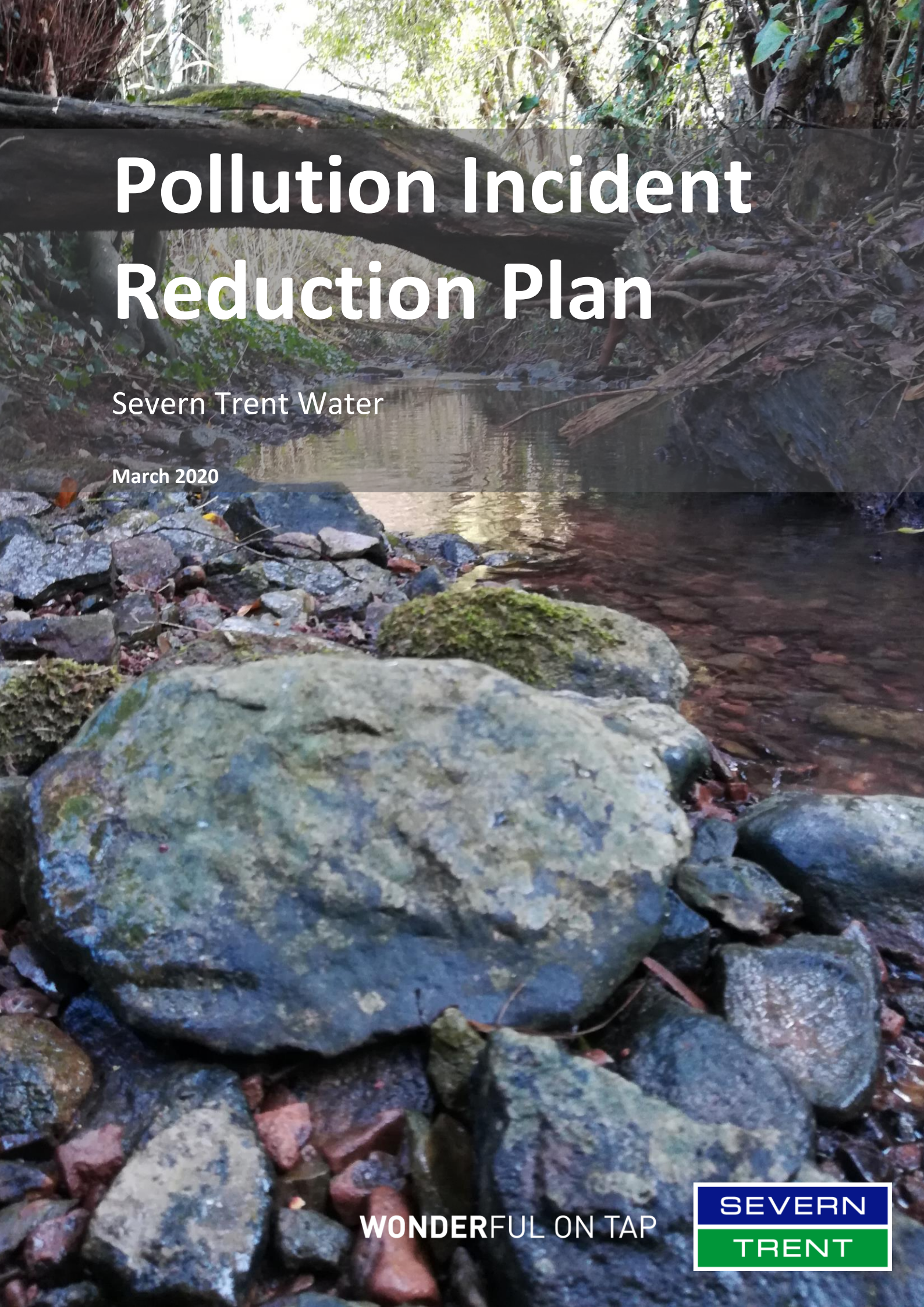


Pollution Incident Reduction Plan

Severn Trent Water

March 2020

WONDERFUL ON TAP

SEVERN TRENT

Foreword from our Chief Executive

Here at Severn Trent we understand the importance of the natural environment to our customers, communities and to our business. All across the water cycle, from the abstraction and treatment of water, to the collection, treatment and recycling of waste water back to the rivers across our region, we constantly interact with and are dependent upon the health of the natural environment.

We have a strong track record of delivering real environmental improvement. In the last five years alone we have improved 1,600km of the region's rivers by working with farmers to improve catchments, improving the quality of the water that we recycle back to environment and reducing the number of pollutions from our assets. This not only improves the biodiversity within our region but also mitigates the need for costly, energy and chemical intensive treatment processes.

We have consistently managed to limit pollutions from our operations to less than the targets set for us by Ofwat, and less than the average of companies in our sector, and we have reduced total pollutions by a third and serious pollutions by over 70% since 2011. We are also one of only a handful of companies to regularly achieve the industry's highest accolade of four star status from the Environment Agency (EA). We also have a strong record of self-reporting more pollutions to the EA than the industry average each year.

Despite a strong track record, we want to do more to mitigate the impact we have on the natural environment. We're therefore aiming to halve the number of pollutions over the next five years. This is well beyond the targets set by Ofwat in our business plan and the EA in their WISER document. We truly believe that this is the right thing to do and we know that improving the environment is something supported by our customers as well.

Most of the pollutions linked to our assets are the result of sewage escaping before it is properly treated. This is typically caused by asset failure, sewers being overwhelmed during heavy rainfall or customers putting the wrong things down the toilet or sink which blocks up the sewers. All of these challenges have the potential to result in a pollution and we recognise that every pollution can cause harm to the water environment. It's our job to manage and mitigate the challenges and risks from operating such an extensive network. Our plan is therefore based on preventing issues in the first pace and then responding quicker when they do occur.

This Pollution Incident Reduction Plan explains the actions we will be taking to address these issues and minimise the number of pollutions related to our operations. Together we can all play our part in improving the quality of the rivers in our region, the Severn, the Trent and all their tributaries. Good for nature and great for us all to enjoy.

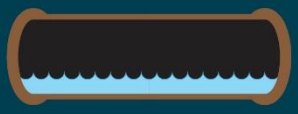
This plan has been approved by the Board of Severn Trent Water Limited. The Board are fully committed to delivery of this plan and regular performance updates will be provided to the Board on an ongoing basis.

Liv Garfield

Chief Executive

Our **Pollution Reduction Plan**

WE LOOK AFTER



Over 92,000km
of sewers

Over 1,000
sewage treatment works

4,500
sewage pumping stations

WE HAVE A STRONG TRACK RECORD ON POLLUTIONS AND PROTECTING THE ENVIRONMENT

We've improved 1,600km
of river over the last five years

We have beaten our total pollutions Ofwat target every year
for the past 5 years

£21bn invested
since 1990

We've visited **3,000 food outlets** to educate them about dealing with fats, oils and greases that create pollutions

We've reduced total pollutions by 1/3 and serious pollutions by
70% since 2011

One of the **highest performers** in the sector having achieved the Environment Agency's **highest 4 star rating** twice in the last 4 years
...and always been 3* or 4* in the last 6 years

BUT WE WANT TO DO EVEN MORE

Our ambition is to
halve pollutions by 2025

We're improving a further 2,100km
of river (1/3 of the rivers in our region) over the next five years

We're improving 5000 hectares
for nature (an area the size of Gloucester!) by 2027 to improve water quality

We're working with **63% of the farmers** in our region to reduce pesticides running into rivers

WONDERFUL ON TAP

SEVERN TRENT

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1. Glossary of terms used in this plan

Like many industries, we have lots of acronyms and technical jargon that becomes common place. We hope this list helps those of you less familiar with our industry to follow this plan.

AMP – Asset Management Period – The water industry develops plans on a five year basis. Each five year period is called an AMP, thus AMP6 covered 2015-2020 and AMP7 will cover 2020-2025.

Comm cell – an internal visual management tool used by Severn Trent.

CoP – Community of Practice – an expert group made up of Severn Trent and supplier personnel who advise on key issues and promote best practice and standards.

CSO – Combined sewer overflow – an asset on our sewer network that acts as a relief point when combined sewers are overwhelmed with rainwater allowing discharge into rivers/watercourse.

EA – Environment Agency – the environmental regulator.

EPA – Environmental Performance Assessment – an assessment framework used by the Environment Agency each year to report on environmental measures in the water sector.

GIS – Geographical Information System.

Golden measures – Critical process parameters we measure through treatment processes to ensure we meet the required quality output – and warn of any issues in time to take corrective action.

ODI – Outcome Delivery Incentives – a performance mechanism set by Ofwat which allows companies to earn rewards if they beat targets and be penalised if they fail targets.

Ofwat – Economic regulator for the water sector.

RBMP – River Basin Management Plan.

SSSI – Site of special scientific interest.

Total pollutions – the sum of Category 1, 2 and 3 pollutions.

WISER – Water Industry Strategic Environmental Requirements – the strategic steer to water companies on the environment, resilience and flood risk for business planning purposes.

WINEP – Water Industry National Environment Programme - a set of actions that the Environment Agency have requested all 20 water companies operating in England to complete between 2020 and 2025, in order to contribute towards meeting their environmental obligations.

WFD – Water Framework Directive – a legal directive that outlines the accepted standard for water bodies in England and Wales.

2. Background and context for this plan

Who we are and where we serve

We are privileged to serve over 8 million people and businesses in an area stretching across the heart of the UK, from the Bristol Channel to the Humber, and from the West to the East Midlands.

We serve a rich mix of customers of different cultures, interests and experiences. Our region includes some of the most affluent areas of the country as well as some of the most deprived. We have more urban conurbations than any other water company, yet we also serve predominantly rural counties. So while our region is home to manufacturing, space technology and teaching excellence, it's also where you'll find the National Forest... in short, it's characterised by, and draws its strength from its diversity. We provide a service for everyone, and always aim to do something more for our region than just water and wastewater services.

The Severn Trent area

6,800 km
of rivers

17,693 km²
company area

£21bn
invested since 1990

Working in, and for, the environment

We take our name from the two main rivers, the Severn and the Trent, which run through our region – two of the three biggest rivers in the UK. To us, the health of rivers represents the health of the whole landscape and the communities that they exist alongside.

From abstracting raw water to returning safely treated wastewater, everything we do is intrinsically linked to rivers and other water bodies in our region. So we work hard to play our part in protecting and improving them. That includes collaborating with stakeholders to help manage their catchments, and 40% of our workforce have volunteered time in order to clean up 40 kilometres of riverbank.

Mitigating pollutions forms an integral part of our AMP7 business plan that delivers for customers and environment

In preparation for AMP7, which covers the work we will focus on for 2020-2025, we have agreed our business plan outcomes with our regulators (commitments we will deliver for customers and how much this will cost). This plan[1] is published on our website.

We developed this plan in conjunction with our customers and with added scrutiny from the Water Forum (a challenge group comprising of key stakeholders including the Environment Agency (EA)).

£6.6bn	9	40
Expenditure on maintaining and improving service	Outcomes – we'll deliver against, to meet the needs of our customers and society	Performance commitments - against which we will deliver improvements covering service, asset health, resilience and the environment

Our AMP7 business plan focuses on nine outcomes that we've designed to meet the needs of our customers and wider society, safeguarding the natural resources we use, improving rivers and habitats and above all protecting our environment is the fundamental basis of our thinking and delivery approach.

The outcomes outline a long-term perspective and look 25 years ahead. The next five years will see real progress - driven by performance. Details of our nine outcomes are provided in our Business Plan 2020-25[1].

The nine outcomes are underpinned by 40 commitments which form the basis of how our performance will be assessed for the next five years. Of the 40 commitments, 18 (highlighted in pink in figure below) are aimed at improving the environment. Pollution reduction is a key metric within the plan and we have pledged a 23% improvement over the next five years which is set to put us in the upper quartile of the sector.

[1] https://www.stwater.co.uk/about-us/future-plan-2020-2025/your-opinions-matter/

Our 40 commitments

Service now – water

- Water supply interruptions
- Leakage
- Speed of response to visible leaks
- Persistent low pressure
- Resolution of low pressure complaints
- Water quality complaints

Service now – wastewater

- Internal sewer flooding
- External sewer flooding
- Public sewer flooding

Service now – retail

- Reduce residential void properties
- Reduce residential gap sites
- Reduce business void & gap site supply points
- Customer measure of experience
- Developer services measure of experience

Resilience

- Risk of sewer flooding in a storm
- Collaborative flood resilience
- Risk of severe restrictions in a drought
- Resilient supplies
- Increasing water supply capacity

Asset health

- Treatment works compliance
- Sewer collapses
- Sewer blockages
- Mains bursts
- Unplanned outage
- Water quality compliance (CRI)

Community

- Help to pay when you need it
- Supporting our Priority Service customers during an incident
- Protecting our schools from lead
- Value for money
- Inspiring our customers to use water wisely

Environment

- Improvements in WFD criteria
- Biodiversity (water)
- Biodiversity (waste)
- Satisfactory sludge use and disposal
- Pollution incidents (Cat 1 -3)
- Per capita consumption (PCC)
- Abstraction Incentive Mechanism (AIM)
- Farming for Water
- Number of water meters installed
- Green communities

3. What are pollutions and how do they occur?

A pollution is the introduction of a substance that has a harmful impact on the environment.

Different types of pollution incidents and environmental measures

Based on guidance from the EA, all incidents are categorised based on their impact. A Category 1 incident has a serious, extensive or persistent impact on the environment, people or property and may, for example, result in a large number of fish deaths. Category 2 incidents have a lesser yet significant impact. Given the scale of impact from a Category 1 and 2 pollution incidents, our mind-set and ambition are focussed on ensuring we have no serious pollutions.

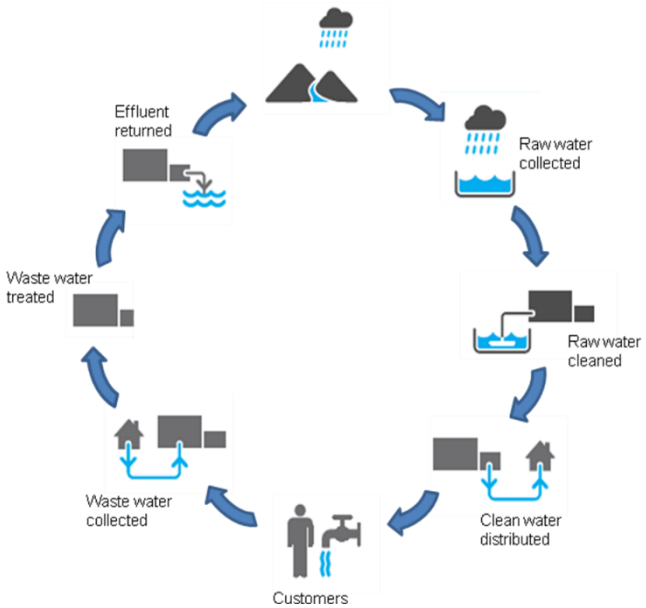
The majority of pollution incidents we are responsible for fall within Categories 3 and 4. Category 3 incidents have a minor or minimal impact on the environment, people and/or property with only a limited or localised effect on water quality and Category 4 incidents are those where there is no impact but a discharge has occurred.

'Category 1-3 pollutions' and 'serious pollutions' are also two key measures within the basket of six metrics that form part of annual Environmental Performance Assessment (EPA) that the EA undertakes across the sector. This assessment forms the basis by which the EA undertakes horizontal comparison across the industry, recognising industry leading performance on the environment and addressing poorer performance.

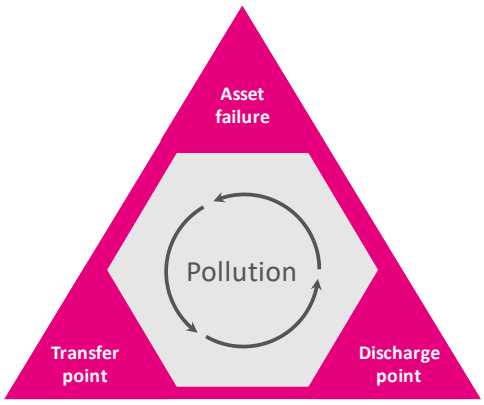
How are pollutions caused?

A pollution can be caused when any polluting matter (such as sewage or silt) enters a watercourse. We operate a large network of sewers that takes wastewater from homes and businesses and transports it to treatment works where it is cleaned and returned to the environment. A failure in our sewer network or at our treatment works could allow sewage to escape and cause a pollution to a watercourse.

We also operate a large network of water mains to distribute drinking water. If a water main bursts it can result in a pollution if it results in sediment being washed into a watercourse.



We undertake a detailed assessment on each pollution incident, focussed on three key aspects:



- **which asset** has failed and why
- **the transfer point** – the route the wastewater takes from an asset to the discharge point and
- **the discharge point** – the point where wastewater has escaped into the environment

To understand the root cause of a pollution incident we must trace the pollution back from the discharge point to the asset that has failed and the route by which the pollution material has reached the watercourse. This understanding helps us take action to stop similar incidents happening in the future.

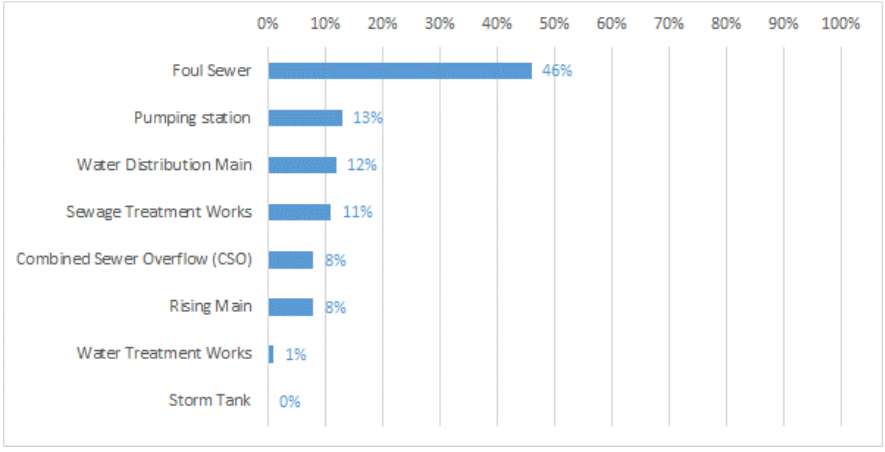
Our pollution response crews have standard operating guidelines and training which provide guidance on the process to follow when a pollution incident has been reported. This includes:

- A - attend pollution site within 2 hours and assess the site
- C - communicate with the EA, escalate to senior staff and the Severn Trent control room
- T – take photographs and samples for analysis
- I – investigate the site thoroughly and stop the pollution
- O – Ownership – own the incident
- N - Never assume, deal in facts

Following the site visit we put together a storyboard which captures the results of our investigation. The storyboards are used to share any lessons learnt and provide evidence of the impact on the environment and the mitigating actions we have taken.

This plan is underpinned by applying this rigour to understand the asset type and root cause that has resulted in a pollution. Our data tells us that 46% of our pollutions come from our sewers and the root cause of the majority of these are from blockages (caused by things such as fats, oils and greases (FOG) and non-flushable items, such as wet wipes). As such a big part of our plan focuses on how we prevent or proactively find these blockages before a discharge of wastewater can occur.

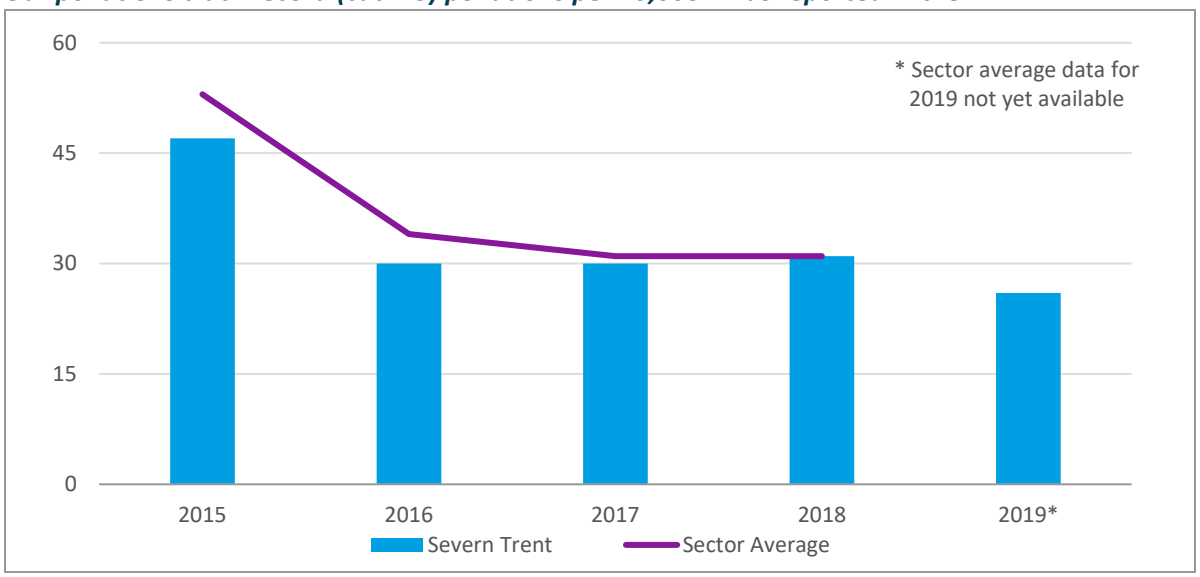
Percentage of pollutions by source asset type



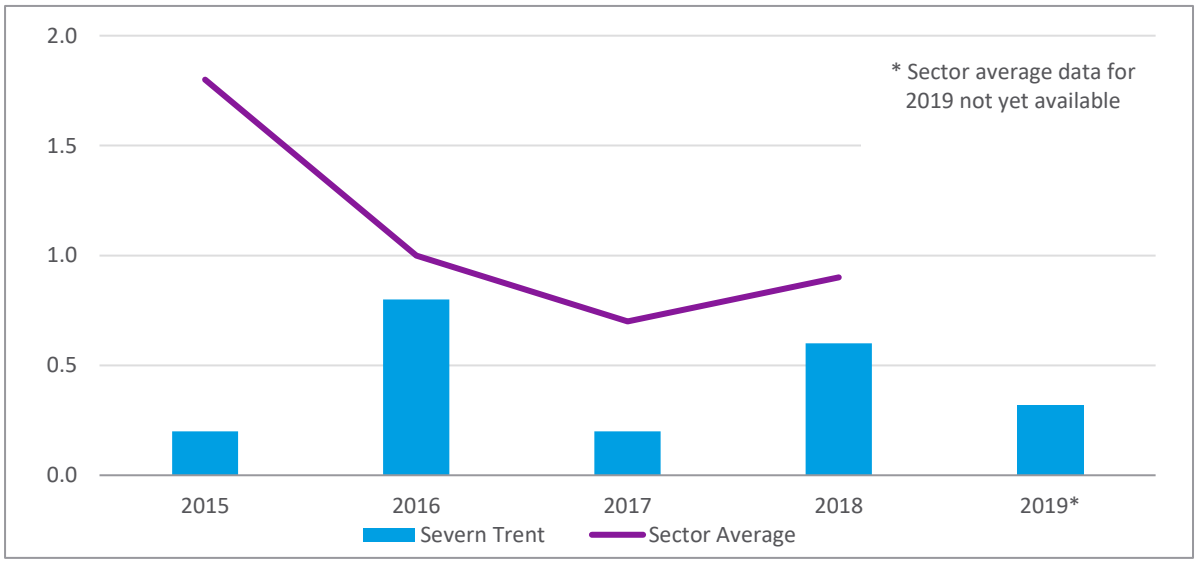
4. Our track record on pollutions

We have consistently performed better than the industry average on total pollutions and serious pollutions, and demonstrated sustained improvement over the past ten years. This helped us achieve 'industry leading' EPA 4-star status as assessed by the Environment Agency in 2013, 2015 and 2017, which we are extremely proud of, and in all other years we have been 3-star 'good' status. We are on track for EPA four star status again in 2019.

Our pollutions track record (cat 1-3) pollutions per 10,000km as reported in the EPA



Our serious pollutions track record (cat 1-2) pollutions per 10.000km as reported in the EPA



In addition to total pollutions performance, we have a strong track record of self-reporting pollutions, a higher proportion than most other companies and above the target set by the EA (as outlined in the table below). Self-reporting is a measure of a company's integrity in spotting issues and telling the EA about them before the EA become aware through other means. This was achieved through significant staff training on following process alongside an overall cultural change in the organisation.

Percentage of self-reported incidents

	Self-reported incidents against 2015-19 EPA (%)				
	2015	2016	2017	2018	2019
Severn Trent	77	79	80	79	78
Sector average	69	72	76	76	-
EPA Target (green threshold)	75	75	75	75	75

What did we learn through this improvement journey?

Through our improvement journey, we have focussed heavily on improving the rigour in understanding root causes, asset maintenance, people skills and training and trialling new approaches, learning at every step. This learning has shaped our proposed approach to delivering our 50% reduction ambition.

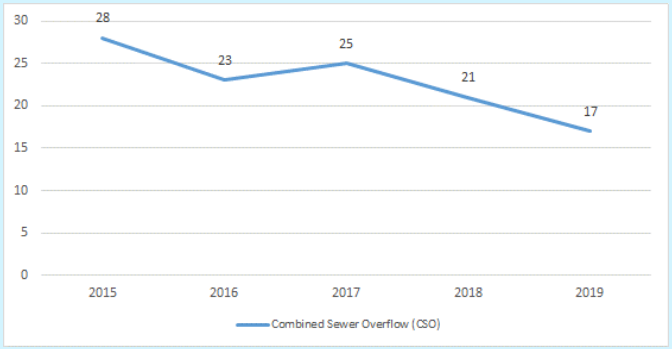
What we have learnt on each asset class

Source asset	Best performance	What worked?
Sewers	125	Proactive hotspot cleansing and repairs
Sewage treatment works	26	Strict compliance to golden measures
Pumping stations (excludes transferred assets)	25	Zero assets out focus
Rising mains	18	Proactive monitoring and maintenance
Combined sewer overflows	17	Installing smart monitors and ensuring effective response to alarms
Storm tanks	0	Improved storm tank emptying
Water treatment works	0	Strong adherence to procedures
Water distribution	9	Pollution response support and training from wastewater teams

Case study – how we have reduced our pollutions from CSOs using smart monitors

We have installed around 2,300 Event Duration Monitors (EDM) at Combined Sewer Overflows (CSOs). These monitors give us the ability to report the number of spills from a CSO as well as giving us the ability to analyses changes in depth and/or flow in the sewer so we identify potential problems as they are forming and react before a pollution is caused. The data from these monitors is tracked by our Control Centre and operational teams are ready to react proactively to any reports of a potential issue. This has helped us to significantly reduce pollution incidents from CSOs over recent years.

Annual trend Cat 1-3 pollutions from Combined Sewer Overflows (CSOs)



5. Our ambition to halve pollutions

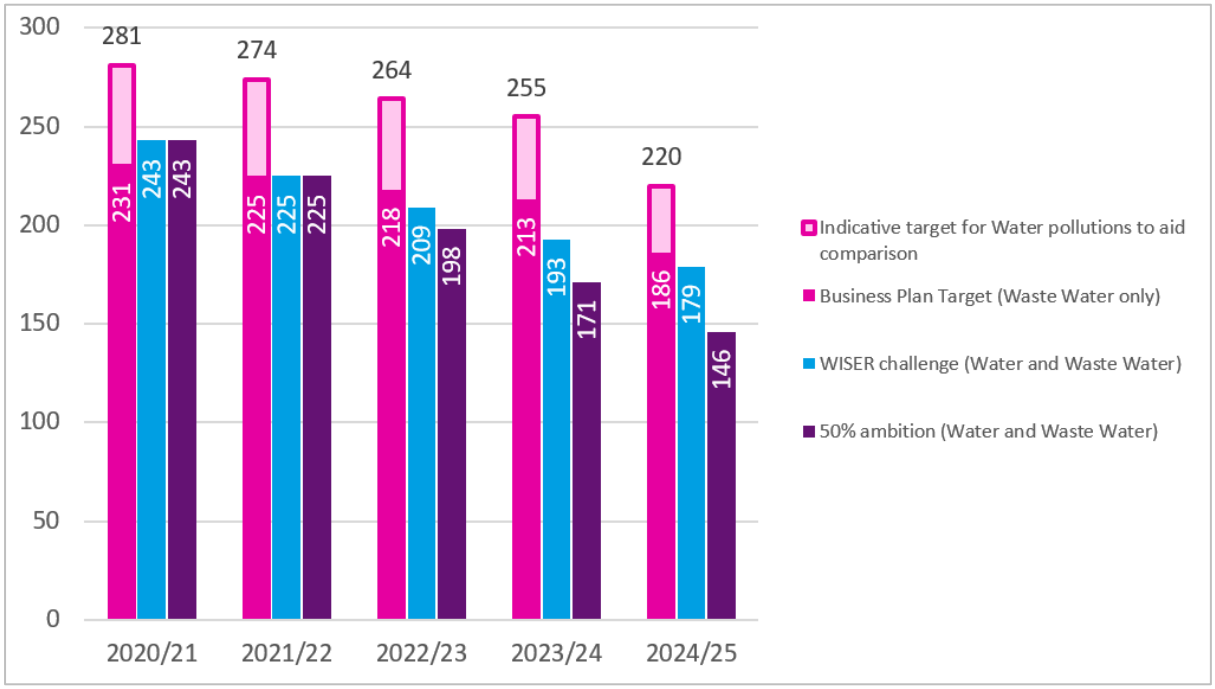
Our mindset on pollutions starts from the position that we are aiming to stop them from happening at all – especially the ones which have the most serious impact. However, given the challenges of operating a diverse and complex network, with many issues that are often out of our control, we are setting an ambition for the next five years to halve pollutions. We are stretching ourselves beyond the water industry sector target set by Ofwat and the 40% reduction target set by the Environment Agency in WISER.

Our ambition for the next five years

Source	Target (% reduction by 2025)	Comments
50% ambition	50% (from 2019)	Our ambition to challenge ourselves to go beyond the targets already set and halve pollutions by 2025. We have included both Waste and Water pollutions in our ambition.
EA WISER challenge	40% (from 2016)	A challenge to the sector for each company to reduce by 40% from their 2016 performance. We have applied this challenge to both Waste and Water pollutions.
Our AMP7 Business Plan Target	23% (from 2019)	Set by Ofwat based on forecast upper quartile performance for our sector. This measure only includes Waste pollutions. For ease of comparison we have shown an indicative allowance for Water pollutions in the graph below.

The glide-path we propose to adopt over the next five years aligns with the targets committed to in our Business Plan and shows what it would take to achieve our ambition to meet the WISER challenge and go beyond this to halve our pollutions by 2025.

The glide-paths we are targeting



Case study - Is 50% reduction by 2025 a challenging target for pollutions?

To halve pollutions by 2025 means we will have to:

- Achieve our best ever performance in every asset class in the same year, a performance level that we have not delivered thus far
- And then deliver a further improvement of 35% to halve pollutions by 2025

Source asset	Typical performance	Best performance
Foul sewer	140	125
Sewage treatment works	34	26
Pumping station (excludes transferred asset)	41	25
Rising main	26	18
Combined sewer overflow	23	17
Storm tanks	1	0
Water treatment	4	0
Water distribution	36	9

Wastewater best ever Cat 1-3 = 211 (+ 6 transferred pumping stations) = 217
Water best ever = 9

At the time of publishing this plan we are all having to adapt to the challenges thrown up by Covid-19, which is changing how we operate and work with customers, in accordance with the latest Government guidelines. There may be implications to our plan but we are seeking to limit these to where;

- the impact of the situation has a direct and obvious impact on our ability to deliver our performance commitments; and,
- it would be counter to our customers' or society's interest, or government advice to try and mitigate the impact.

The most obvious example would be per capita consumption (PCC) where the clear advice around hygiene and washing hands appears to having an impact by increasing use of water by a few litres per head per day – and where we should clearly not seek to send any counter messages. In addition to this, we believe blockages (which directly affect the number of pollutions) may also increase as customer education is key to driving improvements and customers may be using even more wet wipes or other products given the shortage of toilet rolls at times.

We will work closely with the Environment Agency through this time and keep them informed on potential impacts to performance.

6. Our pollution improvement plan for 2020-2025

Our 'on POLE' improvement strategy

We have the ambition of being in 'pole position' as one of the best performers in our sector. To deliver this we have set out our 'on POLE' (Prevent, Operate, Learn, Engage) improvement strategy. Our strategy builds on our past learning and best practice to help us focus on targeted interventions and investment on the assets that pose the greatest risk.

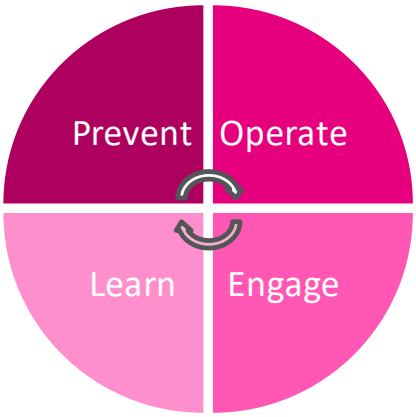
'On POLE' improvement strategy

Prevent failures

- Targeted capital investment
- Zero assets out approach
- Maintenance and cleaning plans
- Contingency plans
- Extreme weather plans
- Use of predictive data

Operational readiness and response

- Response plans and measures
- Reactive tankering and support
- Key spares holding
- Telemetry and monitoring
- Greater operational accountability



Learn and continuously improve

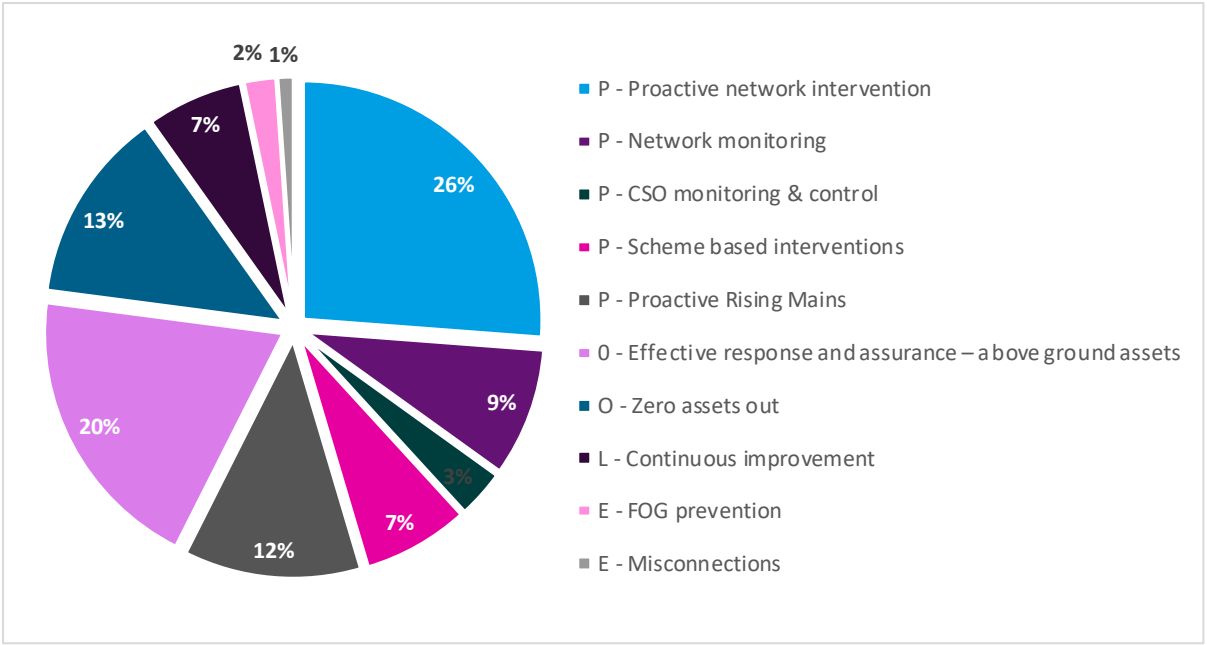
- Forensic root cause analysis
- Improve cycle time for incident review
- Develop and adopt innovation
- Ensure we are aware of best practice
- Demonstrate continuous improvement

Engage with third parties

- Strategic stakeholder engagement plans
- Targeted awareness campaigns
- Work with the sector, retailers and manufacturers to establish and enforce standards for flushable products
- Educate, engage and enforce on FOG

Additionally the strategy is underpinned by a strong ethos of continuous learning and engagement with third parties as our journey on environmental leadership has highlighted that these cultural and engagement principles (internally and in wider society) are core to sustaining improvements. At an asset level through our 'POLE' approach we will target a series of programmes focussed on delivering a 50% reduction in pollution incidents from our 2019 performance to achieve our ambition. We've outlined in the pie chart below how this breaks down for year one of AMP7. We will keep the benefit profile under-review through AMP7 as we track benefits delivered and optimise the interventions.

Delivering our 50% ambition – benefits by programme



The table below shows the links between the programme and the source asset being targeted. The benefits are indicative and represent the potential benefit we hope to deliver from each intervention. As we undertake further feasibility and work on site we will learn and understand more on the level of benefits. Thus the programmes represent our pipeline of activities that we will target for AMP7 and based on the benefits delivered, we may choose to alter the priority and focus on a certain activity. The percentage of pollution reduction is based on year one of AMP7. A good example is that we have only included a modest pollution benefit from FOG reduction. In the short-term the benefit is attributed to the proactive sewer cleansing work as we will have to keep removing non-flushables and FOG from the sewers until such point that they stop being tipped down them. Over time we hope that the changes to flushable standards, widespread use of fat traps and increased care over what is flushed down sewers can deliver more pollution benefit and we will have to invest less on cleansing sewers.

Programme	Asset	% Benefit
P – Proactive Network intervention	Foul sewer	26%
P – Network monitoring	Foul sewer	9%
P – CSO monitoring and control	Foul sewer	3%
P – Scheme based interventions	All assets	7%
P – Proactive rising mains	Rising Mains	12%
O- Effective response and assurance	Sewage treatment works	20%
O – Zero assets out	Pumping stations	13%
L – Continuous improvement	People/Asset focus	7%
E- FOG prevention	People/Asset focus	2%
E- Misconnections	People/Asset focus	1%

Serious pollutions

The initiatives set out above will work for all pollutions. However, we recognise that serious pollutions require a specific focus to consistently stop these incidents that have a greater environmental impact. We can split the serious pollution focus into two broad areas; Prevent and Respond.

Prevent:

- Focus on most sensitive environmental sites near our assets (e.g. SSSIs) to refine risk assessments and prioritisation on interventions.
- Proactive asset health plans for high risk assets and locations.
- Enhanced build standards for assets in sensitive locations.
- Installation of more monitors (e.g. asset condition, pollutants or operational performance) to detect changes in performance prior to catastrophic failures.

Respond:

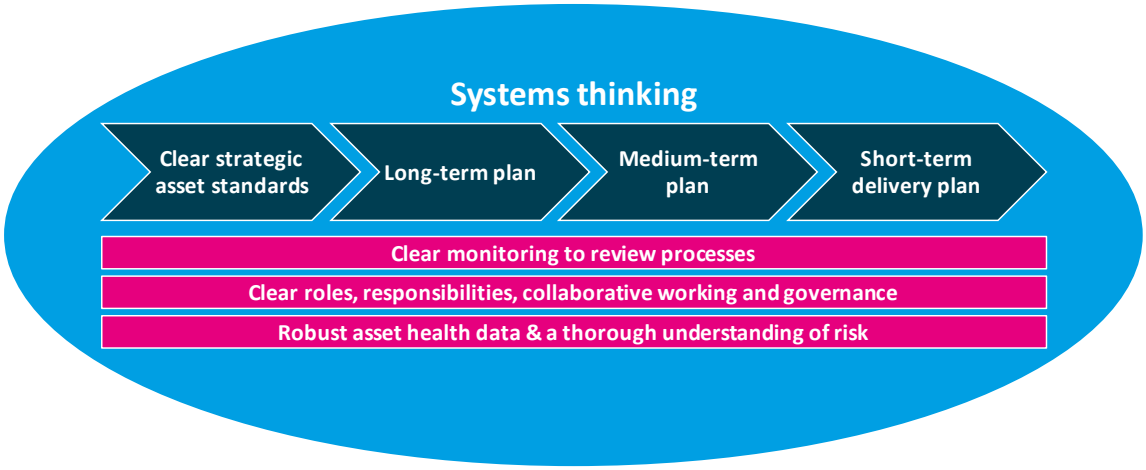
- Reduced numbers of repeat blockages on the sewer network and heightened response for any incidents within a set distance of a watercourse.
- Enhancing our end-to-end alarm handling.
- Improved emergency response – exploring insource of emergency tankering, over pumping and large rising main burst capability (>300mm).

Using robust processes to identify interventions

We have a robust Asset Management Framework built on principles of Overall Equipment Effectiveness, a concept widely used in manufacturing which underpins the process we use to identify suitable interventions. This allows us to ensure that we focus strongly on ensuring our assets are both available and operate effectively, limiting failures and creating a calm operating system.

We have outlined the key focus areas that form the building blocks of the Asset Management Framework below.

Systems thinking



In our day to day world, the framework outlines the processes and governance we will follow to identify, select, implement, deliver and monitor multiple interventions through various teams across Severn Trent.

In working through each asset class activity and associated programme, we have sought to apply:

- Cost benefit analysis and learning from past performance
- A gated delivery process which allows us to be agile and learn as we deliver the improvements – this can lead to a shift in our investment approach over time. We expect to update this section over time should these reviews indicate a material shift in our investment approach.

Case study – how we value the marginal benefit of interventions

We don't just apply a standard value for the reduction of a pollution incident, we consider the potential severity of that incident, the lasting impact that it could have on the environment and the statistical likelihood of how often it might occur.

We then use a matrix to convert the risk of pollution (expressed in terms of both consequence and likelihood) into a monetary value based on the amount our customers have told us they are willing to pay for pollution reduction and the risk of prosecution and fines. The end result is what we know as an Equivalent Pollution Index (EPI) value.

Our approach allows us to consistently compare benefits across different projects and programmes of work. For example we can easily compare a project that is solving a pollution risk with one that is solving flooding risk (which has an Equivalent Flooding Index (EFI) value) so we can make sure we are making optimal investment decisions.

Asset class led interventions (prevent and operate)

We are focussed on understanding failure by asset class and linking these to the improvement programmes that will enable us to deliver our 50% pollution reduction ambition by 2025. Each asset class requires bespoke interventions and technical expertise from our people to manage and operate them. Therefore having an asset class focus allows us to develop expertise on specific assets, ensuring that assets are available, maintained and operated so that they work as they should and are there when they are needed.

Our improvement activity is structured around specific asset types, with ambition set to achieve our best ever performance for each asset class. We have provided details in the following sections on each of the key asset class interventions that are shaping our thinking for AMP7.

Underpinning all of our interventions is a continued focus on maintaining and improving the health of our assets through specific projects (Referred to as 'Scheme based interventions' in our plan). These projects cut across all the different asset classes and generally involve the replacement or refurbishment of structural assets (such as sewers, rising mains or tanks) or mechanical and electrical assets (such as pumps or control systems). The delivery of these projects will address emerging pollution risks and should contribute around 7% of the benefits in our improvement strategy.

Foul network

This is the most challenging asset class to improve. At Severn Trent our network of sewers is over 92,000km in length and given its underground position it is essentially an invisible asset. The value of this asset class is costed at £56bn (which is what it would cost us to replace the entire asset base alongside significant disruption to customers) which is indicative of the scale of investment that would be required to make large scale upgrades to the sewers.

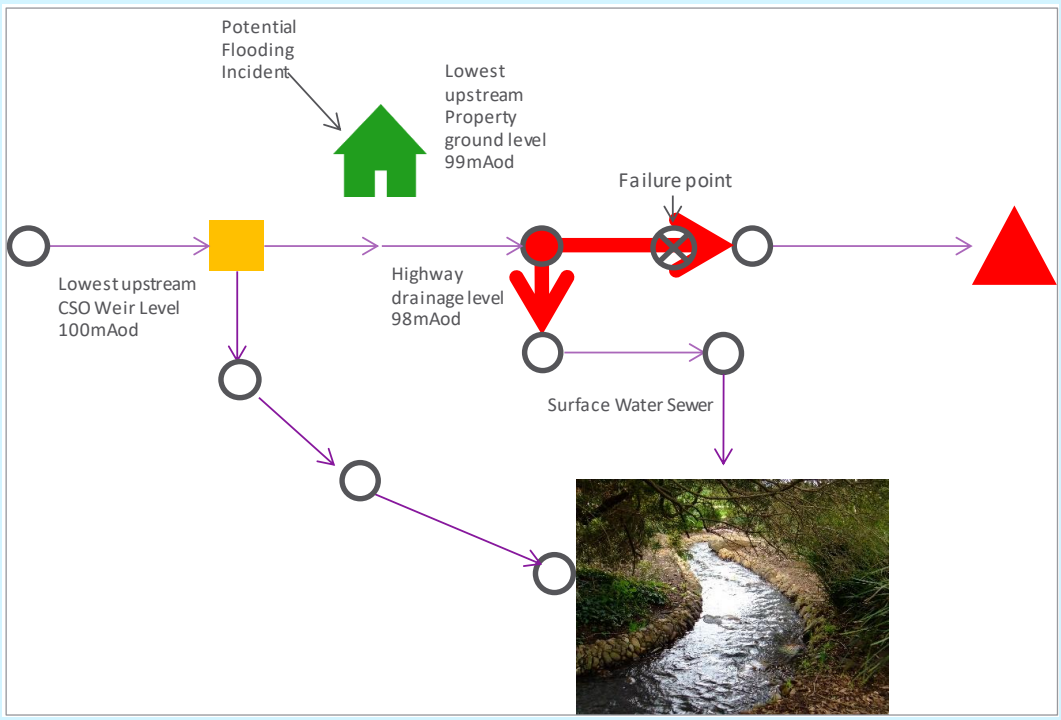
Our interventions are therefore focussed on maintaining the asset (proactive network intervention before failure occurs), improving visibility (network monitoring programme) to allow us to respond effectively when failure occurs and working with customers to stop disposal of non–flushable items and fats, oils and grease (FOG) down the sewer system and stop misconnections where foul household pipes are incorrectly connected into a storm water pipe that is designed only to carry rain water.

Our data indicates that blockages in foul sewers can cause pollutions. To address this we have traditionally used a proactive programmes to good effect to target known troublesome blockage and pollution hotspots. This involves inspecting, cleansing and repairing specific sections of the sewer network before failures occur. This programme should contribute around 26% towards our pollution reduction ambition by 2025.

Case study – proactive network interventions (pollution improvement plan)

100% of our catchments are covered by "live" hydraulic models which mimic how sewage & rainwater flows through our foul and combined networks. To assess which pipes we should clean, repair and monitor, we introduce a blockage on every pipe in the model and then assess the discharge point via which a pollution can occur. We then use the ground topography to understand the flow route.

As a result, we build an understanding of the chances and location of where a pollution could occur. We then assess the impact on the watercourse by using factors such as river flow and sensitivity. This work has identified over 600,000 potential points of escape from our network that could result in a pollution and around 28,000km of sewer, that if blocked or collapsed, could cause a pollution via one of these escape points.



Based on the chance of a blockage occurring, and its potential consequence, we rank our pipes based on risk and ensure we cleanse, repair and monitor high risk pipes.

In addition to proactive network interventions, we are also proposing a dedicated network monitoring programme for AMP7 which should contribute c9% of the reduction in pollutions by 2025. We are currently undertaking trials to test monitoring solutions which will enable us to have more eyes and ears on our sewer network through our control centres. This will require us to source cost effective monitors to allow for sufficient coverage to make this activity cost effective. Trials are underway with multiple suppliers. Different sensor technologies are being tested for reliability, accuracy, low power usage and sturdiness. The challenge is to reduce monitor costs by 75% through innovation and value engineering to allow for widespread application. To date in AMP6 we have installed over 1,000 network monitors, mostly targeted at preventing pollutions, which has built our learning.

Sewage treatment works

We have over 1000 treatment works in our region. In addition to pollutions performance, there are additional environmental parameters that we are also required to deliver such as compliance with our treatment works permits and fulfil our Water Framework Directive (WFD) obligations as outlined within the Water Industry National Environment Programme (WINEP), an environmental improvement programme overseen by the Environment Agency.

Through work on our sewage treatment works we propose to deliver around 20% of the pollutions reduction needed to achieve our ambition by 2025 via the 'effective response' and 'zero assets out' programmes.

Our investment is focussed on wide scale WFD and capital maintenance interventions. Our WFD interventions are targeted on treatment works discharges as agreed in conjunction with the Environment Agency, primarily to reduce levels of phosphate in the receiving watercourses. Some of the new consent limits for our phosphorus discharges will be as low as 0.2mg/l, compared to previous

low limits of 1mg/l. This step change in effluent performance has driven innovation and new technology trials in order for the new permits to be met. On capital maintenance we prioritise investments based on pollution risk, treatment works effluent quality and flow compliance.

Case study – phosphorous innovation to meet wider environmental compliance on discharge standards

We have invested £4m in trials in Packington sewage treatment works to trial an innovative phosphorous removal technology. The Packington demonstration trial complemented the national low phosphorus trial that followed a couple of years later. The fact we started early allowed us to implement innovative solutions in AMP6 and hence realise the benefits sooner.

For example, the magnetite ballasted coagulation process combines a coagulant, a magnetite ballast and a polymer to produce a weighted precipitate that settles very quickly and effectively. The trial was successful and showed the potential for delivering very low phosphorus levels.

As a result, we are already installing the process at Finham sewage treatment works in Coventry, one of our largest sewage works, to achieve a very tight phosphorus limit of 0.22mg/ while saving £8.7 million in capex on this one scheme alone.

We are planning to invest in further schemes across our estate in the next five years.

In addition to capital projects, we are also driving improvements through the line as governed by our Environmental Compliance community of practice (CoP). This collaborative group consists of subject matter expects and key stakeholders from multiple departments within Severn Trent who will be working together to:

- ensure our processes and procedures are fit for purpose,
- mitigate our key performance risks
- drive continuous improvements from any failures and embed lessons learnt to avoid repeats.

The CoP effectively drives the ‘zero pollutions’ and ‘no failing works mindset’ that we need to have embedded across all our operational teams.

A good example of the impact the CoP has had is a renewed focus on tactical risk management of vulnerable sites. Bespoke care plans were drawn up for 61 treatment works that were considered most at risk of failure against their numeric consent (this accounted for around 6% of our asset base). As a result of the heightened level of focus and asset improvements on site, none of these sites are at failing status in 2019 and the list of sites subject greater oversight from our teams has now been reduced to 28 works.

We have also created a new Assurance Manager role accountable for driving second and third line assurance against our frontline processes and procedures. We have shown an increase in adherence to our golden measures procedures since this role was introduced. These are the key measuring points in treatment process that give an indication of how healthy the works is. If a golden measure suggests that things are going off track, this creates an action or escalation to avoid a consent failure. This approach has brought success over the last 16 months without a single failing works attributed to a repeated 'look-up table' breach which is testament to our improving controls.

Our 2019 improvement plan resulted in a significant improvement in treatment works compliance from 10 failing works in 2018 to just 1 failing in 2019 (giving 99.86% compliance). The failing works in 2019 was due to an upper tier failure on aluminium following a chemical dosing set point error and a faulty monitor. A detailed root cause analysis has been completed and lessons shared to avoid a repeat event across 18 similar installations.

The plan has also delivered an improvement on polluting discharges from our treatment works, seeing numbers reduce to 27 in 2019 from 55 in 2018. Further reductions in works pollutions is a key focus area for the Environmental Compliance Community of Practice in 2020, with the root cause data from previous events being used to inform the improvement plan.

Overall, our environmental performance in 2019 puts us on the required run rate for AMP7.

Pumping stations

We have 4,539 sewage pumping stations in our region and work on pumping stations should contribute around 13% towards our pollution reduction ambition by 2025.

Our investment plan will focus on replacement and maintenance of pumps, installation of flow monitors to increase our visibility of site performance and enhancement of telemetry to aid operational response. The interventions will be selected based on risk of failure and consequence impact. For example, a vulnerable pumping station in a SSSI site will be given a higher rating as opposed to a pumping station in a less sensitive location.

Case study – Transient pressure monitoring

Transient pressure monitoring was originally developed from trials undertaken to understand the impact of transient pressures (very short duration spikes of pressure caused when pumps start or stop) on water main bursts. We have taken this a stage further and applied this to our wastewater rising mains which transfer sewage to other locations. Using an ultra-high-speed pressure logger we can detect the transient pressures in the rising main. We can then undertake work on the pumps, controls or ancillary equipment such as air valves, to remove transient pressures, reduce the likelihood of a burst and extend the asset life of the pipe. We can also use the monitoring to give an early warning of a burst, helping to reduce pollutions and flooding.

In addition to the strategic investment, our operational management approach is based on a 'Zero Pumps Out' mantra which has four key strands of activity focussed on ensuring our assets are not out of operation and thus always available limiting the risk of pollutions:

- **Pump service centre stock** – we recognise that assets will fail and to limit the risk of pollution, we need to replace or repair the broken asset as quickly as possible. To facilitate this process for AMP7 we aim to ensure our pump centres are stocked with a greater range of non-standard pumps which will allow us to quickly replace pumps when they fail.

- **Emergency response time** – We have managed to reduce the time taken to replace broken pumps through quick access to pumps and parts from our pump centre and improved contractual agreements. This has helped reduce the time that assets are not operating effectively.
- **Operational asset health wet well checks** – we undertake regular asset health wet well checks and cleaning activities.
- **Improving our top 250 priority risks** – we have prioritised our top 250 risks that want to address. We will be working through these sites to reduce the risk of pollution and rolling out any learnings to other sites.
- **Reactive tankering** – small pollutions can turn into serious pollutions if we don't react quickly. Containing spills typically takes lots of tankers to suck up the sewage, stopping it getting out into the environment, and taking it to another site. In 2019 we invested in additional clean water tankers and in-house drivers and operators to man them – and they have made a huge difference to our supply interruptions performance. We plan to do the same thing this year for wastewater.

Rising mains

Rising mains convey sewage uphill from pumping stations. They can contain large flows at high pressures, which presents a risk of pollutions or flooding if they burst suddenly. When a rising main failure happens it can lead to a pollution or flooding impact. Reactive investment on this asset will only repair those that have already burst, so the only way to reduce the number of bursts is to invest in a proactive maintenance or replacement programme.

Work on our rising mains should contribute around 12% towards pollutions reduction needed to achieve our ambition by 2025.

Our proactive investment is based on a rising mains model similar to the foul sewer network model; however, this model is less robust due to the lack of pipe condition information on rising mains and the small data sample (1,824km). To address this, we have used the clean water pipe relationships to enhance the modelling and then calibrated to account for sewer rising main characteristics to understand failure risk. Additionally, we are also collaborating across the water industry and beyond to investigate better intervention techniques.

Case study – Investigating no-dig techniques to repair rising mains

In 2019 we joined a two-year partner project with the Institute of Underground Infrastructure (IKT) which is based in Germany. The aim of the project is to recreate common rising main failures in their 1:1 scale test rig and then invite suppliers to demonstrate their no-dig repair technologies so that they can be tested and quality assured. The project has received funding of 1.5m euros from government and water authorities in Germany with additional contributions from a number of UK water companies including Severn Trent Water.

In AMP7, we will be focussing on proactive investigative planning to better understand our rising main asset performance, in addition to ensuring quick response and repair when failures occur. We will utilise new tools to conduct a review of asset health and risk to get a better visibility of the performance of rising mains. We are targeting a number of activities to mitigate risk and performance issues for our assets, building on the lessons learnt from previous pollution events and assigning appropriate care packages focussed on these key areas:

- **Technology tools to monitor rising mains** – a newly developed app has been trialled to facilitate mapping of rising mains in our GIS system to improve the quality of our asset records. Visibility of all our assets is crucial to effective delivery of proactive maintenance and response during a failure event.
- **Pipe bridge inspection** – some of our rising mains cross water bodies such as canals and rivers. We regularly inspect these assets and assess them in respect to current condition and security of the asset to prevent third party issues. This assessment feeds repair or replacement activity dependent on condition to reduce the risk of failure and potential pollution.
- **Air valve replacement & maintenance** – maintaining air valves slows the deterioration of rising main material by allowing the release of pressure and potentially eroding gases. Our maintenance plans drive the inspection of these assets and where necessary further remedial actions are raised and completed. Utilising burst history and root cause analysis we also target and replace air valves that have the potential to contribute to a pollution event.
- **Pressure monitoring** – having excellent insight to manage assets is critical for our engineers to assess site performance from an investment and operational perspective. Installation of monitors provides data to advise on the health of rising mains, and to measure the effectiveness of steps taken to reduce the pressure to a healthy level. This ensures we reduce pressure transients which can cause rising main bursts. Alarms can also be used to directly inform operational crews in the event of a burst.
- **Ice pigging (cleaning large rising mains)** – ice pigging is a technique we utilise that uses a slush mixture of ice and brine to flush through a rising main. This restores the full flow capacity by scouring sediments and biofilms that may have built up on the inside of the pipe, thus reducing the potential for blockages and pollutions.
- **Improving our response** – in the event of a burst, contingency planning is important to inform a quick and effective response. A standard template capturing key site data and most effective response (such as tankering and over-pumping requirements) has been developed and progressed for high-risk sites.

Combined Sewer Overflows (CSOs)

We have around 2900 Combined Sewer Overflows (CSOs). This is an asset on our sewer network that is designed to act as a relief point when combined sewers are overwhelmed with rainwater allowing legal discharge into rivers/watercourses. It is therefore an important asset as without its existence there is a potential for flooding of homes and businesses. Equally it is important that the overflows operate within the terms of their permits so as not to have a detrimental environmental impact on the receiving watercourse.

We have made significant improvements in our CSO performance since 2005 through a structured approach focussed on using information from monitors and responding effectively. We are in the process of installing monitors on our CSOs and storm tank discharges as part of the EDM (event duration monitor) programme with significant testing via our hydraulic models to identify the right levels to set alarm levels and identify potential blockage points.

In addition to continued use of monitors in AMP7, in collaboration with our local Environment Agency water quality specialists, we have built an ambitious set of investigation and improvement drivers into the Water Industry National Environment Programme for the 2021 to 2027 River Basin Management Plan cycle.

We have delivered over a 40% reduction in CSO pollutions between 2015 and 2019. Our ongoing improvement activities for AMP7 should see us delivering a further 25% improvement on our 2019 performance which is planned to contribute 3% of the benefits in our improvement strategy.

Water distribution

Whilst wastewater pollutions have been the primary focus of our improvement plan, and are the ones which feature in most of the industry metrics, we also need to reduce pollutions from clean water operations. The principle areas of focus are:

- Pollution e-learning packages tailored for clean water operations
- Clean water pollution focus group established
- New dewatering innovations now available in stores
- Pollution response kits for clean water operatives
- Focus on network calming to reduce burst mains

People focus (prevent, operate & learn)

The focus on people has been critical to the performance improvements and has involved training our staff and supply chain on all aspects of managing pollutions. In addition to the training, use of common tools and techniques and stringent compliance targets for all personnel in the business have provided a robust performance framework to monitor and embed performance. We have also ensured our staff are incentivised based on delivering improved performance on metrics that are within the business plan of which pollutions is a key metric.

To make our workforce the most technically skilled in the industry, we're committed to creating a centre of excellence – The Severn Trent Academy.

Case study – Severn Trent Academy

In 2020/21 we will be opening the doors on our £10M investment in a new dedicated learning facility.

Our Academy will enable a step change in the way we provide training and development to our colleagues.

We strive to create careers with purpose and meaning. Our aim is to attract and retain talented, hard-working people who want to progress in their careers and provide great customer service. We support the development of all colleagues at all stages of their career and want every employee to feel competent and confident in their everyday work. This will ensure that our people have the right mindset, technical competence and leadership skills for now and in the future.

To accelerate creation of our Academy, we have repurposed an existing site to provide a greener solution and are developing an exciting syllabus that uses state-of-the-art training techniques including virtual reality (VR) and network simulation.

We have invested in creating four virtual reality learning solutions, one of which is sewage treatment works optimisation. The VR will improve operators' diagnoses and early interventions to optimise the process, so we improve the quality of the product and reduce the energy usage to operate the plant. The integrity of the process will also help us to reduce the risk of pollutions.

During July 2019, we used our expertise to support the wider water industry by providing technical training to a smaller water company. With the success of this activity, we are exploring other courses and companies we can support. We are proud of being able to take a lead role in the industry today and the future opportunities our Academy investment, will give us to 'share' our facilities and expertise amongst the communities we serve.

We recognise the power of experts coming together. We have an established culture of communities of practice formed from our network of subject matter experts (within our business and supply chain) who share a passion for innovation. We have over 40 communities with around 1,500 active participants. These communities share and embed best practice in our day to day operations – helping us to improve and to ensure new innovations are translated into the c70 standards we operate to. The Wastewater Infrastructure CoP and Environmental Compliance CoP are especially dedicated to improving our pollutions performance.

Our people focus extends to our supply chain and we ensure our contracts allow for effective performance management and continuous learning. We have where reasonable sought to in-source skilled frontline staff to undertake maintenance activities on our assets for example pumping stations. This has enabled us to improve consistency on standards and retain asset knowledge.

Our emphasis on continuous improvement is expected to deliver around 7% of the pollution reduction needed to achieve our ambition.

Customer focus (Engage)

The plan has an external focus on education programmes for schools, colleges and commercial customers designed to help customers reduce pollutions from sewers by ensuring there are no misconnections on their property and by not disposing inappropriate items (i.e. non-flushables) that can cause blockages in sewers. To date we have educated over 700,000 customers and over the next five years we will have educated a generation and have received over 500,000 pledges on using water wisely. This is delivered through our dedicated team who visit primary schools across our region.

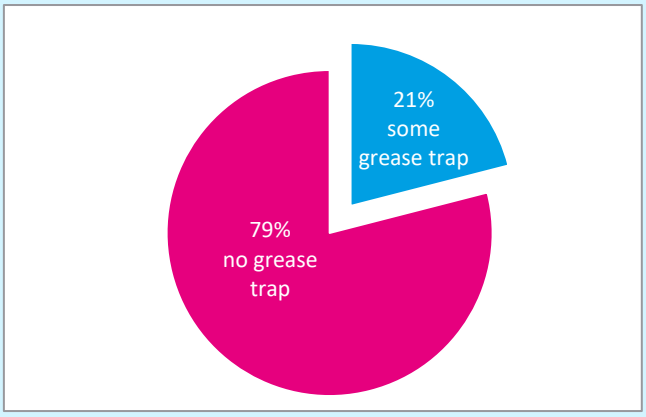
We recognise the need to do more to help customers understand what can be flushed down the sewer system and how that can help prevent pollutions. We have previously undertaken a targeted

education programme via our partnership with Environmental Compliance and Services (ECAS) covering food service establishments which was a great success.

In AMP7 the fats, oils and greases (FOG) prevention activity is planned to contribute around 2% towards our ambition on pollution reduction by 2025, due to its uncertain nature. If we can make significant progress on this as a broader society then there is the potential for this to have a much bigger impact on reducing pollutions.

Case study – working with ECAS to reduce fats, oils & grease (FOG) from food service establishments (FSEs)

Assessment of food survey establishments



- We have over 70,000 food service establishments (FSEs) in our region.
- In 2019, we visited over 3000 FSEs and commercial customers.
- The visits aim to achieve compliance through an engage, educate, and enforce approach.
- Advice is provided on best practice, such as installation of grease traps, with a last resort to recharging and prosecuting under the Water Industry Act 2011.
- In 2019 enforcement of use of trapping equipment in our region prevented around 197,392 litres of fats, oils and grease entering our network
- Since 2016 we have successfully taken four prosecutions against establishments who were damaging the performance of the sewer network and currently have two more prosecutions underway

Based on the above approach we are we are also trialling an engagement activity with domestic customers.

These include:

- Reactive visits in hotspot areas where there are repeat problems.
- Innovation on products and other practical ways to change behaviour.
- Ensuring field team engagement activity is included in current and future contracts.
- Following up planned work with customer visits and door drops of material.

Our new media campaign '*be a binner not a blocker*' is being tested in Nottingham and we are also educating broader business teams to become ambassadors for reducing non flushable items in their communities.

Misconnections lead to widespread chronic pollution incidents when wastewater (often washing machines or other white goods) that get connected to surface water sewers instead of foul (wastewater) sewers. This results in wastewater from such appliances (or sinks/toilets when conversions/extensions are not connected to the right sewer) going straight to streams or rivers via the surface water sewers. We do our best to find and trace these today – but they are notoriously hard to spot and trace in extensive urban areas. Reducing the number of misconnections could deliver 1% of the pollution reduction needed to achieve our ambition. However, as proven misconnections do not impact on our pollution numbers, the real benefit here is to the wider environment where this could remove hundreds of long running low level pollutions across the UK each year.

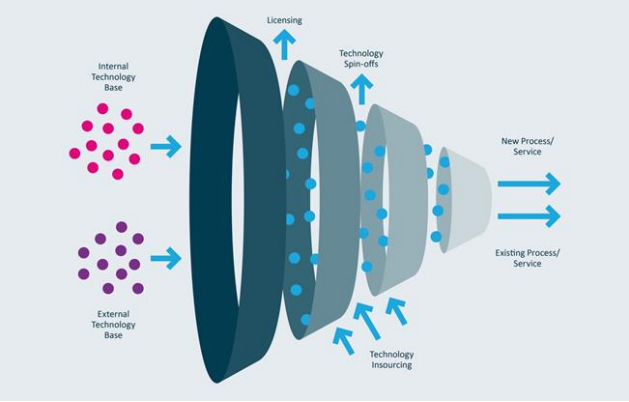
Best practice sharing (Learn & Engage)

We strongly believe in the power of combined learning and thus are supportive of cross- sector best practice sharing platforms.

In July 2019 we co-sponsored and presented at the inaugural **Zero Pollutions Conference** in London. On the day we shared some of the successes we have had in reducing flooding incidents and how a similar approach could support proactively addressing pollution risks. This was a great platform to get the conversation going across the industry on 'zero pollutions' and a great way of sharing best practice across the industry and we propose to do more by committing to supporting the event again in 2020.

Innovation (Learn)

Our **innovation** approach is all about facilitating the flow of expertise and intellectual property between organisations. Instead of a more traditional 'closed' approach to innovation, we adopted an open innovation model. This collaborative approach enables us to actively seek and bring innovation to the water industry from academia and other sectors. We believe it is a more efficient approach for our customers too.



In addition to collaboration within the sector we have also reached out globally via the World Water Innovation Fund. The World Water Innovation Fund was set up in April 2019 and has been established to share global knowledge and best practice, and to accelerate the rate of innovation adoption through co-ordinated and collaborative trials. It's made up to 12 members from across the globe in Australia, the United States, Brazil, Singapore, Spain and the UK. One year on, Severn Trent is already benefitting from this network.

United Utilities recently shared a trial through the World Water Innovation Fund to conduct condition assessment on clean water pipes. The technology uses an intelligent pipe system which digitises the

surface of any pipe to conduct structural condition assessment of the pipe itself, in real-time, and predict failure using mechanical modelling and artificial intelligence. Learning from this work, Severn Trent is now scoping out a similar trial on our wastewater rising mains, so that we can predict failure and prevent pollution events.

South East Water in Australia have also shared a sewer sensor they are developing, which could help us make the shift from being reactive to predictive with intelligent sewer spill prevention. Their solution may also be much cheaper than current options available on the market. Being able to reach out to our worldwide network is helping ensure innovative companies like these are aware and able to apply to our tendering processes.

Closer to home, within Severn Trent, our people are full of great ideas about how to improve service. But with over 5,500 employees it can be challenging to find these ideas and make sure they get the right traction. We therefore use campaigns to draw these ideas out and give them proper focus. The challenge cup is entering its fifth year. It has saved millions of pounds over the years through adoption of innovative products. We've generated thousands of ideas over this time and each year we sponsor the top 20 ideas with senior management sponsors to develop and refine the best products.

- **Annual competition** – to harness ideas and share best practice from our 5,500 employees
- **Best ideas selected** – get sponsorship from senior leadership to bring the idea to life
- **2019 winner** – 'Reservoir logs' idea – to allow us to have communication from site when power is off - has potential to help waste and waste treatment sites

7. Ambition to further reduce pollutions over the long term

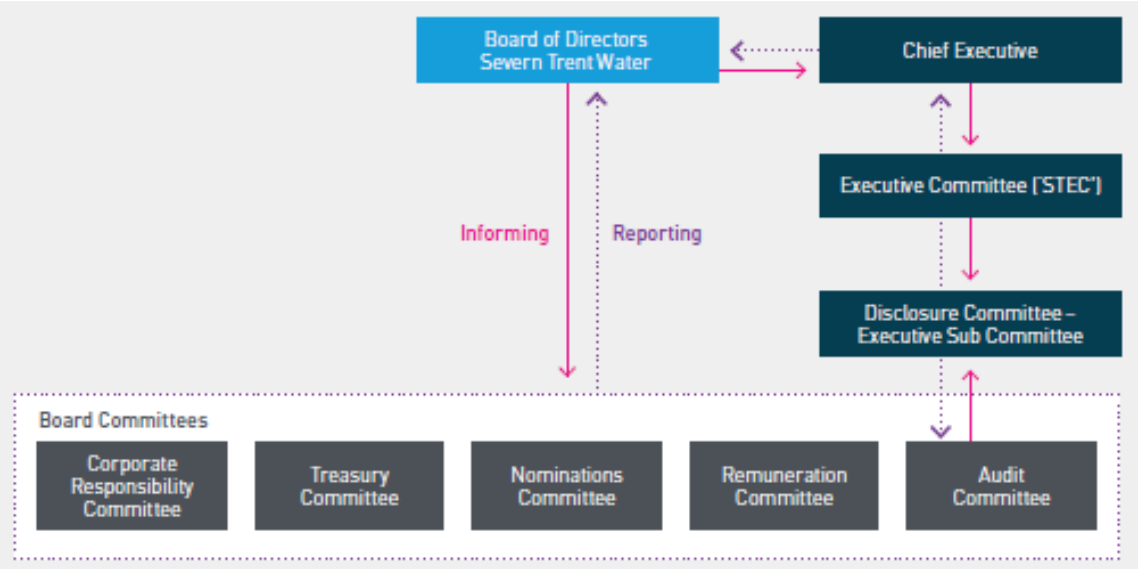
If we succeed in our ambition of halving pollutions by 2025 then it will inherently get harder and harder each AMP to drive further step change reductions. To continue an ambition of making significant reductions in pollutions over the long term it will take changes that extend beyond our direct influence and require technology that is not readily available to us today. We are active both individually and in concert with the wider industry to support national initiatives and investment in innovation to reduce both the number and level of impact of pollutions. Examples of such initiatives include:

- Further development and consistent adoption of a flushables standard (Fine to Flush) by manufacturers would have a significant long-term benefit. It should significantly reduce blockages (which are the largest root cause of pollutions) and would reduce the microplastic content being placed into the sewers.
- Exploring how public policy could support pollution reduction in areas such as on fats, oils and grease (FOG) and non-flushable product disposal
- Further advances in innovation to make low cost and reliable sensors that can send signals back from the sewerage network would allow a step change in monitoring and intelligence on a network that today has limited telemetry due to the cost and logistical challenges of doing so.
- Greater training, awareness and adherence to building regulations for plumbing and building work. Reducing the number of misconnections would provide a significant benefit to the wider environment and reduce background levels of pollution in watercourses.
- Smart networks and predictive modelling using big data are key tools we will be developing for the long term. We are working with various suppliers to identify the right technology. We are undertaking detailed 2-D hydraulic modelling to allow us to identify risk areas and we are implementing a structural change where our technology teams are now working in the same directorate as our Asset Management teams to enable us to have an Asset Management approach in which smart technology is central to our thinking.
- Underpinning the above focus areas, we will continue to employ our innovation approach to search for new solutions to help us deliver outcomes, stretching performance commitments and long-term targets more effectively.

8. Monitoring and reporting on our plan

Our Board is fully committed to this plan and maintaining the highest standards of governance is integral to its effective delivery. The Board is supported by the Severn Trent Governance Framework, which is set out below. The Governance Framework comprises the Board, Executive Committee and their respective Committees.

Governance framework



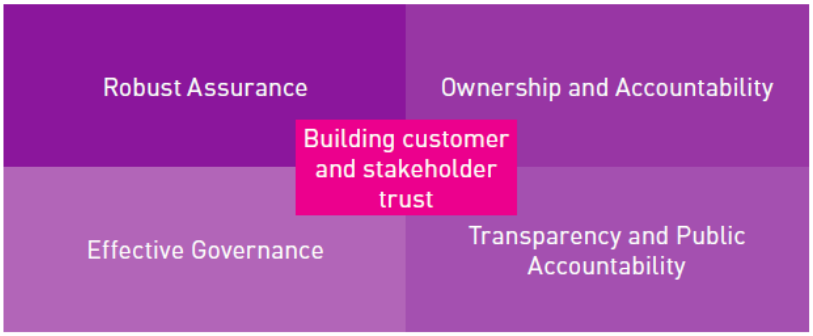
Assurance and performance management framework

To support our Governance Framework, we also have a well-established, rigorous and robust assurance and performance reporting framework. The assurance processes we use come from best practice identified across many organisations and industries ensuring that managers, senior managers and Directors are responsible for delivering high quality information.

To ensure we're applying an effective programme of assurance over this plan, we will employ our three lines of assurance model. We target this model using a risk-based approach so areas of significant importance receive the full three lines of assurance while other areas may be targeted with first or second line only.

The diagram below provides additional detail on our internal assurance, governance and performance management framework that will support the ongoing monitoring and reporting of progress against delivery.

Internal assurance, governance and performance management framework



- **Robust assurance** – we operate a three-lines of assurance model, targeted at areas of greatest risk.
- **Ownership and accountability** – we have clear lines of ownership for both the delivery of performance, and the accuracy of the information provided.
- **Effective governance** – provided by our Board, Audit Committee, Executive Disclosure Committee and Executive Committee with additional challenge provided by our Water Forum.
- **Transparency and public accountability** – we publicly report on our performance and hold ourselves to account where we do not meet our commitments.

Additional detail on how we will monitor our AMP7 delivery is provided in our 2019/20 Final Assurance Plan[2]. We propose to follow the three-level approach outlined below when reporting on our progress against this Pollution Incident Reduction Plan.

Our customers – It is important that our plan earns our customers' trust and confidence and to support this we expect to periodically update our plan to ensure transparency and visibility of our progress.

Environment Agency – We will be engaging with the EA on a regular basis through our established Performance Management Group meetings. Senior management from both the company and the agency meet to review progress and address any emerging issues or topics through the year.

Board and our Executive team – Our Executive Team receive updates on a regular basis in respect of pollutions performance with onward reporting to, and oversight by, the Severn Trent Board.

The plan will be refreshed as we progress through AMP7, with updates being published on our website periodically as the plan, and progress against it, evolves through delivery of interventions and the development of new initiatives.

[2] https://www.stwater.co.uk/about-us/future-plan-2020-2025/your-opinions-matter/