow, for the safe, clean and wholesome drinking water we provide to our customers. We also bear a huge responsibility in treating the wastewater to a standard that can be safely discharged back to those same rivers.

As it happens, I am a fisherman, so I have a deeply personal connection to rivers and the wildlife and landscape alongside them, and I understand why others are equally passionate about them, for various forms of recreation and for their intrinsic value as a fundamental part of the natural ecosystem that sustains all our lives.

My immediate priorities are threefold; the health and safety of our people, delivering our turnaround plan and securing the right settlement in the 2024 Price Review so that the company continues to improve performance for our customers and the environment in the future.

Putting untreated sewage into rivers is unacceptable. Maintaining and improving the health of the rivers in our area matters to me, and I have made reducing pollution a key part of the turnaround plan for the company. The right 2024 Price Review settlement will also enable us to deliver further improvements which will benefit our rivers.

This document provides a snapshot of our current performance and what we are doing to improve it. It also reveals just how much we have to do and sets out the steps we are already taking in the current regulatory period, with an indication of what we are seeking to do in future periods, working with our regulators and, where necessary, under Government direction.

I need to be clear that it will take time and money to do all the things that need to be done to improve our infrastructure, make substantial reductions in pollutions and consistently achieve the levels of operational performance that are expected of us. To give just one example, the Thames Tideway Tunnel, which we gained approval to build as long ago as 2007, will become operational next year. But the size of the prize is huge – the Thames Tideway Tunnel is the last of three projects that, taken together, will reduce the volume of storm water entering the tidal River Thames by 95% in a typical year. Improvements at much smaller sites still take several years to design and build, so it is important that we are fully transparent about what we are doing and respond openly to all challenges and requests for information.

I hope you will find the information here of interest and be willing to engage with us as we work with our many partners to improve river health, for the benefit of all.

Chris Weston
Chief Executive Officer

May 2024

Contents

Introduction

Our purpose is to deliver life's essential service so our customers, communities and the environment can thrive.

As the world around us changes, we can only deliver our purpose if we change too. Our ambitious vision for 2050 imagines a world where we've learnt from the past and adapted to the future so we are providing life's essential service and our customers, communities and the environment can thrive.

It starts with tackling the issues that matter most to our customers right now: providing better customer service, reducing leakage and stopping pollution incidents. And it goes beyond our core services to help us become a force for good: equipping local communities with new skills, restoring rivers and producing more green energy than ever before.

Here's what we're building up to by 2050:

For our customers

- Making sure everyone always has access to top-quality water and a reliable waste system
- Providing outstanding service and value for all our customers
- Motivating customers to save water and protect the environment

For our communities

- Using our land to benefit surrounding communities
- Equipping local communities with the skills they need to thrive
- Championing our people to deliver our purpose

For our environment

- Investing in our network to prevent leaks and keep water flowing
- Preventing all wastewater pollution and leading wider efforts to restore river health and increase biodiversity
- Producing all the green energy we can to power what we do

Leading wider efforts to restore river health and increasing biodiversity is an important part of our Vision for 2050. This plan is an important part of our journey.

We recognise that our assets are not in the condition they need to be. This will require significant investment. This, together with the right partnerships, skills and policies, will help us be a stronger company – one that's closer to our customers, better connected to our communities and ready to create the best conditions for our environment to thrive.

This plan sets out to achieve a future where Thames Water is recognised as a leading contributor to the delivery of environmental improvements, working collaboratively with our stakeholders, and where we have minimised any negative impact on the environment through the provision of our services.

We know this is an ambitious long-term goal and it is not where we are today, nor is it something that can be achieved overnight, but working towards this outcome is fundamental to almost every decision that we make in our business.

To achieve this, we will:

- Enhance the performance of our assets through optimisation, maintenance and upgrades;
- Continue developing our monitoring to strengthen early detection of performance deterioration;
- Share more of our data and information to build confidence in our approach; and
- Work with our stakeholders to deliver wholesale environmental improvement.

In April 2022, we introduced our initial River Health action plan, outlining our strategy to improve the health of our rivers within the Thames catchment. We are aiming to:

- Discharge higher quality treated effluent that meets all required standards
- Reduce storm overflows in line with government targets and reduce pollution incidents
- Work with partners to improve river water quality

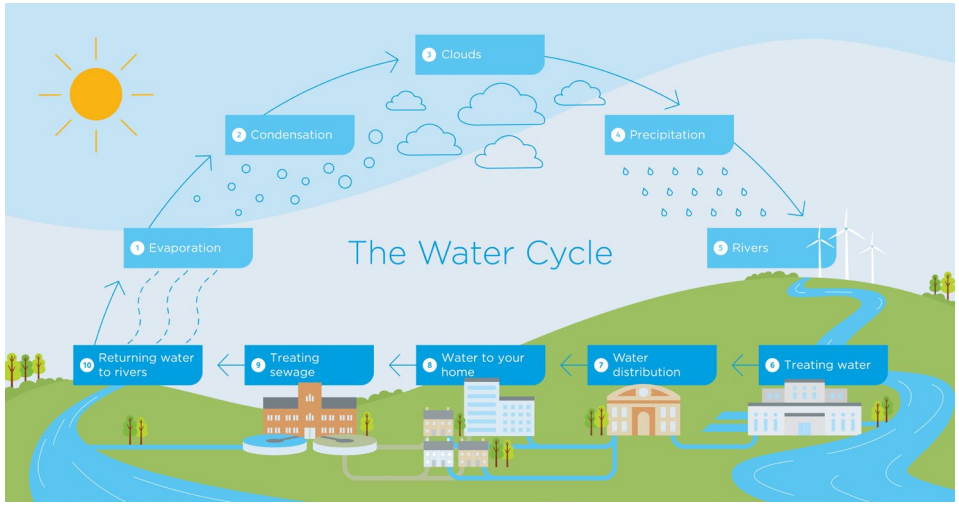
We are now providing an update on the progress we've made and our future plans to April 2025.

Background

What we do for rivers in the Thames catchment

Protecting the environment, including the responsible and sustainable use of natural resources, is fundamental to our business. As a water company, our entire operational cycle links directly to the natural environment. It's how we source water to treat and supply to customers, and we return treated wastewater back to the environment, providing flow that is needed to support the ecological health and water quality of stream and rivers. This forms part of a larger process called the water cycle.

Figure 1: The water cycle



Source: Thames Water

Sewage treatment works (STWs) are designed to treat wastewater flows directly from our customers' homes and businesses and return good-quality treated effluent to the environment. While in some cases the system is also expected to convey surface water drainage, outside London we predominantly have a separate system for rainwater which utilises the surface water sewage network; this conveys flows from customers' roofs, driveways etc to a soakaway or local watercourse.

In some areas, high volumes of unwanted surface water get into the foul sewage system, particularly when groundwater levels are high. This means that the flow arriving at the sewage treatment works can be considerably greater than the works was designed to treat. This can be caused by groundwater infiltrating into our sewers, misconnected surface water from roofs/driveways connecting into the foul network, and surface water inundation leading to additional flow into sewers through manholes. Understanding the origin of the unwanted flow is critical to the design of an appropriate solution that reduces flows to a level that can be treated effectively at the sewage works.

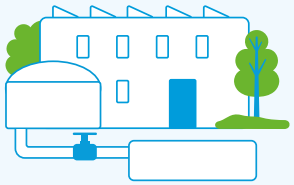
During normal weather conditions, incoming foul sewage flows go to our treatment works. Larger items are then screened out and wastewater is settled, biologically treated and often filtered before being discharged to the environment. If the incoming flow exceeds the capacity of our treatment process, excess flows are stored in a storm tank until incoming flows subside enough to allow us to return the contents of the storm tank to the treatment process. The maximum storm tank volume is defined within our permits. Once the storm tank is full, if incoming elevated flows continue, screened but untreated storm flows are discharged to the environment under permit. This mechanism is required to prevent the sewage system from backing up and flooding people's homes and businesses.

We are taking steps so that more wastewater is fully treated before being discharged into our rivers and streams and to prevent sewage escaping from our network. For instance, we have installed monitoring throughout the wastewater collection and treatment process to increase our understanding of flows and the performance of our equipment. This helps our operational employees to manage the process more effectively.

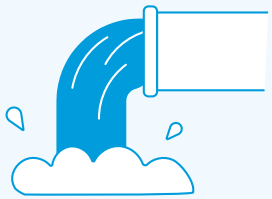
This document provides an update on the activities and commitments that we are undertaking to play our part in getting all rivers to a standard of which everyone can be proud.

Our plans comprise three different strands of activity.

Our plan for improving river health



Discharge high quality treated effluent that meets all required standards



Reduce storm overflows and polluting discharges to our rivers

Work with partners to improve river health

Figure 2: Our plan for improving river health

Discharging high quality treated effluent that meets all required standards

Treated sewage effluent is an important source of flow in many of our rivers and streams in the southeast of England, particularly in dry weather conditions, and without it many of them would run dry in the summer months.

The majority of our sites are subject to a legal permit that prescribes what and how much we're permitted to discharge to the river. We operate in a changing environment, with a population that is growing in many areas, so we continually monitor the potential need for upgrades at our STWs (which are initiated subject to funding being agreed by Ofwat). This helps us treat the incoming flow to higher standards and protect the rivers and streams where we discharge treated effluent.

We work closely with local authorities to understand their housing projections so that, where possible, sewage treatment infrastructure is upgraded, where necessary and subject to funding being agreed by Ofwat before development is completed.

Traditionally our STWs have been designed to treat wastewater and to be returned safely into our rivers. But as the population grows, the amount of wastewater that needs to be treated at our STW increases. We must meet tighter standards (typically for suspended solids, biochemical oxygen demand and ammonia) so that the increased amount of treated wastewater returning to rivers doesn't harm them.

Despite the very significant reductions in how much we discharge, addressing the level of nutrients (particularly phosphorus) in our rivers remains a key focus. Excess nutrients can cause algae to grow quickly, which shades out the plant life on which insects thrive. In the Thames catchment, phosphorus is the main problem, and a large proportion of this comes from human wastewater. There is increasing evidence to show that many products that we use in our daily lives can end up in wastewater and residual amounts can enter the environment where chemicals within them risk damage to river life. We're working with the Environment Agency, UK Water Industry Research ('UKWIR') and other water companies to investigate how effective our existing sewage treatment processes are at removing these chemicals and identify what could be done to further reduce specific chemicals from entering the environment, if needed. This includes metals dissolved from plumbing and bathroom fittings, traces of medicines excreted in human waste and fire-retardants on furnishings washed off during cleaning.

Additional information can be found here: [CIP3 Information (ukwir.org)]

In addition to the quality of the wastewater discharged, the volume of wastewater discharged is also important. Improvements to our monitoring has enhanced our understanding of the amount of flow coming into our works.

The majority of our STWs have a permit that usually specifies the minimum flow that we must treat (Flow to Full Treatment or FFT) before we can divert any excess to our storm tanks. This permit can also contain minimum storm storage requirements. Our event duration monitors (EDMs) then record the frequency and duration of any discharges from these storm tanks. To date, we have 619 storm overflows with EDMs installed. We've also fitted monitors to record when these tanks start to fill up. You can view the EDM data to the environment in real time here, as we committed to providing it for our permitted overflow locations.

Our commitments under the Water Industry National Environment Programme (WINEP)

The Water Industry National Environment Programme (WINEP) sets out the environmental investments for each five yearly period covered by our business plans. It forms an important element of our plans submited to Ofwat. Our economic regulator Ofwat tells us how much money we can recover from our customers through charges in each five yearly period. Ofwat challenges the costs associated with these investments as part of their five yearly price review process, before allowing us to recover these costs through customer bills.

Our full programme of works under WINEP for 2020 to 2025 (Table 1), includes both clean water and wastewater activities. This is a dynamic programme, reflecting changes in the list of schemes that we agree with the Environment Agency throughout our investment period.

We are facing challenges in delivering our WINEP programme in this period. This means that the completion of some schemes will be later than the deadlines we previously agreed with the Environment Agency. While we expect to complete over 85% of the total number of schemes within the programme in the period 2020 to 2025, we are now forecasting to complete the remaining schemes post AMP7 as shown in Table 2. The forecast late completion of these schemes is due to a range of pressures, including changes in scope, increased complexity of the schemes and macroeconomic conditions. Macroeconomic events have meant that the cost inflation we have experienced has far outstripped the CPIH uplift on the revenues we are able to recover from our customers in this five year period (known as AMP7). We set out more detail around the cost pressures on the programme in our draft business plan submission to Ofwat for the period 2025-2030, Completion of our AMP7 WINEP. We have also been clear in submitting our business plan for 2025-2030 to Ofwat that our ability to deliver everything set out within it, including completion of the AMP7 WINEP investments, depends on the settlement that Ofwat sets out for us after it has completed its price review process.

Table 1: WINEP environmental activities from 2020-2025

WINEP scheme type	Number of schemes (2023 report)	Number of schemes (2024 report)	Difference explanation
STW quality improvements - phosphorus	74	73	Correction to last year's reported number.
River low flow improvements and investigations	39	39	N/A
STW quality improvements - sanitary	18	17	Our River Health Plan 2023 mis-categorised 1 chemicals scheme as a sanitary scheme; these two rows have been corrected accordingly.
STW flow capacity and storm tank increases	61	61	N/A
Drinking water protection	25	26	Correction to last year's reported number.
Protected area improvements and investigations	8	8	N/A
New overflow monitors (EDMs)	237	237	N/A
STW flow monitoring and investigations	261	261	We installed a further 15 monitors in 22/23 as a result of investigations earlier in the AMP, however these are not counted in the WINEP outputs
STW quality improvement/ chemicals	12	13	Our River Health Plan 2023 mis-categorised 1 chemicals scheme as a sanitary scheme; these two rows have been corrected accordingly.
Chemical investigation programme	61	61	N/A
Biodiversity improvement actions	4	4	N/A
Slowing the spread of invasive non-native species	5	4	Correction to last year's reported number.
Stopping eels being entrained by our abstractions	3	3	N/A
Improving fish passage	1	1	N/A
Water quality investigations	19	19	N/A
Total	**827**	**827**	

Source: Our analysis of the current approved WINEP as at 23/03/23

Table 2: Progress towards completing our AMP7 WINEP obligations

This table represents our best understanding of forecast delivery at the time of publication for this report. However, many of these schemes are still in detailed design and it is highly likely that for some of them the final delivery dates will change again.

WINEP Scheme type	Workstream	2020-March 2024 (actual)[2]	April 2024-end of AMP7[3]	AMP8[4]	Impact
STW Quality improvements – phosphorus	Waste Treatment	1	7	65	Installation of new treatment processes to meet new or tighter standards for phosphorus.
River low flow improvements and investigations	Water Resources	5	21	13	Schemes and investigations to improve river flows to meet WFD (Water Framework Directive) objectives and to prevent deterioration of ecology in rivers, that are impacted by our abstractions.
STW Quality improvements – sanitary	Waste Treatment	11	2	4	Installation of new treatment processes to meet new or tighter standards for suspended solids, biochemical oxygen demand or ammoniacal nitrogen.
STW flow capacity and storm tank increases	Waste Treatment	15	22	24	Ensuring treatment capacity and storage of storm flows is sufficient to meet forecast population growth.
Drinking water protection	Water Resources	2	23	1	Investigations and catchment schemes to improve river water quality where we abstract water, to minimise the need for additional treatment on our sites.
Protected area improvements and investigations	Waste Treatment	4	1	3	Improvements to reduce phosphorus levels in rivers and lakes with special conservation status.
New overflow monitors (EDMs)	Waste Treatment	237	0	0	Monitors to record the frequency and duration of spills to storm tanks so that these are within acceptable limits. We accelerated the delivery of these monitors and have completed all EDM installations within the AMP7 WINEP.
STW flow monitoring and investigations	Waste Treatment	240	21	0	Monitors to record the quantity of incoming sewage that is receiving full treatment and investigations to assess whether existing monitors at other stages of the treatment process are adequate for assessing the flow that is receiving full treatment. We installed a further 15 monitors in 22/23 as a result of investigations earlier in the AMP.

WINEP Scheme type	Workstream	2020-March 2024 (actual)[2]	April 2024-end of AMP7[3]	AMP8[4]	Impact
STW quality improvements – chemicals	Waste Treatment	12	1	0	Installation of new treatment processes to remove certain chemicals or verification that existing processes meet required limits.
Chemical investigation programme (CIP)	Waste Treatment	56	5	0	Investigations to understand the extent of removal of certain chemicals by existing treatment processes over 5 years.
Biodiversity improvement actions	Water Resources	2	1	1	Work on priority habitat creation, restoration, species recovery to contribute to biodiversity priorities and the NERC (Natural Environment and Rural Communities) Act.
Slowing the spread of invasive non-native species (INNS)	Water Resources	3	1	0	Investigations and schemes to prevent deterioration by reducing the spread of INNS and reducing the impacts of INNS, to achieve conservation objectives.
Stopping eels being entrained by our abstractions	Water Resources	1	0	2	Schemes including investigations to improve abstractions and outfalls to prevent the entrainment of eels.
Improving fish passage	Water Resources	0	0	1	Schemes to improve abstractions and outfalls to prevent the entrainment of fish.
Water quality investigation	Waste Treatment	19	0	0	Investigations to understand the impact of specific wastewater activities on river and lake quality.
Total		**608**	**105**	**114**	

Source: Thames Water analysis of current approved WINEP as of February 2024

[2] This column indicates the number of schemes that we delivered between April 2020 and March 2024.
[3] This column indicates the number of schemes that we are forecasting to deliver between April 2024 and March 2025.
[4] This column indicates the number of schemes that we are forecasting to deliver between 2025 – 2030.

Reducing storm overflows and polluting discharges to our rivers

Wastewater discharges can be separated into the following two categories:

- Pollution incidents: When our systems fail or a third party blocks our network.
- Storm overflows: When the system operates as it was designed to do

To learn more about our assets and improved performance, we have installed monitors throughout our wastewater systems, improving processes and being more transparent with our data.

Improved monitoring of our systems and processes

We publish validated data on storm overflow operation every year. Near real-time storm discharge activity is also available from our storm discharge map. In the previous investment period (2015/20) we finished installing several new EDMs to overflows discharging into a watercourse. Under the WINEP, we need to install enough EDMs to monitor all discharges to our storm tanks by 2025, and we're on track to meet this commitment. EDMs indicate when and where a storm discharge is happening.

We have collated a list of sites where currently unpermitted Combined Sewer Outfalls (CSOs) may be present. We've also been adding additional sites whenever they're identified. For each site, we undertake an investigation to understand if the CSO is present and active. Where a CSO is confirmed, we then install an EDM monitor and complete environmental river surveys and modelling. At December 2023 we had EDMs installed at all known CSOs. Not all of the sites identified lead to an additional permitted CSO – some potentially unpermitted CSOs have dropped off the list during this process when:

- We've established that the report is false (i.e. there's no CSO in that location);
- The CSO is no longer active or doesn't meet the EA criteria for permitting, and can be sealed; and/or
- We've been able to remove the need for a CSO.

However, if we do locate a currently unpermitted storm or emergency overflow that's still in use, we seek a permit from the Environment Agency.

We're also increasing our number of sewer depth monitors up to 19,200 by the end of 2025.
These early warning systems draw our attention to any developing problems within our network or treatment works and allow us to proactively respond before the risk of a pollution or flooding incident goes up.

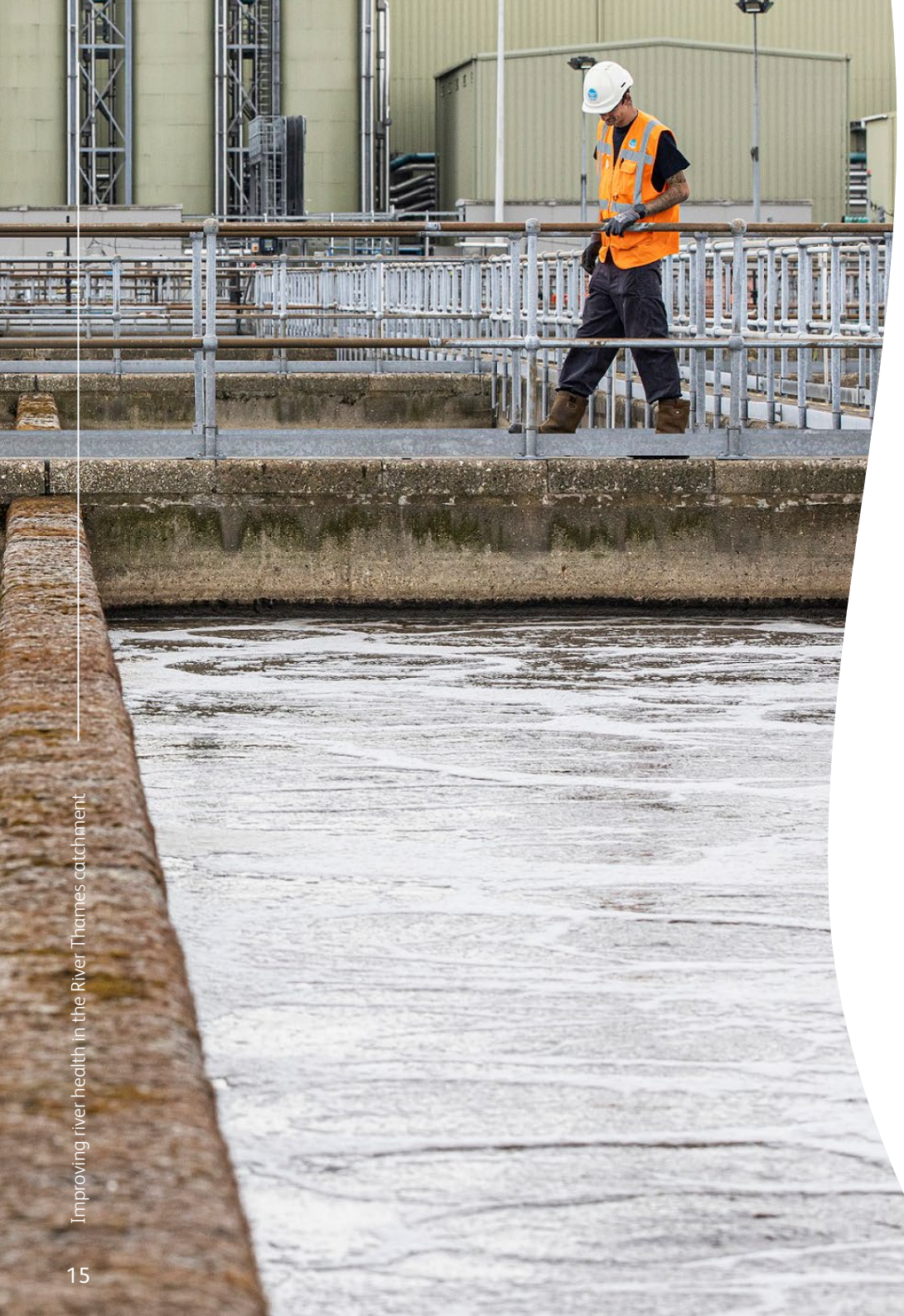
Our Wastewater Asset Assurance Programme (WAAP) seeks to reduce the risk that some of our wastewater assets may operate beyond flow permit conditions.

Preventing pollution incidents

Reducing pollution incidents from all assets remains a top priority for us. Our Pollution Incident Reduction Plan (PIRP) spearheads targeted action to reduce the number of pollution incidents over this business plan period, 2020-2025. We update this plan every year – you can find the latest version here. Incidents are classified according to their impact on the environment. And they range from category 1 (the most serious) to category 4 (no impact).

The PIRP articulates the underlying root causes of pollution incidents, and the series of actions we've developed to tackle them in a coordinated way. The document describes the most significant initiatives we are implementing to manage pollution risks. Since we published our first PIRP in 2020, we've maintained a consistent focus on three main themes across all elements of the sewage system and our treatment process.

- Prevention: Target initiatives to reduce the number of operational events that create higher risk of causing a pollution incident, typically through asset investment and changes to our ways of working.
- Mitigation: Improve our response to incidents in order to prevent and minimise any impact.
- Culture and behaviour: Educate, train and motivate employees at all levels of the organisation to identify risks to the environment and act urgently to prevent impact. Further develop and maintain a culture of openness and prioritising the best environmental outcome.



As the PIRP shows, we're working to minimise all category 1-3 pollution incidents. We have invested heavily in developing a better understanding of what is driving our pollution incidents and this gives us confidence that the initiatives we are currently delivering remain the correct focus for improving our performance. Whilst the total number of pollutions for 2023 is looking similar to the prior year (350 vs. 331), we saw a year-on-year reduction in incidents recorded from our sewer network, pumping stations, and clean water bursts; indicating that our improvement initiatives are showing early signs of delivering benefit across these asset types, with more work to do on our sewage treatment works.

The most significant cause of network pollution incidents continues to be blockages, reducing their occurrence therefore remains a core focus of our plans. Blockages occur due to items being flushed into the sewer network that it was never designed to manage, including wet wipes, fats, oils, and grease. Our focus on targeted customer engagement, enhanced sewer cleaning and proactive use of blockage alarms, is starting to deliver significant reductions in the volume of blockages identified across our sewer network, of approximately 10%. We have other targeted plans to also focus on mechanical equipment failure and human error.

Activity	Workstream	2020/24 delivered	2024/25 forecast	Impact
Digitising our network and installing blockage alarms to alert us to increasing risk of spills. Enabling us to identify and react to potential pollutions before a spill occurs.	Waste Network	19,200 installations	A further 2500 installations.	Having already delivered more than the 18.5k originally planned for this AMP we are now actively running pilots to determine the benefit of further installations. We are also keenly focused on delivering greater benefits from our existing asset base.
Preventing the incorrect disposal of products via the sewers: Marketing campaign to encourage behavioural change around the correct disposal of un-flushable items. Educating customers in hotspot areas of sewer abuse and encouraging behavioural change (could lead to enforcement). Working with food service establishments to install correct grease management. For this year, we are continuing our expansion from restaurants, pubs and cafes in to care homes, hospitals and educational facilities.	Waste Networks	4,543 compliant FSEs this AMP 13m impressions via social media platforms (Meta, LinkedIn and X)	1500 compliant food service establishments per year Continue to engage customers via various media streams.	As well as meeting and exceeding our targets for working with FSE, we have now introduced a new inspection process, revisiting establishments to assess their ongoing compliance, which has demonstrated 90% are continuing to operate to best practices.
Sewer cleaning: Managing our sewer cleaning operations differently so that our contractors are incentivised to reduce risk of sewer blockages as well as clean a fixed length of sewers.	Waste Treatment	6,166km delivered this AMP	1500km per year.	The proactive sewer cleaning programme continues to significantly reduce blockages which remains a high root cause of pollutions and we have again delivered more than our annual 1500km target. Working with our contractors, our approach to delivery is now equally focussed on addressing highest risk areas first, as it is about completing a km target.
Sewage Treatment Works improvements: Investment at the top 13 polluting sewage treatment sites which account for 34% of pollutions over an eight-year review period. Investment to enhance availability of plant and improve equipment condition.	Waste Networks	Investigations completed on the top 13, with work in flight on the top 9.	Deliver investigations into a further 13 sites and initiate prioritised delivery.	4 schemes have been deferred into AMP8 due to affordability and complexity constraints.

Activity	Workstream	2020/24 delivered	2024/25 forecast	Impact
Proactive rising main replacements: Proactively repairing or replacing the pumped mains sewers (rising mains) most at risk of bursting.	Waste Networks	9.7kms of replacement rising main delivered to the end of 23/24.	Our plans for 24/25 include the delivery of an additional 14kms meaning we will exceed our initial AMP target of 17.7kms.	We have established a new rising main working group to collaboratively solve the complex issues associated with rising main replacement. We delivered 6.2km of replacement to Mar 2024 and are on course for the delivery of several complex schemes during 2024 totalling an additional 14.2kms.
Sewage Treatment Works capacity upgrades: Increased capacity of our sewage treatment works for FFT.	Waste Treatment	19 sites	c.42 cumulative	Reduction of storm discharges through an initiative known as 'go to green' (now superseded by the WAAP). We have completed work at 19 sites by end of March 2024, with a further 23 sites to be completed by 2025 through delivery of WINEP & WAAP schemes.
Sewage Treatment Works Inlet Screens: Replacement/refurbishment of inlet screens to facilitate effective screenings removal.	Waste Treatment	Total of 253 units	21 units	Inlet screen failure compromises the treatment process and quality of effluent produced as sanitary products block our on-site equipment. This year we refurbished or replaced 52 units, taking our number over the last four years to 253 units.
Sewage pumping station asset improvement plan: Investment in sewage pumping stations to rectify power blip related faults, as well as upgrade our control systems.	Sewage Pumping Stations	50%	70% completion across our estate of over 5000 sewage pumping stations.	After initial delays in appointing an external delivery partner, we are now moving forward with our asset improvements. With 50% delivered to date, we remain focused on our target of 70% completion by the end of the AMP.
Rising Main Air Valve maintenance programme: Air valves control the flow of wastewater through the sewerage system. Failure of an air valve can lead to environmental pollution. Following a successful trial in Year 2, rolling out a new maintenance programme for air valves.	Waste Networks	Quarterly visits for high consequence rising mains completed.	Continue to inspect and maintain air valves on high consequence rising mains.	In addition to completing quarterly visits on our high consequence rising mains, we have also introduced a new inspection process for medium risk (6 monthly) and low risk (every 2 years) rising mains.

Source: Thames Water

Case study: Smart water management at Mogden

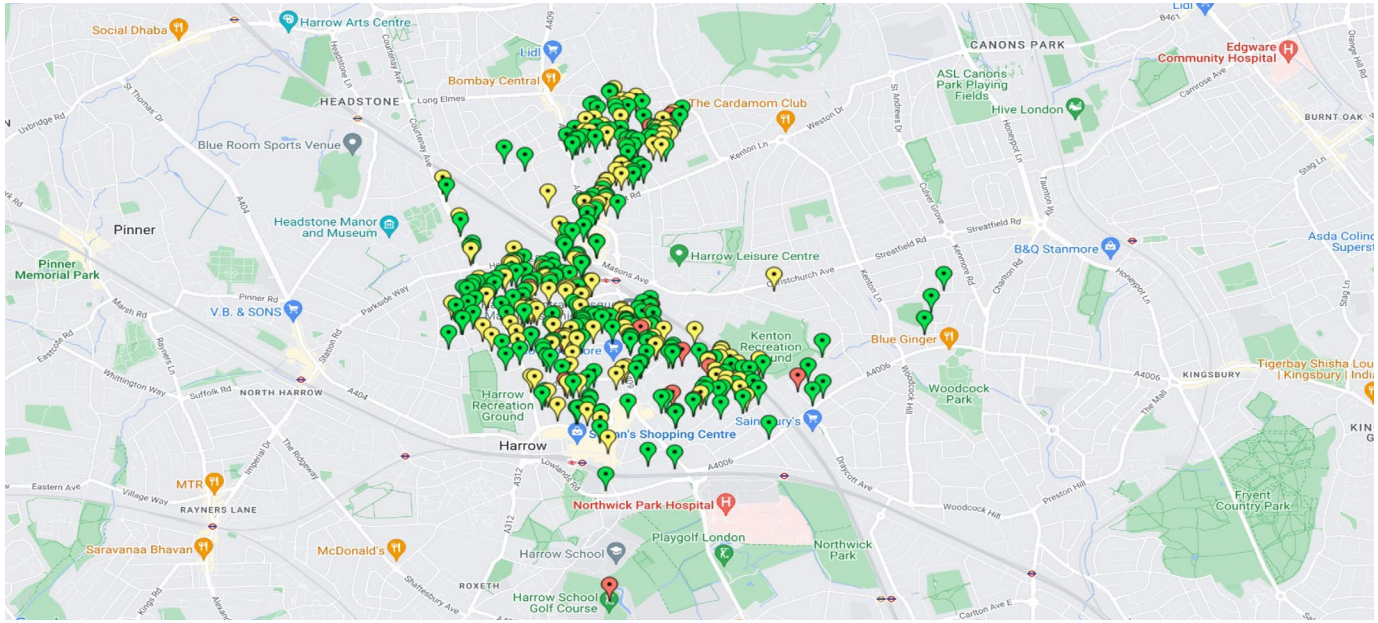
The Mogden wastewater network covers Northwest and Southwest London and treats sewage from some large key sites including Heathrow Airport, Wembley Stadium and Twickenham Stadium and is comparable to Northumbrian Water which serves approximately the same number of customers. The effluent from the works flows into the river Thames at Isleworth Ait. The area covers some important ecological sites of interest including Headstone Manor, Bentley Priory SSSI and Osterley Park.

We've been developing a new way of working in this area using smart tools to deliver a digital solution where we can combine pumping station analytics, sewer level monitor data and weather data so that we can fully understand performance. Mogden embeds all our waste functional specialisms in teams at a system level. This includes treatment, pumping and network assets. It's the showcase area for systems thinking – from our frontline operations through to investment planning and delivering capital investment.

Primarily, it's all about blending our people, our data, and our technology to deliver for our communities and the environment, getting us closer to the customers that we serve.

We have installed approximately 500 smart waste monitoring devices in a small part of the area around Wealdstone Brook. Along with other smart waste devices, they provide us with a holistic view and important data on how the network is performing. This helps us to be more proactive in our response to blockages, reducing the risk of them turning into something more serious such as pollution or a flood. It's a huge step towards being closer to our customers as we develop the ability to get out to them to clear a blockage and let them know about it before they notice an impact in their service.

Figure 3: locations of smart waste monitoring devices at Wealdstone Brook



Source: Thames Water

Reducing storm overflows

The Thames Tideway Strategic Study (TTSS), published in February 2005, set out a three phased solution to improve the Tidal length of the Thames, with mitigating actions until complete. The objective and focus of the Thames Tideway Improvement Programme (TTIP) was to reduce the number of storm overflow discharges to River Thames. We are on track to commission the Thames Tideway Tunnel. Once in operation, working together with the upgrades we have made to five of our London sewage treatment works and the Lee tunnel, commissioned in 2016, we will have reduced sewage spills into the tidal Thames by 95% in a typical year.

The three phases are:

- Phase 1: Increase the treatment capacity at 5 Sewage Treatment Works (STW) discharging into the tidal Thames with a cost of approximately £600m. These projects, enabled Beckton STW to fully treat 27 Tonnes per second.
- Phase 2: Build the 7km Lee Tunnel and intercept the largest Combined Sewer Overflow (CSO) on the river Thames system at Abbey Mills Sewage Pumping Station, with a cost of approximately £700m.
- Phase 3: Construct the 25-kilometer Thames Tideway Tunnel (TTT) and address the remaining significant Combined Sewer Overflows (CSOs) along the Tidal Thames. This phase cost around £4.5 billion for Tideway and £820 million for Thames Water. To make this happen, Thames Water collaborated with DEFRA and Ofwat to establish a new role, the 'Infrastructure Provider' (IP) in legislation. After a bidding process, Bazalgette Tunnels Ltd, also known as Tideway, was chosen to take on this role. This marks the first time since Sir Joseph Bazalgette built the original sewage system in the 1860s that anyone has been permitted to build in the tidal Thames.

During construction, the following mitigation measures have been put in place and will become obsolete at the completion of phase 3.

- 2 oxygenation vessels: These follow any oxygen sag (when the level of oxygen drops) in the river as it moves with the tide mitigating any impact of a CSO discharge.
- Fixed Hydrogen Peroxide dosing points: These are able to inject hydrogen peroxide, which delivers concentrated oxygen into the river if a pollution incident occurs.

To date phases 1 and 2 are complete. With the completion of phase 2 of the Lee tunnel, discharges into the Channelsea River have been eliminated. River water quality and fish surveys conducted in 2023 have shown that the health of Channelsea River has significantly improved.

Phases 1 and 2 cumulatively capture over 50% reduction in volume. Phase 3 will add a further volume reduction of 40% and reduce the frequency of any CSO discharges by 90% into the river Thames.

Table 4: Thames Tideway Tunnel construction phases

Phase	Scope	% volume reduction	Cost £m	When
1	Tideway STWs upgraded	50%	600	2014
2	Lee Tunnel built	50%	700	2016
3	CSO interception along River Thames from Acton to Abbey Mills	40%	4,500 and 820	2025

In the rest of our area, we've developed an initial programme for reducing the number of Storm overflow discharges, with the long term ambition of removing the need for having discharges or storm outlets, which includes removing / managing surface and/or groundwater from impacting our systems in some cases. Our ultimate aim is to keep all untreated sewage out of rivers, but this is a very ambitious goal for the long-term. In the medium term, we've committed to meet Government targets for storm overflow improvements, prioritising overflows in the most sensitive catchments.

Table 3 details our plans on our sewage treatment works. Depending on the site, the work we're doing will:

- Make the site easier to operate, ensuring we treat the required flow;
- make the treatment process more robust to variations in incoming flow, so that it consistently treats the required flow; and
- increase the capacity of the works to be able to treat more flow.

We've presented our WINEP plan to the Environment Agency for consideration, which sets out the specifics of how we'll deliver the investment to target storm discharges in our next investment period, AMP8 (2025-2030).

Keeping unwanted flows out

All sewers, whether combined or separate, will experience some 'unwanted flows', which are likely to be exacerbated by climate change and population growth in the future. This flow can take various forms and can be attributed to the following:

- Increased levels of groundwater infiltration into sewers and manholes during the winter corresponding to annual fluctuations in the groundwater table and rainfall activity (highs in groundwater levels are typically seen every three to five years, this trend may be reducing with climate change, meaning may happen more often)
- Misconnections of surface water into the foul sewage system (from patios, down pipes from roofs etc.)
- Flows from third party sources such as flood water from local rivers, or surface water from saturated fields which can enter the sewers through manholes (inundation).

An allowance for some of the types of unwanted flows mentioned above is made in the design of the system – but in some catchments, the impact can be considerable. This leads to flows backing up in the sewer system and overflows to rivers and streams during and after prolonged wet periods, typically during the winter.

Groundwater infiltration

The presence of groundwater infiltration is not necessarily an indicator that the sewer is in a poor structural state, but simply that jointing techniques used are not designed to be completely watertight. Groundwater can enter the sewer system through our own network and other publicly-owned or privately owned assets. This may occur at a defect (crack, hole or displaced joint) or on a normal joint on the sewer or at the manhole.

To test new techniques and develop a more mature tactical approach to managing unwanted flows, we've selected two catchments for an accelerated programme of work to reduce escapes/overflows to the environment. The focus in these catchments, the Chess and the upper reaches of the Windrush, is to reduce groundwater and surface water inflow (from surface water inundation) and the process of developing detailed mapping of the sewers to detect misconnections. We're using the results of these pilots to inform our plans for other river catchments post 2025. It should be noted that our approach adopts an asset management technique of Plan-Do-Check-Act, hence we have installed a network of monitors in these and other systems to help test effectiveness and measure when the desired outcomes have been achieved.

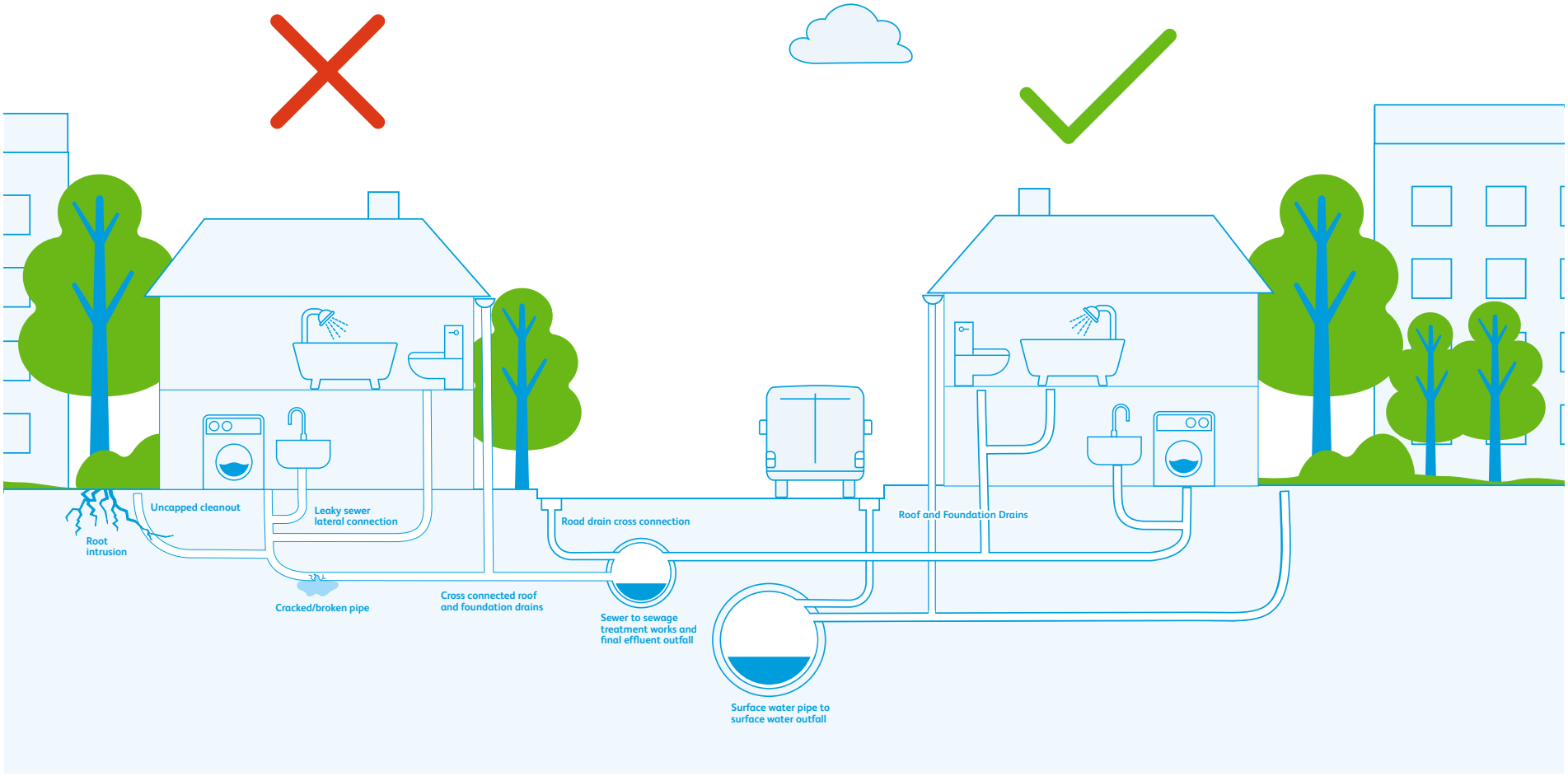


Figure 4: Potential sources of groundwater infiltration

Case study: Bourton-on-the-Water (River Windrush)

In Bourton-on-the-Water we have completed 6.47km of sewer lining targeted on those sewers with evidence of infiltration and sewers modelled to be at high risk of groundwater infiltration. This equates to 22% of the public sewer network in the system. We are at the stage of now assessing the effectiveness of this work to assess the need to do more of this type of intervention or whether we now need to focus on other forms of unwanted flow.

To partially seal the part of the system we are focused on, we have sealed 246 high risk manholes and installed leak tight covers in 127 manholes to prevent river and surface water inundation impacting the sewer network.

The drought in 2022 was followed by a relatively dry winter, preventing us from observing the benefits of the improvements made. We are currently reviewing the results from winter 2023/24, which we believe will provide a better basis for assessing the benefits of our work and whether there is need to extend into the medium risk areas.

Work is also underway to locate unmapped S105A sewers and chambers (private sewers and laterals transferred into Thames Water ownership in 2011) covering circa 1,400 properties in high groundwater risk areas and also to survey properties for misconnected roof water, yard/drive drainage to inform future activities.

Infiltration investigation

Figure 5: Infiltration gushing in around connecting pipe

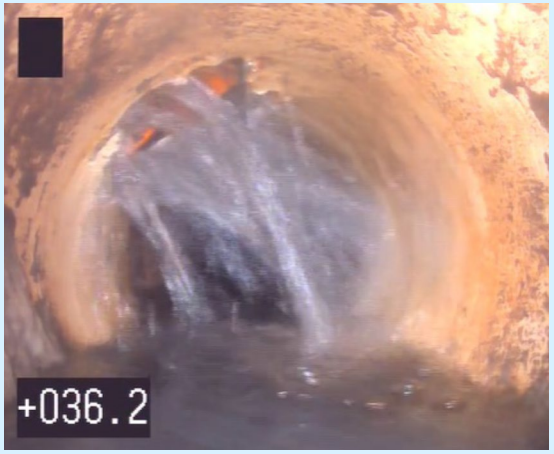


Figure 6: Infiltration gushing in around connecting pipe and past repair

[5] We regularly inspect many of our sewers to detect any obvious defects, which we look to attend as soon as practicably possible with techniques such as patch lining of the affected section of sewer.

[6] Section 105A (S105A) of The Water Act 2003 (2003) introduced a new legislation to the Water Industry Act 1991 (1991), which gave the UK government the power to require sewerage undertakers to adopt privately owned sewers and lateral drains in England and Wales.

[7] https://assets.publishing.service.gov.uk/media/5a79a82740f0b642860d9bf7/private-sewers-transfer-guidance110928.pdf

Table 5: Main Thames Water activities to reduce storm overflows

Activity	Workstream	2020-2023 (delivered)	2024-end of AMP7 (forecast)	Within AMP8	Details
Discharge reduction from the Thames Tideway Improvement Programme	Waste Networks	~50%	Thames Tideway Improvement Programme yields a reduction up to 90% of discharges per annum.	N/A	When operational, the tunnel will prevent millions of tonnes of untreated sewage, mixed with rainwater, from entering the tidal reaches of the River Thames via Combined Storm Overflows each year.
Addressing root causes of unwanted flow in the sewerage system in the Windrush and Chess catchments	Waste Networks	2 catchments			Working towards virtual elimination of overflows in the Chess and upper Windrush catchments. We are continuing to investigate the success of the projects.
STW upgrades to make the treatment process more robust	Waste Treatment	N/A	10 sites	N/A	Estimated reduction in overflows to the river
Delivery of Wastewater Assurance Programme (WAAP) to improve the ability of sites to treat incoming sewage	Waste Treatment	12 sites	32 sites	113 sites	Increased treatment capacity and resilience
Groundwater Impacted System Management Plans (GISMPs): catchment plans to remedy flows of unwanted water into sewers	Waste systems (network and treatment)	54 Plans created, implemented ~2 catchments as part of pilot above. A further two catchments (Clanfied and Hampstead Norreys) are being implemented in 2024. We are reviewing a further 15 systems which may require GISMPs.			Progressive reduction in spills both in the network and at the STWs where impacted by groundwater infiltration and/or surface water inundation.
Surface Water Outfall Programme (SWOP): identifying and resolving incorrectly connected drainage	Customer Behaviour	121 outfalls	79 outfalls	N/A	Reduction in pollution incidents in local rivers
Unpermitted combined sewer overflow (uCSO) Programme	Waste Networks	213 Potential unpermitted CSOs identified for field investigation.		N/A	Dynamic programme to identify and investigate legacy unpermitted CSOs in our network, provide EDM monitoring and apply for permits as required.

Source: Thames Water

Improving river health in the River Thames catchment

Working with partners to improve river water quality

We can only achieve and sustain good river health by working in partnership at a river catchment scale. We need to rethink the way we manage rivers to address this problem. This means being more transparent and sharing more of our data with customers, local communities and stakeholders.

Increasing transparency

Storm discharge map

We met a key commitment to improve transparency of storm discharges with the launch, at the end of 2022, of our new EDM map and Open Data API. The latter is now available for third party users to request data and transfer it directly to their own applications. Our first use of this tool has been to publish EDM data from our sewerage systems at the same time as we receive it. This is available here.

Alongside the map, we have also published information about our future plans for more than 250 sites, and details of when we expect to meet the government's new targets for each of our locations on the map. We're implementing a major programme of work to maintain and improve our STWs. This includes increasing treatment and/or storage capacity at a number of sites, including Mogden, Chesham, Witney, Bourton-on-the-Water, Dorking and many others. You can find out more on Investment plans for storm discharge sites.

All of this data will help people decide whether or not to take part in recreational activities, such as swimming in rivers. We need to be clear that discharge from our STWs is only one potential source of hazards in rivers. There are other potential hazards in rivers, including bacteria and parasites from livestock and other animals, along with pollution from farming, industry and roads. That's why we support the government's advice on open waters swimming, which can be found here.

In launching these new tools, we've become the first wastewater company to deliver on the forthcoming requirements within the new Environment Act , and this has been welcomed by our customers and stakeholders, as well as regulators. In the first year of the map being available on our website it had been viewed over 350,000 times, and we have over 4000 users connecting with the Open Data API.

Partnership Working

Working collaboratively with a broad range of partners across these sectors will deliver more of the benefits we'd all like to see. Working in this way brings the opportunity to pool resources and expertise together and deliver a more diverse range of solutions.

Of the 27 river Catchment Partnerships in our region, we're trialling a more collaborative approach in three of them, investing £9 million from 2020 to 2025. Our SWC trials in the Crane, Chess and Evenlode catchments have seen us collaboratively working in partnership to co-create and co-deliver a ten-year improvement plan. Working with several organisations, this approach has already generated millions of pounds of co-funding in these catchments to address challenges such as river water quality. You can see the progress we're making here.

For all our remaining river catchments, the Catchment Partnership Support (CaPS) fund was launched at the Rivers Trust Spring Conference in 2022. We've already disseminated £1.3 million in the first two years across the partnerships, enabling them to increase resources, reinforce the good work they do and create a line of sight to further development of collaborative working from 2025.

A good example of partnership working is addressing the challenge we face with foul drainage misconnections. When misconnected to surface water sewers, untreated foul sewage can end up in our rivers. While we're not liable for the actions of individuals and third parties using these sewers incorrectly, our comprehensive Surface Water Outfall Programme (SWOP) helps to identify the cause.

Since 2016, we've been funding the Zoological Society of London (ZSL) to run 'outfall safaris' with interested catchment partners. These safaris identify surface water outfalls serving urbanised areas with signs of pollution, with assistance from volunteers to identify and address outfalls likely polluted by misconnections and other potential pollution sources. When the risk of pollution is high, we pass these to our pollutions team for immediate action. This leading approach is now being replicated nationally.

We're pleased to have continued to work in partnership with Thames21 during 2023 to support citizen scientists with water quality sampling as part of their investigations into possible future bathing waters. We've provided support through our laboratory to analyse samples that were taken through the bathing season at both Wallingford Beach and at six locations between Reading and Henley-on-Thames. The samples were tested for sewage-related bacteria, replicating the sampling process undertaken by the Environment Agency at designated locations.

Some of our key partnership activities promoting river water quality are listed on the next page.

Table 6: Key partnership activities

Activity	Workstream	2022 (delivered)	2023 (delivered)	2024-end of AMP7	Details
Oxford Rivers Project: Partnership project to achieve designation of the River Thames at Port Meadow Oxford as the second river bathing water in UK.	Partnership working	Designation achieved in April 2022. Expansion of near-real time notification of storm discharges following our trial at six sites in the Oxford catchment. Launch of near-real time information for storm discharges at 463 permitted locations in the Thames catchment went live 3rd Jan 2023.	Early start on a WINEP investigation to better understand the impact of our assets on the bathing water	Completion of ongoing WINEP investigation. Output from the investigation will support ratification of the scope and timescale of work required to achieve regulatory outputs at Wolvercote Mill Stream, as outlined in our current PR24 plan.	River will be tested regularly for bacteria which are harmful to human health in the summer bathing season and will have signage displayed at the site. Landowners, Oxford City Council and Thames Water have a duty to improve water quality to a standard suitable for swimming in five years. We have investment in the draft PR24 plan for reducing our impact on water quality at bathing waters.
Supporting bathing water designations	Partnership working	Supported citizen scientists for their application for bathing water status at Port Meadow, Oxford	Supported citizen scientists for their application for bathing water status by providing laboratory support for water quality samples taken at Wallingford Beach and Henley-on-Thames	We will continue to work constructively with stakeholders for the existing areas applying for designation following the outcome of which we expect by Defra in Spring 2024. We will continue to work with interested community groups as new locations come forward	River will be tested regularly for bacteria which are harmful to human health in the summer bathing season.

Source: Thames Water

Activity	Workstream	2022 target	2022 delivered	2023/25 forecast	Impact
River Chess (SWC) Catchment Plan: Monitoring & analysis, including implementing Catchment & Nature Based Solutions (C&NBS). Our detailed plan is published here	Partnership working	Monitoring continued and several investigations taken place to build complete picture of river health. Optioneering and feasibility of NBS has taken place and in some cases implemented across the catchment.	Continued monitoring across the catchment. C&NBS prioritised & implemented. Review effectiveness of measures.	Continued monitoring across the catchment. C&NBS implementation continued and expanded where appropriate. Review effectiveness of measures.	Monitoring and analysis in the River Chess catchment has been well established for the last 4 years. Since the start of the SWC initiative, partners have focussed on closing the gaps in knowledge and understanding into the source of issues. The ChessWatch project, led by Queen Mary University has led the collation of this information and produced a targeted action plan on how to address these challenges. This flagship project will very much rely on both the improvement of the ecology, as well as addressing low flows in the river, to see a marked improvement in water quality.
River Evenlode (SWC) Catchment Plan: Monitoring & analysis, including implementing Catchment & Nature Based Solutions (C&NBS). Our detailed plan is published here.	Partnership working	Monitoring continued and several investigations taken place to build complete picture of river health. Optioneering and feasibility of NBS has taken place and in some cases implemented across the catchment.	Continued monitoring across the catchment. C&NBS prioritised & implemented. Review effectiveness of measures.	Continued monitoring across the catchment. C&NBS implementation continued and expanded where appropriate. Review effectiveness of measures.	Working with the EA and local stakeholder groups, this catchment is predominantly focussed on phosphorus removal and the reduction of storm overflows. We are working together to determine the most suitable options for phosphorus removal with the aim of including the schemes in our AMP8 business plan. We are also focussed on delivering community schemes which will address water quality concerns.

Source: Thames Water

Activity	Workstream	2022 target	2022 delivered	2023/25 forecast	Impact
River Crane (SWC) Catchment Plan: Monitoring & analysis, including implementing Catchment & Nature Based Solutions (C&NBS). Our detailed plan is published here.	Partnership working	Monitoring continued and several investigations taken place to build complete picture of river health. Optioneering and feasibility of NBS has taken place and in some cases implemented across the catchment.	Continued monitoring across the catchment. C&NBS prioritised & implemented. Review effectiveness of measures Continued monitoring across the catchment. C&NBS implementation continued and expanded where appropriate. Review effectiveness of measures.		Monitoring and analysis amongst partners in the River Crane catchment has been well established for the last 9 years. Since the start of the SWC initiative, partners have focussed on closing the gaps in knowledge and improving understanding into the source of issues. As such, schemes like Headstone Manor Park & Wetlands have already been implemented, in this particular pollution hotspot. We will see further information guide where C&NBS solutions are implemented to improve the water quality.
Outfall Safaris	Partnership working	Outfall Safaris on sections of six rivers (Pinn, Colne, Ingrebourne, Ravensbourne, Bracknell and Brent)	Outfall surveys on sections of eight rivers (Wandle, Shuttle/ Cray, Lower Lea, Lower Brent, and watercourses in the urban areas of Oxford, Slough, Maidenhead and Wantage)	Outfall surveys in river sections at Reading, Banbury, Swindon, Beverley Brook, Crane, River Rom/Beam, Edgware Brook	Reductions in chronic diffuse pollution in local rivers
Catchment Partnership Support (CaPS) fund	Partnership working	Funded £600k towards catchment partnerships including core host time, capacity building and technical training.	Funded £700k towards catchment partnerships including core host time, capacity building, training (both personal and technical) and competitive bids.	Plan to invest a further £700k towards catchment partnerships including core host time, capacity building, training (both personal and technical) and competitive bids.	Supporting catchment partnerships and environmental groups to better understand the issues in their catchments and formulate a catchment plan towards a solution. Co-funding opportunities. Laying the foundations working towards more ‘good’ ecological health rivers in the Thames region.

Source: Thames Water

Next steps

Everything you're reading represents a snapshot in time. We'll continue to review our plans so that we're always addressing our highest priority issues for maintaining and enhancing river water quality as well as improving our wastewater systems and the way we operate them. These plans will evolve as our understanding of the issues affecting rivers and the most effective ways to improve water quality develops.

More importantly, we'll continue working to improve river water quality caused by our activities. We can only go so far on our own – our efforts are many times more successful when delivered in partnership with others. We're extremely grateful to all those who are working with us. If you'd like to get involved, please get in touch at partnerships@thameswater.co.uk

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