04b

Wastewater WINEP

Providing wastewater services while protecting and enhancing the environment

WONDERFUL ON TAP

SEVERN TRENT

Executive Summary

This proposal outlines our 'no-regrets' plan to meet Severn Trent's expanded statutory obligations as defined in the Water Industry Environmental Improvement Programme (WINEP), focusing on wastewater services (see separate proposals for WINEP plans for water and bioresources).

Case for Change

Only 14% of rivers in England can currently claim to have Good Ecological Status (GES), and the UK is not on track to meet the Water Framework Directive (WFD) requirement for all rivers to reach this status by 2027. This is the stark assessment of the Environmental Audit Committee's fourth report of the 2021/22 session, published in January 2022. This is simply a reflection of the scale of the challenge faced and not a consequence of a previous lack of investment, as acknowledged by the Environment Agency (EA).

> "Overall, water quality in our rivers, estuaries and coastal waters has improved greatly over the last few decades, largely due to robust regulation by the Environment Agency and investment by the water companies. So, for example:
> Sewage treatment works now discharge 67% less phosphorus and 79% less ammonia into rivers than they did in 1995. That matters a lot, because Phosphorus causes eutrophication which starves the water of oxygen and ammonia kills off aquatic organisms.
> Since the 1990s there has been a big increase in the numbers of sensitive macroinvertebrates (snails, worms and insects) in our rivers, an indicator of the improving health of England's waters. Rivers that were heavily polluted during the industrial revolution (most of them) now have salmon back in them; and otters have returned to every English county – another indicator of improved water quality."
>
> Sir James Bevan (former chief executive at the Environment Agency) - speech delivered to World Water-Tech Innovation Summit - 21st February 2023

The EA has identified 34,254 individual Reasons for Not Achieving Good status (RNAGs) across the nation's rivers, lakes, coastal and groundwaters. The water sector as a whole is responsible for 16.2% of these RNAGs and must play its part in delivering the requisite improvement measures. Of 851 RNAGs ascribed to Severn Trent Water's wastewater activities in April 2022, 95 have already been addressed (as at June 2023) and our ambition is that, by 2030, we will have resolved 99% of all the RNAGS impacting rivers that are attributable to us, with 14 remaining – the value of addressing which is approximately the same as our AMP8 programme. While spreading the cost in this way helps to keep bills more affordable, we want to make as much progress against the remaining 14 RNAGs as soon as possible in AMP9. We plan to progress with feasibility throughout AMP8, accelerating investment where we can, so that we are starting construction as AMP9 (2030/31) begins.

In response to these challenges, the Government has set ambitious goals on biodiversity and improving the nation's water environment through its 25 Year Environment Plan and the 2021 Environment Act. The PR24 WINEP has been expanded to incorporate new statutory obligations, including new duties to reduce phosphate discharges by 80% (from a 2020 baseline) by 2038, eliminate harm caused by storm overflows by 2050, and the installation of river quality monitors. These obligations build on the existing environmental legislation that has been in place since the 1990s, which has already driven substantial improvements in water quality.

The steps we plan to take in AMP8 are aligned with our longer-term strategy and publicly stated ambitions through our Get River Positive campaign (Severn Trent – Get River Positive).The vision we set out in our Strategic Direction Statement (SDS) includes protecting and enhancing our environment, and making a positive social difference. Our Long Term Delivery Strategy (LTDS) has set out our planned journey for reaching this destination and how this might need to adapt along the way. Even though our WINEP-related work planned for AMP8 is driven by statute, it is fully aligned and consistent with our LTDS and SDS.

Solution

We intend to deliver 71% of the Environment Act phosphate load removal by 2030 through the combination of our AMP7, Green Recovery and proposed AMP8 programmes. Virtually all the remaining 29% will be delivered in AMP9 through interventions at seven of our largest works. Our Storm Overflow Reduction Plan will eliminate harm from storm overflows that discharge into high priority areas by 2040, with the remainder to be addressed by 2045, in both cases five years ahead of the Government's target.

We will use the knowledge gleaned from the Chemical Investigations Programme to implement solutions in AMP8 that are compatible with future hazardous chemical and pharmaceutical control requirements, facilitating the use of flexible permitting approaches and reducing the future cost burden on customers.

AMP8 proposal

For an investment of £2,315m, we propose to deliver the activities required to meet our statutory obligations to protect and enhance the water environment, together with targeted investigation activities needed to inform future WINEP investment at PR29. This investment proposal is purely enhancement with no contribution from base expenditure. Where individual projects contain elements of base and enhancement, proportional allocation rules have been applied to remove the base costs.

Our programme is composed of 'no-regrets' investment only, and will deliver the following benefits:

- **Protect the water environment.** Reduce ecological harm from storm overflows, bring down the number of spills by 25% and prevent water quality deterioration;
- **Enhance the water environment.** Improve water quality by reducing phosphate, ammonia, and hazardous chemicals in wastewater. Eliminate at least 250 RNAGs; and
- **Prepare for future improvements.** Continue the industry-wide investigations into hazardous chemicals, antimicrobial resistance and, microplastics to inform future regulatory policy and identify strategies for intervention. Investigate nitrate issues in lakes and reservoirs and identify remedies for inclusion in PR29 WINEP.

Our AMP8 WINEP programme was developed over 18 months following the EA's rigorous assessment process and resulting in a best value programme of work that satisfies our statutory obligations. The EA has marked every one of our WINEP wastewater actions as 'Proceed' in the formal PR24 WINEP record, denoting both their acceptance of the need to intervene and our proposed intervention.

Table 0.1: Severn Trent AMP8 WINEP programme (wastewater)

WINEP driver	Activity	Cost	Benefit
Storm overflow improvements	Improve 562 storm overflows.	£1,113m	1,868km of river benefitting from reduced storm overflow activations.
Phosphate removal	Introduce/enhance phosphate removal at 124 sites. Deliver 13 catchment nutrient balancing schemes.	£683m	1,375km of river benefitting from nutrient load reduction (including through effluent relocation or works closure).
Ammonia and BOD removal	Introduce/enhance ammonia or BOD removal at 42 sites.	£215m	346km of river benefitting from sanitary load reduction.
Chemical removal	Introduce 65 new chemical permit limits across 47 separate sites.	£81m	Prevention of deterioration.
Flow monitoring and emergency overflow monitoring	Install 149 flow to full treatment (FFT) monitors. Install monitoring at 324 emergency overflows.	£57m	Certified FFT compliance monitoring. Extend overflow monitoring to pumping station emergency overflows.
Nitrate removal trials	Deliver three nitrate removal technology trials.	£32m	Inform options to meet future nutrient standards.
River quality monitoring	Install 1,000 river quality monitors.	£127m	Inform targeting and prioritisation of future investment.
Investigation programmes	Investigate hazardous chemicals, antimicrobial resistance, microplastics and nitrate in lakes and reservoirs.	£7m	Inform options to address future water quality concerns.
Total		**£2,315m**	

Note that this table and all subsequent tables containing financial information, are inclusive of £100m capex associated with a proposal made to the EA and DEFRA to add a further 198 storm overflow improvements to the 364 listed in our WINEP programme. No concerns have been raised by either Defra or the EA, but if this is not accepted, all capex numbers associated with storm overflow improvements need to be reduced by £100m and the associated benefits. The evidence to support this additional programme of work is included in Appendix A.

Long-term targets set by the Government in the 2021 Environment Act are driving the vast majority of our WINEP investment programme. Table 0.2 below illustrates how the proposed AMP8 programme contributes towards the delivery of these targets.

Table 0.2: Delivery of Environment Act Targets

Environment Act duty	Percentage delivered through AMP7 + Green Recovery investment	Percentage delivered through AMP8 investment	Percentage to be delivered in future AMPs
Storm overflow discharge reduction plan (<10 spills metric)	5	33	62
80% Phosphate removal (from 2020 baseline)	58	13	29
River Quality Monitoring	0	25	75

We have structured our AMP8 WINEP programme to take full advantage of the opportunities presented by WINEP reform, which aim to link all activity to the environmental outcomes that customers want to see.

We are confident this proposal represents the best option for customers, and that it will deliver best value overall in terms of costs, risks, affordability of customers' bills, and wider environmental and social benefits. We have rigorously benchmarked our cost estimates and are confident they are efficient.

Construction and operation of the additional assets required to meet our environmental obligations will generate additional greenhouse gas emissions. The costs associated with ensuring these additional emissions do not compromise delivery of our process emission reduction targets are included in Enhancement case 03 – Net Zero Investments.

Wastewater WINEP at a glance

- Elimination of at least 250 Reasons for Not Achieving Good Status (RNAGs);
- 1,375km of river and 6km^2 of lakes benefitting from phosphate removal;
- 1,868km of river benefitting from 562 storm overflow improvements;
- 346km of river benefitting from enhanced ammonia removal and other WwTW improvements;
- 164 tonnes per annum of phosphate removed from our rivers and lakes;
- 8,393 hectares of farmland benefitting from Catchment Nutrient Balancing interventions covering 10% of all waterbodies in our region; and
- 13 environmentally sensitive areas improved.

The way in which we have structured our approach to meeting the Environment Act phosphate and storm overflow targets means that, for every £1m invested in AMP8, approximately 2km of river will benefit.

Contents

Note:

Annexes referred to sit within separate PR24 documents whereas Appendices are contained within this document

1. The need for investment

1.1 Responding to Government priorities

The UK Government's 25 Year Environment Plan pledged that we will be the first generation to leave the environment in a better condition than we found it. This plan set out a range of ambitious goals, including the improvement of at least three-quarters of the nation's waters to a near-natural state as soon as is practicable. The Government has also passed its flagship 2021 Environment Act, which imposes new duties on water companies to reduce phosphate discharges by 80% by 2038 (from a 2020 baseline), and to eliminate harm caused by storm overflows by 2050. The Storm Overflow Discharge Reduction Plan (SODRP) also requires that individual storm overflows operate no more than 10 times a year and have a screen in place.

The Water Industry Strategic Environmental Requirements (WISER) set out the expectations of our regulators, the EA and Natural England. Legislation-specific guidance is provided by the EA in the form of WINEP driver guidance[1], which is reviewed by the Department for Environment, Food and Rural Affairs (Defra) prior to publication.

It is clear that water companies need to deliver environmental enhancements to improve the state of the UK's rivers. In the most recent WFD assessment, only 14% of rivers achieved Good ecological status. Analysis by the EA shows that 16% of the identified causes (Reasons for Not Achieving Good Status, or RNAGs) are attributable to water sector activities.

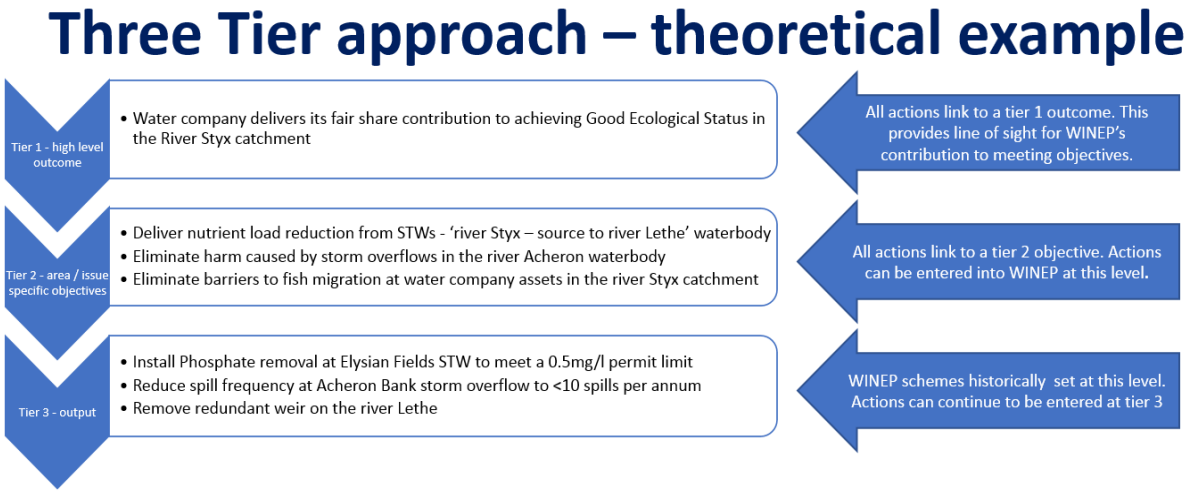
Water Industry Environment Improvement Programme (WINEP)

The WINEP is a wide-ranging programme of environmental improvement measures that has been in place since the 1990s. Water companies' WINEP programmes are agreed in consultation with the EA and other stakeholders through a formal process governed by a standard methodology. Historically, this methodology has focused on a programme of measures that water companies must include in their business plans to deliver defined environmental improvements. Following the WINEP Reform Taskforce, which ran from late 2020 to mid-2021, the PR24 approach has been adapted to deliver wider benefits and so maximise value for money (see Appendix B for further details of WINEP reform, including Severn Trent's contribution). Greater responsibility has also been placed on water companies to develop and submit their programmes to the EA.

In the reformed WINEP, actions can now be expressed as outcomes using a three-tiered approach that illustrates how outputs build up into outcomes. This gives a more meaningful measure of progress, based on the healthy, thriving environment that we, our regulators, and our customers want to see. Figure 1.1 below outlines the new tiers using a theoretical example.

[1] WINEP driver guidance is held on the Defra Sharepoint site here. Access to the site is restricted, but permission can be given on request by contacting Price_Review@environment-agency.gov.uk

Figure 1.1: WINEP tiers



Severn Trent has been a leader of WINEP reform and outcomes-based regulation through our active participation on the WINEP reform taskforce. We have been utilising catchment management approaches for certain issues (e.g. phosphate removal) for over 20 years, and the PR24 changes to WINEP methodology allow us to work more closely with partners, finding innovative and cost-effective ways to deliver our statutory and wider environmental benefits. In particular, we welcome the opportunity to consider catchment-scale permitting to enable us to find the most cost beneficial solution to delivering river quality improvements; this is particularly important in catchments with several small works and already-tight consents.

In response to this opportunity, we have entered large segments of our WINEP programme into Tier 2 outcomes, where several interventions are grouped together under a single WINEP action to deliver a defined environmental outcome. A total of 171 individual improvement actions at wastewater treatment works (WwTW) are grouped into 84 WINEP actions – the majority at waterbody level but also including some actions at the scale of Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC) or even entire river catchments. These Tier 2 outcomes represent 93% of our WINEP improvement measures at WwTWs, or c.£700m of investment. See Appendix C for an overview of how WINEP reform has enabled us to design better solutions for AMP8.

We will continue to support WINEP reform and the ambitions to align planning frameworks and to integrate Natural Capital assessment in our decisions. We believe that a system operator approach for catchments has the potential to deliver these additional reforms and that it will secure catchment focused programmes in partnership with others. We expand upon our proposed System Operator approach in Appendix D.

WINEP drivers for the provision of wastewater services

Severn Trent's WINEP enhancement proposal is divided into three parts: Water, Wastewater and Bioresources. This proposal focuses on Severn Trent's WINEP programme for the provision of wastewater services, and our WINEP programmes for water and bioresources are outlined in separate enhancement proposals. Table 1.1 below outlines the statutory requirements of each driver, defined by the EA and Natural England, and its Tier 1 outcomes (the high-level outcomes sought by the 25 Year Environment Plan and WISER). Details of the WINEP driver codes for these activities can be found in Appendix E.

Table 1.1: AMP8 WINEP drivers and outcomes (wastewater)

WINEP driver	Outcomes (Tier 1)	Legislation	Statutory status[2]
Storm overflow improvements	Water company actions to protect the environment from the effects of intermittent discharges.	Environment Act	Statutory
Phosphate removal	Water company contribution to achieving water quality objectives, including maintaining/restoring habitat to conservation targets where applicable.	Environment Act	Statutory
		Water Environment (Water Framework Directive) Regulations	Statutory plus
		Conservation of Habitats and Species Regulations (Habitats Directive)	Statutory
		Levelling Up Act (Nutrient Neutrality)	Statutory
		Countryside and Rights of Way (CRoW) Act	Statutory plus
Ammonia and BOD removal	Water company contribution to achieving water quality objectives.	Water Environment (Water Framework Directive) Regulations	Statutory plus
Chemical removal	Water company contribution to achieving water quality objectives.	Water Environment (Water Framework Directive) Regulations	Statutory plus
Flow monitoring and emergency overflow monitoring	Water company actions to protect the environment from the effects of urban wastewater collection and discharges.	Urban Wastewater Treatment Regulations	Statutory
Nitrate removal trials	Develop and test nitrogen treatment options.	Water Environment (Water Framework Directive) Regulations	Non-statutory but mandated by Defra
River quality monitoring	Protect the environment from the effects of discharges from storm overflows and WwTWs.	Environment Act	Statutory
Future hazard investigations	Achieve improvement objectives for water quality or prevent deterioration. Develop and test microplastics removal.	Water Environment (Water Framework Directive) Regulations	Mix of statutory and non-statutory but mandated by DEFRA

[2] Statutory obligations arise from legislative requirements and must be achieved. Statutory plus (S+) obligations are categorised as legal requirements where economic evidence (the balance of costs and benefits, and affordability considerations) forms part of the decision-making process.

Across each of these WINEP drivers, we have worked with the relevant regulators to identify the environmental risks and issues across our region and agreed the scope of intervention required. The outcome of this is that 100% of our proposed interventions have been marked as 'proceed' by the Environment Agency following completion of their Options Assessment Review and we have no outstanding queries or clarifications to address.

Statutory drivers

The vast majority of the Severn Trent AMP8 WINEP programme has been defined as 'statutory' within the WISER framework, with the overall programme dominated by the requirements of the 2021 Environment Act. Table 1.2 below outlines the statutory status of our WINEP programme elements, assigned by capex values.

Table 1.2: Statutory status of the AMP8 programme based on primary WINEP driver

Statutory status	CAPEX		Principal legislative drivers
Statutory (Environment Act)	£1,717m	76.3%	80% phosphate load removal by 2038, storm overflow improvements and river quality monitoring
Statutory (other)	£260m	11.6%	WFD ('no deterioration'), Urban Wastewater Treatment Regulations (septic tanks, flow and storm overflow monitoring), nitrate removal trials, investigations (hazardous chemicals, microplastics and nitrate source apportionment)
Statutory plus	£272m	12.1%	WFD (improvements), CRoW Act (SSSIs)
Non-statutory	£0	£0	n/a Note - we have treated a direct mandate from Defra as being equivalent to statutory. e.g. the Nitrate removal trials
Total Capex	**£2,249m**	**100%**	
Totex (capex and opex)	**£2,315m**		

Although some drivers of improvement are 'statutory plus' obligations (i.e. subject to a cost-benefit assessment), this assessment is often superseded by the statutory nature of other legislation such as the Environment Act. EA guidance states that, where multiple drivers are applicable to an intervention, statutory drivers take precedence over statutory plus and non-statutory drivers. In total, £1,977m (88%) of our WINEP programme has a statutory primary driver. The remaining 12% 'statutory plus' obligations became statutory on completion of the EA's options assessment process. Further information is provided in section 3.1.

We have not proposed any non-statutory enhancements in our wastewater WINEP programme. We are very conscious of the fact that this is a very large programme of improvements relative to previous AMP periods. While there is strong customer support for environmental improvements, the key areas of concern (river health and storm overflows) are well covered by the statutory elements of our programme.

We have proposed a smooth trajectory in terms of cost and phosphate load reduction towards the 80% target but frontloaded the environmental benefits. Deadlines set within the Environment Act extend well beyond the end of AMP8, giving scope to prioritise delivery of this duty in a way that

maximises the amount of environmental benefit delivered in this period. To this end, our AMP8 phosphate removal measures will improve 1,375km of river, against a forecast river length in AMP9 of 233km. The explanation for why the AMP9 benefit is much less than in AMP8 for a similar level of investment is that several of our most expensive projects are situated along the same length of river, starting from the River Tame in Birmingham and running through the lower part of the River Trent to the Humber estuary.

1.2 Responding to customer expectations

Despite the statutory nature of the WINEP wastewater programme, we have undertaken extensive customer research to better understand their views on the need for (and desired pace of) environmental improvements. A summary of their feedback is set out below (for full details of our customer engagement on WINEP, please refer to Annex 3a Customer and stakeholder engagement, challenge and assurance). This includes details of the engagement sources, how we have triangulated customer views, our independent assurance, and more information on what we have heard from customers, including customer quotes and research extracts.

Customers care about the environment and want rivers to be healthy

The environment is raised spontaneously by customers as an area of core service and also as a key concern. Preventing or minimising the pollution of waterways is one of the areas customers want us to prioritise and has consistently been the top investment priority in the Social Barometer.

Rivers play an important part in people's lives. In total 81% of customers have visited their local river and people talk about the emotional connection they have with these spaces. As a result, pollution and litter get a strong negative response. In addition, 95% of customers agree that river water should provide healthy habitats for plants and animals[3].

> *"It's always very clean. Very green and very calm. And that's something that I really appreciate, being in the city"*
>
> HH customer, River pollution and river use research
>
> *"Depends on the day, the place on the river and the weather. Some areas are disgusting, some are clean. Some are ok until heavy rainfall then become full of rubbish"*
>
> HH customer, River pollution and river use research

The release of sewage into rivers is high on our customers' agenda – it is a top-three environmental concern for 39% of the region's population, behind climate change (61%) and plastic pollution (46%)[4]. It also emerges strongly in our 2022 Social Media Listening, which sees a major shift in water industry conversation from customer service to environmental and social responsibility.

Research conducted by Ofwat found that almost three in 10 people (29%) rank water pollution of rivers and seas among the top three things having a negative impact on the environment. Almost six in ten (59%) want their water company to prioritise improving the quality and cleanliness of rivers in England and Wales, even if this were to increase the price of their water bills[5]

[3] River pollution and river use research, Blue Marble, April 2022
[4] ibid
[5] Ofwat, River water quality research, July 2022

"It's nice to find an extra excuse to go and visit the river… I struggle with my mental health, so having reasons to get outdoors helps my mood greatly."

HH customer, River pollution and river use research

"I wish for Severn Trent to focus on improving the environment, tackling climate change and reducing the amount of wastewater that is released into rivers, lakes and the sea."

Tap Chat customer

Investing in environmental improvements is a high priority

Across our triangulation of customer priorities "Preventing the sewage network from causing environmental pollution" and "Doing more to ensure sewers and sewage treatment works do not cause environmental harm to rivers" are high investment priorities, ranked by 71% and 67% of customers respectively. Only 13% of customers agree with the statement "there are more important things for Severn Trent to invest in than reducing river pollution". This is also a high priority in the qualitative research.

Independent research undertaken by the LSE on behalf of the EA and Defra on the specific issue of chemical water pollution found that between 68% and 77% of participants at a public dialogue workshop (held in 2016) said they would be happy to pay slightly more on their water bills (defined as £1-2 per month) to reduce chemical water pollution[6]. This research also produced the WTP figures used in the EA's cost benefit tool for assessing chemical removal interventions.

Customers expect us to deliver our statutory requirements. Some customers want us to go beyond this as well, although views are mixed

Delivering the statutory minimum is a basic expectation of the service we deliver. There are some mixed views on how far we should go in terms of going beyond these requirements. Our early qualitative research in 2017 showed an indicative preference towards "Being an environmental champion and exceeding legal requirements"**.** As the cost-of-living crisis has developed, this view has weakened slightly. Quantitative (uninformed) research in 2022 on the water resource management plan shows a swing towards keeping bills low[8].

Since we have been tracking customer preferences in the Social Barometer there is increased uncertainty when it comes to delivering or exceeding level requirements. Despite this, 54% of customers still want us to either exceed where possible/generally exceed/exceed at all times.

In national research conducted for Ofwat[9], respondents were given a choice between improving the quality of rivers or keeping bills low. A total of 59% wanted their water company to prioritise improving the quality and cleanliness of rivers even if this were to increase the price of their water bills. Younger people were more likely than older people to want companies to keep water bills low (40%), as well as those behind the payment of any bills.

Customers are concerned about storm overflows and their impact on rivers and want us to invest to reduce spills. Longer term, they ideally want to see spills reduced to zero, and question why the Government isn't more ambitious

[6] http://etheses.lse.ac.uk/3921/1/Atherton__Capturing-public-views.pdf page 109
[7] Strategic Priorities research, Community Research, December 2021
[8] WRMP deep dive survey, Accent, May 2022
[9] River water quality customer research, Ofwat, July 2022

The activation of storm overflows has become a prominent customer concern, driven at least in part by adverse media attention. Three-quarters of customers in national research are aware that sewage is sometimes released into rivers and seas, but very few report a good understanding of storm overflows. Many respondents report concern about this, with the most common emotions relating to this being anger and upset[10].In our research,[11] over half of customers were unaware of storm overflows, and awareness correlates with older, higher socio-economic groups. River swimmers and environmentally conscious customers are also more likely to claim awareness, as well as those who believe Severn Trent has a bad reputation.

When it comes to tackling the problem, in our quantitative research 70% of respondents agreed that no sewage should enter rivers, no matter how dilute[12],· 63% of customers agreed that investment is urgently needed to reduce the use of storm overflows, and 49% agreed they should stop being used regardless of cost[13].· Those who were aware of storm overflows before taking part in our research felt even more strongly than those who were unaware.

When it comes to the impact of overflow spills, there is some scepticism from customers that storm overflows can cause minimal ecological damage/not cause harm. Only 36% agree it is acceptable for very dilute sewage to enter a river, provided the Environment Agency is satisfied no plants or animals are harmed as a result[14].

While 81% of customers associate "no environmental harm" with "no fish, wildlife or plants being killed or damaged as a result of sewage", 31% think it means eliminating all storm overflows.

There are mixed views about how far Severn Trent should reduce storm overflows in AMP8, with slightly more support for the mid-level investment option[15]. When it comes to the long-term targets to reduce storm overflow spills, with informed customers in the DWMP Customer consultation more customers tend to accept 10 spills per year than aiming for zero. However, there is no universal consensus on this. For less informed customers there are also split views on the level of ambition.

> *"Stop the sewage overflows that go into the river. It's not nice after heavy rains then having to dodge unmentionable stuff and raw sewage."*
>
> River user, River users survey

In the LTDS research customers told us they ideally wanted to see storm overflows reduced to zero, and there are questions about why the government targets are not more ambitious.

Customers care about SSSIs and believe Severn Trent should invest to protect them and other environmentally sensitive areas

Customers care deeply about these sites and value them highly. Almost all (99%) customers polled were in favour of Severn Trent investing in protecting SSSIs from pollution[16].

Our proposed plan is considered acceptable to customers but, if we were going further, investment in reducing overflows is a priority

[10] River water quality customer research, Ofwat, July 2022
[11] River pollution and river use research, Blue Marble, April 2022
[12] ibid
[13] ibid
[14] ibid
[15] Strategic Investment Choices, Explain Research, November 2022
[16] Tap Chat – Investing to protect SSSIs, Feb 2022

In our Affordability and Acceptability research we found that *Improving river water quality and reducing storm overflow spills* is an area of great importance for customers. When discussing performance commitment targets, customers tell us they want to see the specific targets on storm overflow spills to deal with what they see as a major issue for the environment (the research guidance did not include these amongst the common performance commitments discussed).

Customers tell us they are aware of media reports on sewage pollution in rivers and want to see the issue tackled quickly.

> *"This is important because it doesn't just affect us, it's wildlife too. We need a sustainable environment"*
>
> HH customer, Acceptability and Affordability research

Reducing phosphate through the sewage treatment process is also seen as important, but this is less tangible to customers than storm overflows.

Customers felt positive towards our proposed plan, although some wanted more action on storm overflows, and they are often surprised about how expensive this investment area is compared to other priorities. Customers were also pleased to hear we would be working with farmers to reduce their impact too. For some customers, the long-term target feels unambitious and still constitutes more spills than they would like. Others feel that going further would require even more investment (on an already large amount).

While it does not feel as affordable, the proposed plan is seen as acceptable in this area. Overall, customers believe it is essential to protect the nation's rivers and that, while expensive, it is worth the cost. If more money were to be invested, customers often say they would like to this go toward reducing storm overflow spills, which is seen as more of a priority than reducing phosphates.

In our quantitative research, this investment area was ranked the second most important, following *Securing water for the long term*. Older age groups tend to rank it higher than those who are younger, and those who have seen / heard about water companies and about Severn Trent in the media in the last 3 months are more likely to rank it more highly than those who are not aware. Overall, the plan is acceptable to 76% of customers.

Building customer feedback into our WINEP programme

Severn Trent's PR24 WINEP programme aims to address our customers' concerns, particularly about storm overflows, and we have made the following changes to our options identification process (see Section 2.1):

- Prioritising SSSIs and other environmentally sensitive sites in our storm overflow improvement programme. In doing so, we have gone beyond the EA driver guidance (which is to prioritise storm overflows in/within 50m of designated areas) to include additional storm overflows that are located further upstream of these designated areas and our assessment process has identified a risk of harm being caused; and
- Including measures to address all remaining impacts from our continuous discharges into environmentally sensitive areas.

We have prioritised our phosphate removal programme to maximise the environmental benefits delivered in AMP8. We will improve 1,375km of waterways at a cost of £683m in AMP8, approximating

to 2km for every £1m invested. In AMP9 we need to spend a similar amount, but this will deliver 233km of benefit, or 0.3km per £1m.

Because our WINEP programme is driven by environmental legislation requirements, we have applied relative weightings to the views expressed by our customers, stakeholders, and regulators. For statutory obligations, while customer views on pace and priority are important, the fundamental need to deliver obligations mandated by statute are not subject to a customer acceptability test. Where proposed investment is to address defined statutory obligations, we have assigned a high weighting to the views expressed by our environmental regulators as they are the ultimate arbiters on whether our proposals will deliver our statutory obligations. Details on how we have weighted views can be found in Appendix G.

1.3 Management control

All measures contained within our WINEP programme have been confirmed as being statutory or have met the EA's additional qualifying criteria (e.g. have satisfied cost benefit criteria) where applicable. As such, the EA has confirmed that the need to invest is a new requirement and not a consequence of poor management or a historic lack of investment. While there are a small number of investments linked to WFD 'no deterioration' criteria, these relate to WwTWs that are delivering better effluent quality than is required by the existing permit conditions. The EA needs to act to 'lock-in' this over-performance to ensure rivers are not at risk of deterioration (e.g. if loads increase due to the impact of population growth).

We have made significant improvements to the quality of effluent from WwTWs over the last three decades. By 2020 we had invested £12 billion to achieve an 80.5% reduction in phosphate (relative to a 1998 start point), 71.8% reduction in biochemical oxygen demand (BOD), and a 72.1% reduction in ammonia loads being discharged into our rivers and lakes.

We have an excellent track record on delivery of our WINEP obligations and are consistently rated as 4* in the EA's annual Environment Performance Assessment (EPA), with performance only once dropping (to 3*) since the start of AMP6, as outlined in Table 1.4.

Table 1.4: Severn Trent EPA scores and WINEP delivery

Year	Overall EPA score	WINEP delivery
2022	4*	Green Status 100%
2021	4*	Green Status 100%
2020	4*	Amber Status 97.2%
2019	4*	Green Status 99.2%
2018	3*	Green Status 100%
2017	4*	Green Status 100%
2016	3*	Green Status 100%

We are on track to deliver our PR19 WINEP obligations, as well as the additional investment through the 'Amber' WINEP schemes and the accelerated investment approved as part of our Green Recovery programme.

- Our AMP7 wastewater treatment obligations are being delivered through 160 projects, covering 272 separate regulatory commitments. Of these, 148 (93%) have been designed and allocated to the supply chain. Of these, 105 (66%) are now delivered, under construction or in contract (with construction about to commence);
- The additional 500km of WFD river improvement funded through Green Recovery investment is on track, with good progress being made on the design of our storm overflow treatment innovation trials. The learning from these trials will add confidence to our AMP8 programme; and
- Our Green Recovery investments in bathing rivers and sustainable drainage are also well advanced, giving us valuable insight into the delivery of storm overflow improvements.

2. Identifying and assessing the best option for customers

2.1 Identifying the optimum scale and pace of investment

The pace of investment is, to a large degree, dictated by legislation. The EA has issued driver guidance, with which we are required to comply, that assigns a latest allowable delivery date to each WINEP driver. There are three main areas of choice around pace of delivery:

- **Storm overflow improvements.** The Storm Overflow Discharge Reduction Plan (SODRP) – part of the Environment Act – sets out a trajectory of milestone dates between 2030 and 2050, giving us flexibility of targeting within that trajectory;
- **Phosphate removal.** The Environment Act's 80% phosphate removal target has a delivery date of 2038, allowing us to phase delivery over multiple AMPs; and
- **River quality monitoring.** Based on discussions with the EA and Defra, we anticipate this programme being spread over two AMP periods, focusing on Defra-defined priority areas in AMP8 and covering all other areas in AMP9.

In assessing the optimum scale and pace of investment we have considered, and applied, relative weightings to the views expressed by our customers, stakeholders, and regulators. Our WINEP programme is statutory, so while customer views on pace and priority are an important consideration, the fundamental need to deliver obligations mandated by statute are not subject to a customer acceptability test. Our programme must be supported by our environmental regulators as it is they who are the arbiters of whether or not it will deliver our statutory obligations. Details on how we have weighted views can be found in Appendix G.

Below, we outline each of the of three areas of the programme in more detail.

Storm overflow improvements

The Environment Act places a legally binding duty on water companies to progressively reduce the adverse impacts of discharges from storm overflows. The SODRP[17], announced in September 2022, sets targets that water companies are required to meet.

The SODRP sets a trajectory for delivery of the 'eliminate harm' and 'fewer than 10 spills' requirements. This sets both a general set of milestones applicable to all storm overflows, and a trajectory that is specific to defined high-priority storm overflows. We are proposing a trajectory that will deliver these SODRP targets five years ahead of schedule. Our AMP8 programme will primarily focus on four of the five high-priority areas that apply to Severn Trent. When considering a wide range of views on storm overflows, we are concerned that the statutory improvement rate does not reflect the urgency and pace of improvement society expects. Therefore, we are proposing to go beyond the statutory minimum in AMP8. The case for this is set out in Appendix A. See Section 3.2 for details of our AMP8 statutory storm overflow improvement plans.

Phosphate removal

[17] Storm Overflows Discharge Reduction Plan

The Environment Act requires an 80% phosphate load reduction by 2038 across the UK, compared to a 2020 baseline[18]. The EA has instructed that delivery of the Environment Act obligation must maximise environmental benefits, rather than simply targeting load removal at the largest WwTWs.

Water companies can make decisions on both prioritisation and pace, helping to define the activities included within the AMP8 WINEP programme. There is still a degree of uncertainty over the application of the national 80% phosphate removal target to individual companies – for some, the target could be marginally lower. We propose an even phasing in both cost and load reduction terms between AMP8 and AMP9, but sequenced in a way that frontloads the environmental benefits. Our plan will deliver a 77% phosphate load reduction by 2035, with a small residual programme to hit an 80% reduction by 2038 if required. We have deprioritised five of our largest sites to AMP9, maximising the time available to identify and adopt more cost-effective treatment technologies. This approach will also easily accommodate a small reduction in the overall target through adoption of less stringent permit standards. See Section 3.3 for further details.

Phosphate removal can be required under several WINEP drivers[19] which require different levels of treatment to meet the associated environmental and effluent quality standards. Scope therefore exists to optimise our interventions to address multiple environmental needs, and we have designed our phosphate removal programme in this way.

A further area of choice is the role of catchment nutrient balancing (CNB) measures, in which water companies fund third parties to reduce their nutrient inputs to rivers, rather than invest in traditional end-of-pipe treatment. The contribution made by CNB is specifically excluded from the 80% Environment Act target but is often a cost-effective solution to meet WFD targets in rural areas where end-of-pipe treatment has a high unit cost. In total, we anticipate that some 8,393ha of farmland will benefit from CNB activities. Some of the CNB interventions proposed also deliver wider environmental benefits when compared to end of pipe treatment. For example, across our 13 CNB schemes we anticipate conversion of approximately 2,937ha of 'active production' farmland to grassland habitat (e.g. for wider buffer strips between farmed areas and watercourses) which will yield a monetised environmental benefit of c.£4m over 30 years when compared to equivalent end-of-pipe treatment. We consider that the efficiency and additional environmental benefits of CNB far outweigh the disbenefit of any backfilling required to meet the 80% target and will therefore be deploying CNB solutions where these are in the best interests of customers and the environment and not just simply a 'chase the numbers' solution. For context, the total phosphate load removal anticipated through AMP8 CNB schemes equates to 1% of the total Environment Act requirement.

We recognise there has been a degree of regulatory frustration over the backend loaded delivery of previous phosphate removal programmes and are taking steps to ensure this isn't repeated in AMP8. We are investing £70m through transitional expenditure on our P-removal projects to develop solutions for early commencement on site in AMP8.

We have identified 13 catchment nutrient balancing schemes within our WINEP programme (as detailed in Appendix C) which cover 71 of 632 waterbodies in our area.

[18] as set out in the government's Environment Act targets document published on the 16th December 2022
[19] Environment Act, Nutrient Neutrality, Habitats Directive, Urban Wastewater Treatment Directive, Water Framework Directive, Countryside and Rights of Way Act

River quality monitoring

This is a new duty under the Environment Act to install continuous river quality monitoring upstream and downstream of qualifying discharge points (storm overflows and WwTWs). Defra's public consultation on this closed on 23 May 2023, and they provided a draft technical guidance document outlining their proposed implementation plan on August 9. The associated WINEP driver guidance document was then issued on August 17. Defra verbally noted on August 1 that the proposed implementation approach has not been signed off by all relevant government departments and that a statutory instrument will then require parliamentary approval.

The proposed approach outlined on August 9 included the following exemptions from the monitoring duty:

- Sewage treatment works with descriptive permits;
- Storm overflows with an average activation frequency of <10 over a five-year period, based on EDM data; and
- Rivers with a permanent year round depth of <4cm.

Further guidance has also been received on the collective monitoring of discharges that are in close proximity to each other.

Defra is proposing that the AMP8 programme delivers monitoring at 25% of all qualifying discharges, with an expectation that this will also cover 50% of discharges into priority areas. For Severn Trent, monitoring at 25% of qualifying locations will not equate to 50% of priority area discharges, so there will be some scope for choice. Our proposed approach will broadly mirror our approach to delivering the storm overflow discharge reduction plan in that we will focus activity on protected areas (SSSI, SAC, Ramsar sites) and rivers where overflow spills are recorded as an RNAG. This will ensure that the monitors are in place to confirm that our overflow improvements deliver the intended water quality improvement.

2.2 Process for identifying options

The WINEP methodology requires the production of Options Development Reports (ODRs) for all major areas of investment. This includes identifying unconstrained and constrained lists of potential interventions for each type of investment.

The constrained list of options identifies every intervention that could be applicable for a site of given size and level of treatment required, and is defined through the following filters:

- Is the proposed approach compliant with legislation?
- Is it technically feasible and practical?
- Could it result in reputational damage?
- Could it result in adverse environmental impact?

Table 2.1 below contains example unconstrained options identified for delivering phosphate removal from our rivers, and the reasons why these options were excluded from our constrained options list. Please note that similar ODRs were developed for other elements of the programme, including storm overflow improvements, measures to remove ammonia, and others. This table is included as an example only.

Table 2.1: Unconstrained options for phosphate removal and reason for rejection

Option	Reason for rejection
Chemical dosing (CD) and reverse osmosis	Not technically viable – no viable disposal route for reverse osmosis plant reject stream
Injection of sewage effluent into groundwater strata	Not legal under the Groundwater Directive Adverse impact on public water supply
Transfer sewage effluent discharges from England to Wales to avoid application of the Environment Act 80% phosphate removal target	Unacceptable reputational damage Unlikely to be practical (NRW would probably refuse to issue discharge permits)
Wholesale long distance effluent transfers from freshwater to coastal waters to avoid need for phosphate removal	Environmentally catastrophic loss of flow from our rivers Reputationally damaging Adverse impact on public water supply abstractions

An example list of constrained options is provided in Table 2.2 and demonstrates we have considered a wide range of options.

Table 2.2: Constrained options for phosphate removal

Treatment option	Phosphate permit	Minimum Population equivalent	Maximum Population equivalent	Other limitations
CD only	≧1-2mg/l	250	Unlimited	1mg/l at ASP and OD 2mg/l at filter works
CD with sand filters	≧0.5mg/l	250	Unlimited	
CD with cloth media filters	≧0.2mg/l	2,000	100,000	
CD with ballasted coagulation	≧0.2mg/l	50,000	Unlimited	
CD with multimedia filter	≧0.2mg/l	2,000	100,000	
CD with conventional reed beds	≧1mg/l	250	2,000	Occasionally at larger sites
Biological nutrient removal	≧1mg/l	5,000	Unlimited	Only works on ASP or oxidation ditch
Reactive media reed beds	≧0.5mg/l	1	2,000	
Algae treatment systems	≧0.5mg/l	1	1,000	
Constructed wetlands	≧2mg/l	1	1,000	Land availability
CNB	n/a			If sufficient third-party load available, so generally offsetting small WwTWs.
Asset consolidation				Must ensure WFD 'no deterioration' at receiving watercourse.

Discharge relocation				Restrictions depend upon requirements at new discharge point.
Catchment-level permitting				Applicable to all outcomes.

The constrained list is then overlaid with site-specific constraints (e.g. land availability, site access, etc.) to determine the viable options that are taken forward for assessment at individual site level.

2.3 Maximising innovation and learning

Our AMP8 WINEP programme will build on innovation and learning gleaned from delivery of our AMP7 and Green Recovery programmes. To this end, we believe customers will benefit from the confidence gained from the following innovations through cost efficiency, faster delivery, additional amenity value, and greater certainty that interventions will deliver desired outcomes.

Storm overflow improvements

We will be drawing heavily on the learning from our Green Recovery sustainable urban drainage project in Mansfield to inform the delivery of our £1.1bn storm overflow improvement programme as part of our WINEP. Working in partnership with Mansfield District Council and Nottinghamshire County Council, we are investing £76m in nature-based solutions which will provide the equivalent of up to 58ML of traditional stormwater storage and approximately 2,000 separate interventions. While the primary objective of the Mansfield project is to provide sustainable flood resilience, the measures being employed are equally applicable to storm overflow improvements.

Rain gardens and surface water attenuation under construction – Market Place, Mansfield

We are also investigating the use of treatment options as a means of addressing the harm caused by storm overflows. As part of our Green Recovery programme, we are trialling two technologies at our Spernal Resource Recovery and Innovation Centre that have the potential to remove significant amounts of polluting material from storm discharges:

- **Cloth media filters**: already widely used as a tertiary treatment at WwTWs, which removes high levels of particulate matter, is easy to scale, and commercially ready; and
- **'Rapid radicals'**: a novel technology that is being developed in the US which uses ozone treatment to remove solids and which also provides disinfection and micropollutant removal.

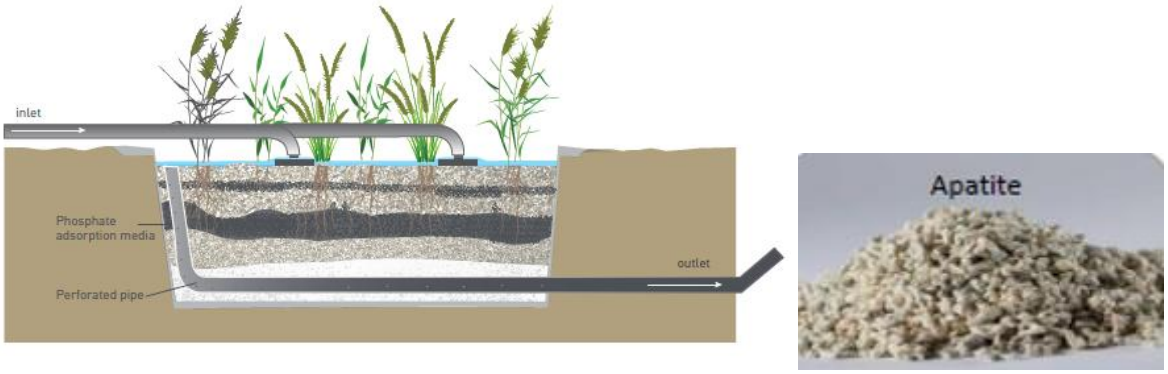
In addition, we are evaluating nature-based treatment solutions for improving, or even eliminating, storm overflows, including:

- **Aerated reed beds.** We already have 76 small WwTWs that provide full treatment to all incoming flows, operating under Combined Final Effluent discharge permits. Under this operating model, dilute storm flows in excess of conventional treatment capacity receive biological, nature-based treatment through combined reed bed systems. The combined flow is then discharged as a fully treated effluent. We are investigating options to extend this approach to more small- and medium-sized WwTWs through aerated reed beds (which provide enhanced ammonia removal over conventional reed beds) and use of reactive media for phosphate removal;
- **Wetland treatment systems.** We are planning a full-scale, nature-based wetland treatment system at Hinckley WwTW. As part of our AMP7 WINEP programme we intend to transfer

flows from Hinckley to Nuneaton for enhanced treatment but retain the storm overflow at Hinckley to avoid excessive pumping requirements. To deliver all our WINEP commitments, the proposed wetland system is being designed to treat the storm discharge to a standard sufficient to eliminate any adverse impacts on the adjacent watercourse; and

- **Reactive media reed beds.** As part of our Green Recovery Phosphate removal programme, we are installing two chemical-free, reactive media reed beds at our Hungarton and Dalbury Lees WwTWs. This novel technology uses a mineral called apatite in place of some of the traditional pea gravel used in conventional tertiary treatment reed beds. Apatite is a naturally occurring mineral that can remove phosphate through adsorption. We are also looking to the use of a modified calcite (calcium carbonate) material with similar phosphate adsorption properties. Our AMP8 phosphate removal programme contains a significant number of small, rural WwTWs where adsorption technology will offer significant advantages over conventional chemical dosing.

Reactive media reed bed and apatite



Continuous River quality monitoring

We have installed a number of river water quality monitors as part of our Green Recovery bathing rivers project. This has yielded some important learning that will inform the wider roll-out of river quality monitoring under the new Environment Act obligation, including:

- **Security of installations.** Vandalism and tampering with water quality monitors are particular challenges. Solutions such as kiosk housing design and colour selection (to blend in with local surroundings) have been investigated, together with economic viability of additional security measures such as alarms and CCTV**;** and
- **Monitor location.** River levels can differ dramatically between summer and winter, which poses a major challenge for location selection. Monitors can be placed in a bankside kiosk with pumped sample feed, or within the river itself. Each option has its advantages and disadvantages, and it is important to gather knowledge of river flow characteristics before installation to optimise sensor location.

2.4 Approach to assessing options

We have tested a range of options for this proposal through our robust options development process:

- We have followed the EA's rigorous WINEP development methodology in producing our final programme. This entailed production of 'Option Development Reports' (ODRs) for all the key elements of the programme. These reports included unconstrained and constrained lists of

interventions available to deliver an outcome (e.g. nutrient removal). These ODRs were then used to develop site specific interventions which were then captured in 'Options Assessment Reports', which captured costs and benefits of interventions. Several hundred OARs were produced in total. A sample of OARs and ODRs went through three-line assurance as part of our draft WINEP submission in November 2022;

- We fully utilised the new WINEP tiered approach to group our interventions into wider Tier 2 (area- or issue-specific) outcomes. For example, we have grouped 12 wastewater treatment works (WwTW) phosphate removal projects, as well as a catchment nutrient balancing programme, into a single WINEP action ('River Teme WFD and SSSI phosphate removal'), the outcome of which is to deliver our fair share of the phosphate load reduction required across the entire river catchment;
- In line with the WINEP methodology, viable options and their associated benefits are calculated based on the NCRAT[20] tool and methodology, which results in a quantified natural capital benefit. Through our Benefits Assessment Tool (BAT), we have extended the assessment to consider greenhouse gas impacts and customer preferences in the form of willingness to pay (WTP). This identifies our best value and least cost options and supports decisions on where additional benefits justify the selection of options that are not least cost. More detail on our approach to cost benefit is provided in Annex 2 LTDS, section 4.3;
- We have drawn upon lessons learned from delivery of previous WINEP programmes, our Green Recovery work, investigations (such as process trials undertaken under the Chemical Investigations Programme - CIP), UKWIR research, and the knowledge base within our organisation to develop this latest WINEP programme. We pre-empted national trials on enhanced phosphate removal by conducting our own research at Packington STW in 2014. The EA used data from national trials conducted in 2015/16 to set a new Technically Achievable Limit (TAL) of 0.25mg/l in July 2017, applicable to PR19 and future obligations. Our trials enabled us to adopt a similar TAL for our AMP6 investments and we now have extensive experience of building and operating enhanced phosphate removal plants to meet these very tight standards. We have also acted on knowledge gleaned from three rounds of CIP to propose zero investment solutions to a number of new hazardous chemical obligations in PR24;
- For our programme of 147 sewage works improvements delivering 154 new permit conditions (excluding stretch and flexible permitting solutions), we considered an average of three different interventions per site and took an average of two options forward for full scoping, cost and benefit assessments. In total around 450 options were considered. This doesn't include potential interventions rejected at the river quality modelling stage of the process - sites where the potential doesn't exist for an upgrade to make a material contribution towards achieving river quality targets were not included in the options assessment process; and
- For our storm overflow programme, we have assessed six different scenarios (combinations of climate change projection and population projections), combined with two solutions types (100% grey and hybrid 70:30 grey/green) applied to each project, giving a total of 12 solutions per project. Across our 562 overflow improvement obligations this equates to 4,368 options costed.

20 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1180209/Natural_Capital_Register_and_Account_Tool_-_User_Guide.pdf

Table 2.3: Climate change and population projection scenarios

Scenario	Climate Change	Growth
Adverse climate change	RCP8.5 (high)	Office National Statistic (low)
Benign climate change and benign growth	RCP2.6 (low)	Office National Statistic (low)
Adverse growth	RCP2.6 (low)	Local Plan (high)
Alternative pathway A	RCP6.0 (medium)	Office National Statistic (low)
Alternative pathway B **(Preferred option)**	RCP6.0 (medium)	Local Plan (High)
Alternative pathway C	RCP8.5 (high)	Local Plan (high)

2.5 Seeking independent challenge and robust assurance

We have sought independent challenge at every stage of this process to test the rigour of our assessment and the prioritisation of our AMP8 activities. This has included:

- Consultation with the EA and other stakeholders through a formal process governed by the standard WINEP methodology;
- Working with the EA and Natural England throughout the WINEP development to identify risks, issues and potential improvements needed;
- External, independent assurance from Jacobs to ensure correct application of WINEP driver guidance;
- Independent advice and assurance on the application of the NCRAT tool; and
- Our storm overflow improvement programme has undergone additional levels of assurance through the Drainage and Wastewater Management Programme (DWMP) process, including public consultation between July and October 2022. Our Storm Overflow Action Plan (submitted to Defra on 30 June) was also subject to rigorous assurance.

Appendix G sets out the main challenges that have been raised throughout the development of this investment case and how we have responded to them.

3. A ‘no and low regrets’ strategy for the long term

In Annex 2 LTDS, we set out our single adaptive Long Term Delivery Strategy. It provides details of our approach, the building blocks of our core pathway, details of how that has been shaped by customers, stakeholders and our Board and the evidence to show that it is no or low regrets investment against a wide range of plausible futures.

In this section we provide the specific evidence to show how we have applied adaptive planning principles described in Annex 2 to this investment case and how this investment meets the definition of no-regrets investment choices.

In summary: All (except the additional storm overflows) of the investment in this case is statutory by 2030 and therefore meets the definition of no regrets. The only WINEP driver that is sensitive to the Ofwat common reference scenarios is the storm overflows programme and we have modelled the optimum programme under all plausible futures to ensure our proposed investments remain the best value across all 8 of Ofwat’s common reference scenarios.

3.1 Our long-term ambition

Our long-term ambitions are to ensure we take waste safely away and create a thriving environment. The investment planned within this business case will help ensure we continue to meet these aims.

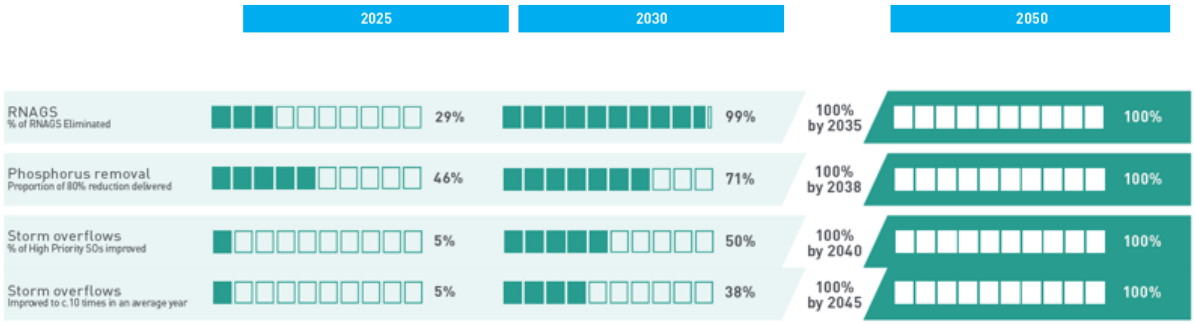
In July 2022 we launched five river pledges to improve river water quality by 2030.

Figure 3.1: River Pledges

Our river pledges are a steppingstone to our long-term ambition borne out in our Strategic Direction Statement.

Some aspects of the programme have clear long-term regulatory targets as defined in the Environment Act (for example an 80% phosphate load reduction by 2038 across the UK (compared to a 2020 baseline)). The graphic below shows our journey towards meeting our long-term ambitions for key programme elements.

Figure 3.2: Long-term ambition



The main area where our ambition goes faster than government targets is on overflows. The SODRP sets a trajectory for delivery of the 'eliminate harm' and 'less than 10 spills' requirements. This sets both a general set of milestones applicable to all storm overflows, and a trajectory that is specific to defined high-priority storm overflows. Figure 3.3 shows Severn Trent's proposed delivery trajectory, and Table 3.1 compares it to the SODRP targets and gives an estimated investment per AMP. These reflect our ambition to deliver all high priority area improvements by 2040 and to reduce all overflows to fewer than 10 spills per annum by 2045, five years ahead of the Government's targets.

We have a relatively high proportion of overflows within Defra's priority areas, delivering the improvement trajectory set out for these areas will put us ahead of overall improvement rate. In Appendix A we explain why we think this is necessary and in line with customer and stakeholder views.

Figure 3.3: Severn Trent delivery trajectory

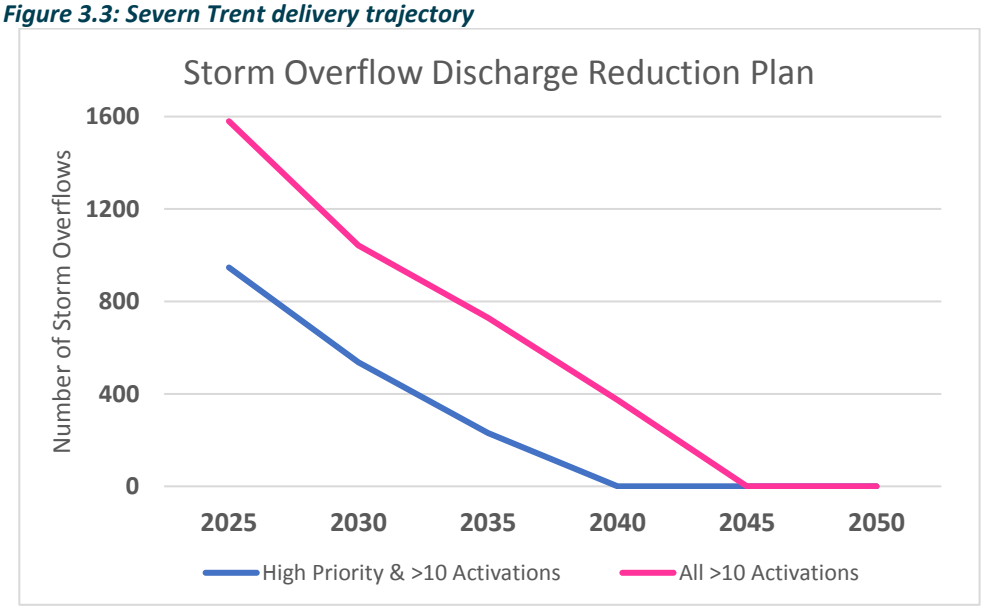


Table 3.1: SODRP trajectory vs. Severn Trent delivery trajectory

Year	High-priority storm overflows improved		Total storm overflows improved	
	SODRP target	Our trajectory	SODRP target	Our trajectory
2025	0%	5%	0%	5%
2030	38%	50%	14%	38%
2035	75%	79%	28%	57%
2040	87%	100%	52%	78%

2045	100%	100%	76%	100%
2050	100%	100%	100%	100%

3.2 Approach to creating our strategy

To identify the best strategy to meet our long-term ambitions we applied the adaptive planning principles set out in Annex 2 LTDS. The first step was to consider the degree to which this investment is sensitive to the Ofwat common reference scenarios (CRS) and any other drivers of uncertainty. We did this for the main sub-programmes as shown in table 3.2. This assessment concluded that for all components of the WINEP except storm overflows the investment choices are not influenced by the factors in the CRS, therefore all eight CRS assume the same investment programme. For storm overflows we created an alternative pathway which identified the optimum programme that would best meet the future described by the CRS.

Table 3.2: Assessment of uncertainty

Enhancement investment areas	Type of investment	Degree of Uncertainty (H,M,L)	Sensitivity to Ofwat common reference and bespoke scenarios					robustness of data to understand relationship	Decision support needed
			Climate change	Tech-nology	Growth	Environ-ment	Other		
Storm overflows	Statutory	H						High	Yes
P-reduction	Statutory	H							No
Ammonia and BOD removal	Statutory and Statutory Plus	H							No
Chemical removal	Statutory	H							No
Flow monitoring and emergency overflow monitoring	Statutory	H							No
Nitrate removal trials	Statutory	H							No
River quality monitoring	Statutory	H							No
WINEP investigations	Statutory	H							No

3.3 Creating our no-regrets core pathway

We are confident that the core pathway represents no regrets investment for the following reasons:

- The investment included in this case (excluding the £100m for accelerated storm overflow improvements) has been confirmed by the EA as being statutory by 2030 and therefore by definition is no regrets;
- As shown in Section 2 we have considered a wide range of options, which have been assessed using robust cost/benefit analysis, so we are confident we have identified the best possible solution;

- We have considered the impact of future changes in legislation but do not consider this to be certain enough to include in our core pathway;
- We have considered possible future changes to legislation and potential tightening of standards where possible in our optioneering by, for example, embracing the use of modular solutions which would allow us to 'bolt-on' treatment processes rather than redesign them; and
- There was consensus between all consulted parties that this investment is no regrets.

3.4 Adaptive pathway

Annex 2 LTDS describes how we have identified and created the adaptive pathways. The table below explains what we have assumed for this investment in our three alternative pathways.

Table 3.3: Adverse Climate Triggered Change Pathway

	By 2030	By 2035	By 2040	By 2045	By 2050
Assumptions	The statutory plan has been set for AMP8 and no changes are expected.	The sizing and scope of our overflow solutions may increase due to more intense rainfall.	The sizing and scope of our overflow solutions may increase due to more intense rainfall. There will be improved predictive flood and pollution forecasting.	The sizing and scope of our overflow solutions may increase due to more intense rainfall. There will be improved predictive flood and pollution forecasting.	The sizing and scope of our overflow solutions may increase due to more intense rainfall. There will be improved predictive flood and pollution forecasting.
Monitoring	We will use our Event Duration Monitors (EDM) to understand overflow performance and potential climate change impacts to see how this may impact future solution scope and sizes of our storm overflow programme. We will monitor UK climate change reports (UKCP 2028) to see if new data should be fed into our modelling.				
Trigger/Decision Points	New climate information or EDM data will trigger analysis to inform PR29 solutions				
Enabling Investment within this case	None				

Table 3.4: Societal Shifts Pathway

	By 2030	By 2035	By 2040	By 2045	By 2050
Assumptions	The statutory plan has been set for AMP8 and no changes are expected.	We will invest in line with our Storm Overflow Discharge Reduction Plan.	We will invest in line with our Storm Overflow Discharge Reduction Plan.	We will invest in line with our Storm Overflow Discharge Reduction Plan. There will be improved predictive flood and pollution forecasting based on societal demand and increased use of nature-based solutions.	We will invest in line with our Storm Overflow Discharge Reduction Plan. There will be improved predictive flood and pollution forecasting based on societal demand and increased use of nature-based solutions.
Monitoring	We will continue to work in cross-sector working groups to understand societal shift and likely policy changes resulting from this. Through our media scraping and customer engagement we will track customer views on the progress we are making against our targets to inform any future changes in pace or sequencing.				
Trigger/Decision Points Monitoring	The introduction of new legislation resulting from societal shift will inform our PR29 plan				
Enabling Investment within this case	None				

Table 3.5: Government-Led Legislative Future Pathway

	By 2030	By 2035	By 2040	By 2045	By 2050
Assumptions	The statutory plan has been set for AMP8 and no changes are expected. Our plan includes investigations and trials to inform possible future legislation.	New requirements for nitrate and/or hazardous substance removal will come into force. We will continue to deliver our Environment Act targets for	Improved monitoring and construction materials will be available. We will complete our Environment Act targets for 80% phosphate	Improved monitoring and construction materials will be available.	Improved monitoring and construction materials will be available.

		80% phosphate removal.	removal by 2038.		
Monitoring	The outcomes of our AMP8 investigations and trials, e.g. chemicals investigation programme and nitrate removal trials will inform future AMPs; We will monitor the efficiency and wider environmental benefits gained from our nature-based solution and catchment initiatives to inform any future trial programmes; and We will continue to work in cross-sector innovation groups to understand the best ways of achieving Technical Achievable Limits for phosphate at a large scale as our Environment Act-driven 80% phosphate removal programme must be completed by 2038.				
Trigger/Decision Points	The introduction of new legislation will inform our PR29 plan .				
Enabling Investment within this case	Our plan includes £7m for nitrate and chemical investigations and £32m for nitrate removal trials. These are statutory but also essential to inform future investment.				

Conclusion:

We know all the statutory elements are no regrets because the requirements all have to be completed by 2030. We consider the additional £100m on additional storm overflows is low regrets because it is statutory within the 2050 timeline, under the adverse common reference scenarios for climate change they would be optimal investments to make in AMP8 and given their low unit costs they are always the overflows that get selected in any optimisation process.

4. Summary of the 'no-regrets' investment for AMP8

4.1 Overall AMP8 WINEP programme

Our AMP8 WINEP programme for wastewater has now been finalised with the EA. There are no outstanding issues to be resolved, with the exceptions of the river monitoring duty and our proposal to upsize our storm overflow improvement programme. The WINEP spreadsheet issued on September 1 includes the outcome of the EA's options assessment process, and actions are only confirmed when this process has confirmed the need and agreed the solution.

Column Heading	Purpose of Column
Options_Assessment_Outcome	To capture the outcome of the options assessment undertaken by the EA on the preferred option submitted by WC. Please assign 'Proceed' once you are happy the Action has passed the Options Assessment stage AND once there is sufficient mandatory information for the Action populated within this spreadsheet.

The WINEP spreadsheet states that the following categories are used by the EA in the Options Assessment Outcome column:

- 'Proceed';
- 'Proceed to stage 1' (for A-WINEP actions);
- 'Pending' (decision is still pending for the proposed option); and
- 'Reject Option' (environmental risk/issue to be resolved; option(s) proposed are not suitable).

Every line in the WINEP spreadsheet covered by this business case is marked as 'Proceed', denoting that the need for action is confirmed, the preferred option has been accepted and the WINEP spreadsheet has been completed correctly, and this is the trigger for the actions being classed as statutory obligations.

As all the measures contained within the WINEP have been agreed and confirmed with the EA, we consider this to be a 'no regrets' programme. Together with the EA we have sought to ensure that where uncertainty over the need to invest exists, measure were included on the WINEP drafting spreadsheet as potential AMP9 interventions, to be further considered at PR29.

Our programme has a strong focus on delivering storm overflow and sewage effluent quality improvements (primarily phosphate removal) driven by the new Environment Act. Table 4.1 below summarises the main areas of investment.

Table 4.1: Severn Trent AMP8 WINEP programme (wastewater)

WINEP driver	AMP8 activity	Capex	Opex	Totex	Benefit
Storm overflow improvements	Improve 562 storm overflows.	£1,112m	£1m	£1,113m	1,868km of river benefitting from reduced storm overflow activations.

Phosphate removal	Introduce/enhance phosphate removal at 124 sites. Deliver 13 catchment nutrient balancing schemes.	£647m	£36m	£683m	1,375 km of river benefitting from nutrient load reduction.
Ammonia and BOD removal	Introduce/enhance ammonia or BOD removal at 42 sites.	£209m	£5m	£215m	339 km of river benefitting from sanitary load reduction.
Chemical removal	Introduce new chemical removal permit limits at 47 sites (65 obligations).	£79m	£2m	£81m	Prevention of deterioration.
Flow monitoring and emergency overflow monitoring	Install 149 flow to full treatment (FFT) monitors. Install monitoring at 324 emergency overflows.	£56m	£1m	£57m	Certified FFT compliance monitoring. Extend overflow monitoring to pumping station emergency overflows.
Nitrate removal trials	Deliver three nitrate removal technology trials.	£31m	£1m	£32m	Inform options to meet future nutrient standards.
River quality monitoring	Install c.1,000 river quality monitors.	£108m	£19m	£127m	Deliver our Environment Act obligation
Future hazard investigations	Investigate hazardous chemicals, antimicrobial resistance, microplastics and nitrate in lakes and reservoirs.	£7m	0	£7m	Improve understanding of hazardous chemicals and options to address.
Total		**£2,249m**	**£66m**	**£2,315m**	

In the remainder of this section, we detail the key AMP8 activities for each of the WINEP drivers for wastewater.

4.2 Storm overflow improvements

Storm overflows exist to provide surcharge relief on combined sewers, so that excess flows from heavy rain do not cause foul flooding to property.

The Environment Act places a legally binding duty on water companies to progressively reduce the adverse impacts of discharges from storm overflows. There are three core requirements of the SODRP[21] that are applicable to Severn Trent:

1. **Eliminate harm.** Water companies will only be permitted to discharge from a storm overflow where they can demonstrate that there is no adverse ecological impact (WINEP driver code EnvAct_IMP2);

[21] Storm overflows discharge reduction plan

2. **Fewer than 10 spills.** Storm overflows will not be permitted to discharge above an average of 10 rainfall events per year by 2050[22] (WINEP driver code EnvAct_IMP4); and
3. **Screening.** Water companies will be required to ensure all storm overflows have screening controls (WINEP driver code EnvAct_IMP5).

A fourth requirement, relating to storm overflows discharging in or close to bathing waters, is not currently applicable in our region. We only have one designated bathing water, Colwick Lake in Nottingham, into which no storm overflows discharge. We are making voluntary improvements to 25 storm overflows within our region as part of our Green Recovery bathing rivers programme, and the requirements of the SODRP will become applicable if our work on these undesignated bathing rivers (the Leam/Avon and the Teme) leads to formal designations. We have not proposed further overflow improvements in AMP8 specifically to meet bathing water standards but our programme will deliver incidental benefits to some undesignated rivers with known recreational usage.

Within the Severn Trent region, we have 2,466 storm overflows. Our investigations to date have identified 1,669 storm overflows spilling more than 10 times per year, projected to rise to 1,724 by 2050 due to the impacts of climate change and population growth. A total of 1,073 overflows (rising to 1,114 by 2050) are defined as high priority based on EA/Defra guidance as set out in the table below (note that in the table overflows that fit into more than one priority area are counted more than once. Totals are also just those that will require improvement). In addition, there are a small number of storm overflows that spill fewer than 10 times per year but will require improvement to eliminate harm to the environment.

Table 4.2: Defra categories of high-priority storm overflow[23]

Category	Description	Commentary
RNAGs	Where sewage intermittent discharges are identified by the EA as the confirmed or probable Reason for Not Achieving Good Status (RNAGs).	638 sites across 83 waterbodies, identified as RNAG due to intermittent discharges through data from the EA.
SOAF Sites	Where sites have been identified as having an environmental impact following Storm Overflow Assessment Framework (SOAF)[24] investigations, as defined by the PR24 WINEP driver guidance definition of adverse ecological impact[25].	76 sites identified following Stage 2 SOAF investigations that found the storm overflow causes an environmental impact.
SSSI	Where the storm overflow discharges into or within 50m of a Site of Special Scientific Interest (SSSI), as defined by the PR24 WINEP driver guidance definition of harm.	40 sites identified through geographic information system (GIS) analysis.

[22] Note that while there is a high degree of commonality between the first and second targets, there are a small number of storm overflows where a spill reduction to well below an average of 10 per year is required to eliminate harm.

[23] We have included only categories with application to the Severn Trent region. SODRP also gives definitions for high priority storm overflows into chalk rivers, shellfish water, coastal bathing waters, and inland bathing waters.

[24] Environment Agency, 2018. Storm Overflow Assessment Framework, Version 1.6

[25] No local adverse ecological impact means achieving the UPM FIS for ammonia and dissolved oxygen and the UPM 99 percentile standards at point of mixing and critical location (e.g. lowest point of dissolved oxygen sag) downstream of the discharge point.

SAC, SPA, Ramsar	Where the storm overflow discharges into or within 50m of a Special Area of Conservation (SAC), Special Protection Area (SPA) or Ramsar water feature, as defined by the PR24 WINEP driver guidance definition of harm.	25 sites identified through GIS analysis.
Eutrophic Sensitive Area	Where the storm overflow discharges into or within 50m of a Eutrophic Sensitive Area, as defined by the PR24 WINEP driver guidance definition of harm.	672 sites identified through GIS analysis.

AMP8 activities

Our AMP8 programme comprises a total of 562 storm overflow improvements. This includes 198 additional improvements over and above the 364 listed in our final WINEP (as per our letter to the EA of May 15 proposing an expanded programme).

The bulk of our WINEP programme is made up of improvements to simultaneously eliminate harm and to reduce spill frequency to fewer than 10 per year. In a limited number of circumstances, we have opted to address only the harm element in AMP8, with further improvements to reduce spill frequency in subsequent investment periods. This approach has been adopted in a few very large urban catchments, where we anticipate needing a 10-year programme of surface water separation and other blue/green interventions to yield the optimum balance between traditional (i.e. concrete storage tanks) and non-traditional measures such as rain gardens. For all overflows where a spill reduction improvement is proposed, 6mm aperture screening will also be provided (where not already installed) to meet the terms of the SODRP (expressed through the WINEP EnvAct_IMP5 driver requirement).

The remaining 12 overflows within our confirmed WINEP are at sites outside the Defra priority areas. These have been selected and included due to their synergies with the wider DWMP programme, or because the associated WwTW is to receive significant investment in AMP8 under other drivers, presenting opportunities for cost efficiencies.

Within this programme we have identified three overflows where the proposed 'eliminate harm' upgrade will also be designed to meet bathing water standards. These are all at small sewage works that discharge upstream of a popular (but as yet undesignated) amenity area on the River Dove at Dovedale in the Derbyshire Peak District.

All the drivers assigned to the storm overflow programme are statutory, with the exception of BW_IMP4 which is non-statutory. We have not assigned any costs to this non-statutory driver as the outcome will be delivered by the solution required to meet the statutory requirements.

Table 4.3: Breakdown of the AMP8 storm overflow programme

Outcome	Primary Driver	Other Drivers	Number
Eliminate harm and reduce to <10 spills pa	Env_Act_IMP2 – Eliminate Harm	Env_Act_IMP4 - <10 spills pa Env_Act_IMP5 - provide screen	325
Eliminate harm, reduce to <10 spills and meet bathing river standard	Env_Act_IMP2 – Eliminate Harm	Env_Act_IMP4 - <10 spills pa BW_IMP4 – improve non-designated bathing waters	2
Eliminate harm and meet bathing river standard	Env_Act_IMP2 – Eliminate Harm	BW_IMP4 – improve non-designated bathing waters Env_Act_IMP5 – provide screen	1

Eliminate harm, reduce to <10 spills pa and eliminate impact on SSSI	Env_Act_IMP2 – Eliminate Harm	SSSI_IMP – improve SSSI Env_Act_IMP4 - <10 spills pa	1
Eliminate harm only	Env_Act_IMP2 – Eliminate Harm	Env_Act_IMP5 – provide screen	23
Reduce to <10 spills only (already in WINEP)	Env_Act_IMP4 - <10 spills pa	Env_Act_IMP5 – provide screen	12
Reduce to <10 spills only (proposed addition to WINEP)	Env_Act_IMP4 - <10 spills pa		198
Total			**562**

Our AMP8 programme is targeted on four of the high-priority areas identified by Defra: RNAG, SOAF, SSSI, and SAC/SPA/Ramsar. These are the areas for which we have the greatest evidence of harm being caused, or they are protected areas where the propensity for harm to be caused is greatest. We have included a small number of storm overflows that are not within these areas, where this ties in with other planned AMP8 investment at the site. The remaining high priority area (eutrophic rivers) will be the focus for AMP9, as overflows are not a material cause of eutrophication.

We have shared our plans to accelerate 198 storm overflow improvements with the EA and Defra who understand the need and have not raised any concerns.

4.3 Phosphate removal

Phosphate is the main driver of eutrophication (excess algae growth) in freshwater systems. Addressing this issue is therefore one of the largest component parts of our WINEP programme.

Since PR14, Severn Trent has implemented a systematic, catchment-based approach to address our fair share of the phosphate challenge (which is shared with other stakeholders, including the agricultural community). Our initial focus has been on rivers where phosphate loads from WwTWs were the major contributor to poor water quality, and where end-of-pipe treatment was the only viable options for delivering our fair share of the required load removal. Our systematic 'source to estuary' approach builds on previous rounds of UWWTR driven phosphate removal such that, since 1998 (when our first six phosphate removal plants came online), we have delivered an 80.5% decrease in the phosphate load discharged from our WwTWs.

The Environment Act now requires an 80% phosphate load reduction by 2038 across the UK, compared to a 2020 baseline[26]. Taken in combination with the 80.5% already achieved, this means that by 2038 we will have reduced our overall phosphate load by 96%, compared to the 1998 start point. The statutory nature of the Environment Act target means that this has become the primary driver for phosphate removal in the WINEP programme. The EA has instructed that delivery of this Environment Act obligation must seek to maximise environmental benefits, rather than simply target the largest WwTWs with the largest phosphate loads, so we must also take into account phosphate removal requirements driven by other legislation, namely:

- Conservation of Habitats and Species Regulations;
- Levelling Up Act (Nutrient Neutrality), assuming the legislation is duly approved;
- Water Framework Directive, where measures are cost beneficial; and
- Countryside and Rights of Way Act (SSSIs), where measures are cost beneficial.

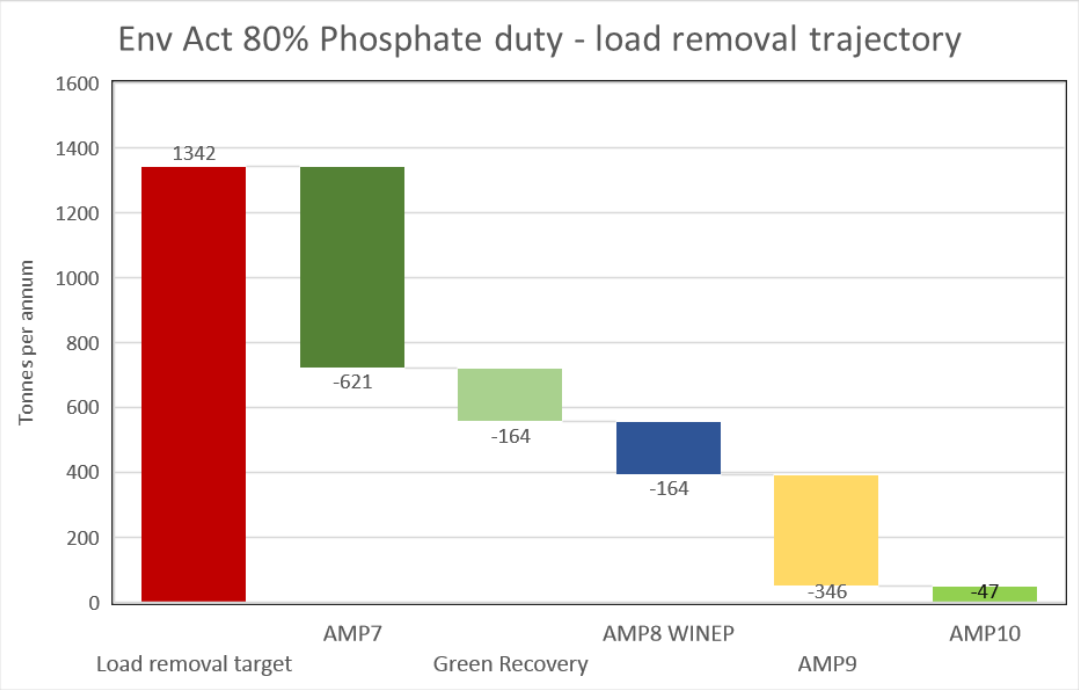
[26] As set out in the Environment Act targets document, published on 16 December 2022.

The 80% phosphate removal target is a national objective and not necessarily specific to water companies. While the EA has stated that delivery of this target will be assessed on the basis of 'at permit' 2020 baseline load (i.e. the maximum load that could be discharged by WwTWs while remaining compliant), not actual performance, it has not yet published a detailed methodology that sets out company-specific targets or measurement of the delivery of this duty.

Indicative SAGIS[27] modelling provided by the EA, supplemented with our own calculations and data corrections, indicates that Severn Trent must reduce the total phosphate load discharged from our WwTWs by 579 tonnes per year, after completion of the AMP7 WINEP programme. However, delivery of this target would only equate to an approximate 72% reduction of our calculated 2020 baseline position of 1,678 tonnes being discharged per year.

We have therefore decided to plan on the basis of the 80% national target being applied directly to Severn Trent, which equates to a total phosphate load reduction from our 1,678 tonnes baseline of 1,342 tonnes per year. The trajectory set out in Figure 4.1 below shows a proposed glide path to deliver a 77% reduction by the end of AMP9, with a small residual programme in AMP10. Our central estimate of the total load removal required is 77%, being the mid-point between the original data supplied by the EA and the target in legislation. We have planned to have both the cost and phosphate load reductions (taking our Green Recovery programme into account) evenly paced to 2035 to achieve the 77% target. The uncertainty over how the 80% target will be translated into company specific targets is expected to be marginal (c.+/-3%) and will be managed through minor scope changes to AMP9 solutions (i.e. slightly laxer permit conditions, not material changes in scope) or a modest programme in the first three years of AMP10 (which is likely to be a programme of asset optimisation rather than significant investment), as appropriate.

Figure 4.1: Phosphate load removal trajectory, AMP7 - AMP10



[27] The Source Apportionment Geographical Information System (SAGIS) is a digital information management and visualisation platform which serves as an integrated system for modelling water quality in rivers and lakes.

In line with EA guidance and customer feedback (see Section 1.2), we have sought to frontload the environmental benefits of our phosphate removal programme. We will deliver 124 projects in AMP8, with 1,375km of rivers benefitting from reduced phosphate inputs. In AMP9, we have identified eight major projects that will deliver 346 tonnes of phosphate load reduction per year and benefit 233km of rivers. These eight WwTWs are all within the River Tame and lower River Trent catchment area and include five of our 10 largest sites. Phasing these sites into AMP9 will maximise the time available to identify and adopt more cost-effective treatment technologies for meeting the most stringent standards at very large WwTWs.

The way in which we have structured our approach to meeting the Environment Act target means that, for every £1m invested in AMP8, approximately 2km of river will benefit. This is projected to fall to 0.33km of river per £1m in AMP9, hence our decision to leave some of our largest individual phosphate projects to AMP9 while we continue to investigate more cost-effective process technologies.

In the table below we have broken down our AMP8 phosphate programme into its component parts and summarised the agreed intervention and outcome. Virtually all of these projects have multiple drivers (e.g. Env_Act_IMP1 will also deliver WFD_IMPg objectives).

Not every obligation will require investment to deliver the required outcome. We have identified 11 sites where additional load removal requirements should be achieved through optimisation of existing assets, some of which are still being delivered in AMP7. We have agreed with the EA to apply 'stretch permit' conditions via operating technique agreements rather than propose further investment. We also have 24 new Urban Wastewater Treatment Regulations obligations, but in every case the required treatment standard is met (or exceeded) through historic or ongoing investment to meet WFD objectives. All 24 are therefore just a desktop re-permitting exercise.

Table 4.4: Breakdown of the AMP8 phosphate programme

Primary Driver	Driver description	Driver status	WINEP Agreed Action	Number of obligations	WINEP Outcome
Env_Act_IMP1	Environment Act 80% phosphate removal	Statutory	Named sites New or amended permit condition	95	P-load reduction
HD_IMP HD_IMP_NN	Habitats Regulation Improvement Levelling Up and Regeneration Act Nutrient Neutrality	Statutory	Named sites New or amended permit condition	7	P-load reduction
HD_IMP	Habitats Regulation Improvement	Statutory	Named site Relocate discharge point	1	Local river benefit but no company level P-load reduction
HD_IMP	Habitats Regulation Improvement	Statutory	Catchment Nutrient Balancing in a named catchment	2	P-load reduction
SSSI_IMP	SSSI improvement	Statutory (measures passed CBA)	Named sites New or amended permit condition	5	P-load reduction
SSSI_IMP	SSSI improvement	Statutory (measures passed CBA)	Catchment Nutrient Balancing in a named catchment	5	P-load reduction
WFD_IMPg WFD_IMP_MOD	Improvement to meet WFD objective	Statutory (measures passed CBA)	Works closure or discharge relocation named sites	3	Local river benefit but no company level P-load reduction

WFD_IMPg	Improvement to meet WFD objective	Statutory (measures passed CBA)	Catchment Nutrient Balancing in a named catchment	6	P-load reduction
WFD_IMPg	Improvement to meet WFD objective	Statutory (measures passed CBA)	Stretch permit conditions at named sites	11	P-load reduction with existing assets – nil cost
WFD_IMPg	Improvement to meet WFD objective	Statutory (measures passed CBA)	Named sites New or amended permit condition	1	P-load reduction
WFD_ND	WFD no deterioration	Statutory	Named sites New or amended permit condition	3	No P-load increase
U_IMP1 U_IMP2	UWWTR – new qualifying discharge UWWTR – new sensitive area designation	Statutory	Named sites Permitting exercise only	24	Nil Cost - required standards already met through historic/ongoing investment

Of the 111 sites where new limits are being applied, 36 have existing, laxer P-limits in place. The vast majority of these are on sites where the new permit limit required is sub-0.5mg/l. Most of these existing permits are historic, applied under UWWTR (and based on population served not environmental need) or are pre-AMP6 limits set in accordance with a much higher TAL. This does mean that expressing costs as a function of load removed can make projects that are delivering low P-solutions look considerably more expensive than laxer 'first time' P-removal projects.

Permit limit range	Number of sites	Sites with existing P-limits
1mg/l or greater	48	2
0.5mg/l> <1mg/l	29	9
<0.5mg/l	34	25

4.4 Ammonia and biochemical oxygen demand (BOD) removal

The EA has introduced a new requirement in AMP8 for water companies to upgrade all septic tank-only treatment works that discharge to surface waters to include secondary (biological) treatment. We have identified 13 such sites within our region, and our preferred solution for all 13 is to provide a nature-based wetland treatment system. In terms of both cost and benefit, there was an extremely marginal difference between the nature-based solution and a conventional alternative. Given that these 13 sites are mostly in remote, rural areas we have favoured this intervention on the basis of expert judgement around long-term sustainability.

Modelling work has also identified 22 sites where enhanced ammonia removal is required to deliver Water Framework Directive good status objective and eliminate our WwTWs as an RNAG. In one instance the ammonia improvement project will also deliver WFD BOD/dissolved oxygen improvement to good status.

Modelling has also identified five sites where population growth (that will not result in exceedance of existing works permit limits) could result in a downstream water quality deterioration. In such circumstances, the EA is required to tighten the historic quality standard to prevent deterioration from occurring.

One final BOD improvement will be delivered as an incidental benefit to a phosphate improvement project. This is because the agreed intervention to address the nutrient issue is to move the discharge to an alternative watercourse.

Table 4.5: Breakdown of the AMP8 ammonia and BOD programme

Primary Driver	Driver description	Driver status	WINEP Agreed Action	Number of obligations	WINEP Outcome
U_IMP7	Upgrade Septic Tank sites to secondary treatment	Statutory	Named sites Provide secondary treatment	13	Improved water quality
WFD_IMPg	Ammonia improvement	Statutory (measures passed CBA)	Named sites Amended permit condition	22	Improved water quality
WFD_IMPg	BOD improvement	Statutory (measures passed CBA)	Named Sites Effluent discharge relocation	1	Improved water quality
WFD_IMPg	Combined Ammonia and BOD improvement	Statutory (measures passed CBA)	Named sites Amended permit condition	1	Improved water quality
WFD_ND	No deterioration (ammonia)	Statutory	Named sites Amended permit condition	5	Safeguard river quality

Note that four of these projects are combined phosphate and ammonia/BOD removal projects. Where this is the case 'primary driver' refers to the driver that is specific to the sanitary determinand element of the project and not the primary driver as it appears in WINEP. In all four cases the primary driver in WINEP relates to the phosphate removal element.

4.5 Hazardous chemical removal

Based upon data generated from Phases 3 and 4 of the Chemical Investigations Programme (CIP) 2 (2015-20) and further data generated under CIP3, the EA has identified the need to include 65 hazardous chemical obligations in WINEP, the majority of which are to prevent deterioration in river quality. We have carefully assessed these proposed limits and determined that, for all except three sites, we are in a position to comply with the proposed limit using our existing assets and without taking on undue/unmanageable permit compliance risks. For the three sites where intervention is proposed, the need to invest has been accepted by the EA through the WINEP review and assessment process, with the obligations marked as 'proceed' in the final WINEP. Table 4.6 below gives an overview of the interventions required to meet our chemical removal obligations in AMP8.

Table 4.6: AMP8 chemical removal interventions

Substance	Number of obligations	Approach
PFOS (perfluorooctanosulphonate)	22	Operating Technique Agreements added to permits for addition of PFOS to final effluent sampling programme.
Cypermethrin (no deterioration/load standstill)	15	No investment required: accept new permit conditions and manage compliance risk. Almost all these sites upgraded in AMP6/AMP7/Green Recovery for phosphate removal. Upgrades implemented are compatible with cypermethrin removal.

Cypermethrin (improvement)	7	Flexible permit conditions, optimise and monitor assets being delivered in AMP7. No investment proposed.
Metals (dissolved zinc, nickel, copper, total cadmium)	18	No intervention required: Sites can meet required limits without undue compliance risk, or a proposed AMP7 intervention will remove need for the limit.
Dissolved zinc	2	Intervention required (Bromsgrove and Armthorpe WwTWs): Investment in activated carbon tertiary treatment proposed.
Dissolved nickel	1	Intervention required (Coventry WwTW): Investment in activated carbon tertiary treatment proposed.

Residual risks at sites where no investment is proposed will be managed through trade effluent management and other 'control at source' interventions. Processes are being put in place in AMP7 to enhance our capability to trace and control inputs of these chemicals into our sewerage system to minimise the need to invest in enhanced treatment. We have also instigated a programme of monitoring at these sites to identify any changes in compliance risk and facilitate interventions to address them.

The EA has identified seven sites where an improvement is required to reduce levels of cypermethrin. In all cases, we have agreed with the EA to implement a flexible permitting arrangement that removes the need to make investments at these sites in AMP8. All seven sites are included in our AMP7 or Green Recovery programmes for enhanced phosphate removal, and the solutions being implemented will also deliver significant reductions in cypermethrin. Under the terms of the flexible permitting approach, the performance of these new assets will be monitored in AMP8 to determine whether sufficient cypermethrin has been removed to meet the needs of the receiving river. Where this is not the case, the need for further improvement will be considered at PR29.

The flexible permitting approaches for hazardous chemicals were co-developed by the water sector and the EA, by a group chaired by Severn Trent, with the specific intent of protecting customers and companies from the uncertainties that arise from the imposition of new chemicals limits. The permitting approach being deployed at these seven cypermethrin sites is designed to address situations where sites being upgraded with enhanced treatment technology in the current investment cycle are identified for potential chemical enhancement in the next. We are firmly of the view that the performance of new assets should be assessed before any further investment is proposed so we designed and championed a permitting approach that allows this to happen.

Table 4.7: Breakdown of the AMP8 hazardous chemical programme

Primary Driver	Driver description	Driver status	WINEP Agreed Action	Number of obligations	WINEP Outcome
WFD_NDLS_Chem2	No deterioration/ load standstill (PFOS)	Statutory	Named sites OTA agreement – PFOS monitoring	22	Regulatory final effluent monitoring
WFD_NDLS_Chem1 WFD_NDLS_Chem2	No deterioration/ load standstill (cypermethrin)	Statutory	Named sites No intervention – accept new permit condition	14	Prevent deterioration
WFD_ND_CHEM3	No Deterioration (cypermethrin)	Statutory	Named site Amend permit conditions	1	Prevent deterioration by preventing flow increase (nil cost)

WFD_IMP_CHEM	Chemical Improvement (all cypermethrin)	Statutory (measures passed CBA)	Named sites Flexible permitting agreement	7	Optimisation of assets being provided in AMP7
WFD_NDLS_Chem1 WFD_NDLS_Chem2	No deterioration/ load standstill (assorted metals)	Statutory	Named sites No intervention – accept new permit condition	18	Prevent deterioration
WFD_NDLS_Chem1 WFD_NDLS_Chem2	No deterioration/ load standstill (assorted metals)	Statutory	Named sites Intervention required for new permit condition	2	Prevent deterioration
WFD_ND_CHEM3	No deterioration (nickel)	Statutory	Named sites Intervention required for new permit condition	1	Prevent deterioration

4.6 Other programme elements

Flow to full treatment monitoring and emergency overflow monitoring

Flow to Full Treatment (FFT) monitoring is the continuation and completion of a programme that started in AMP7. In AMP7, 203 investigations are being undertaken (of which 200 are now complete) to determine whether existing flow monitoring equipment could be certified for the purpose of FFT compliance monitoring. These investigations primarily covered sites where existing dry weather flow meters are at the back end of the works, but also covered some uncertified equipment installed at works inlets. The outcome of these investigations is as follows:

- 28 sites – The 'back-end' flow meter is suitable. No further action required in AMP8;
- 26 sites – Existing 'front end' meter is suitable and certified in AMP7. Change to reporting frequency (15-minute to two-minute interval) required in AMP8; and
- 149 sites – Existing meters cannot gauge FFT compliance. New flow meter assets required.

Provision of these 149 flow meters will be more expensive that the corresponding AMP7 programme (from a unit cost perspective). This is because the investigation programme was directed at sites where existing dry weather flow compliance meters are at the back end of the works and so the likely outcome was investment in new assets at the works inlet. The AMP7 upgrade programme was focused on sites where existing certified flow meters were already at the works inlet, so any further investment was likely to be significantly lower by comparison. See Section 5 cost robustness and efficiency for more detail.

In addition, the EA has decided that the required reporting frequency of FFT monitors installed under the U_MON4 driver in AMP7 should be increased from every 15-minutes to every two-minutes. This requires a very minor modification and is captured as an obligation in WINEP.

As part of the Defra acceleration programme, we are committing to the early delivery of 69 of these 149 FFT monitors by March 2025, with the remainder to be operational by no later than December 2026.

The EA has also introduced a new duty to provide event duration monitoring (EDM) on emergency overflows at sewage pumping stations and WwTW inlet pumping stations. This new duty has two components:

- Provision of EDMs on all emergency only overflows at pumping stations. We have 768 such overflows that will need to be fitted with event monitors; and
- Provision of certified flow meters at pumping stations permitted for both storm and emergency overflows, to enable differentiation between storm and emergency discharge events. We have 523 pumping stations in this category, all of which already have EDMs in place.

We were advised by the EA on August 17 that 75% of this duty to monitor emergency overflows (75% of 768 EDM's and 75% of 523 flow meters) should be deferred out of AMP8 to help mitigate the impact of WINEP on customer bills. We have complied with this request and the numbers in the table below reflect this instruction.

Table 4.8: Breakdown of the AMP8 flow monitoring programme

Primary driver	Driver description	Driver status	WINEP agreed action	Number of obligations	WINEP outcome
U_MON4a	Change to reporting frequency	Statutory	Named sites Minor asset modification	195	Improved data accuracy
U_MON4b	Change to reporting frequency	Statutory	Named sites Minor asset modification	26	Improved data accuracy
U_MON4c	Provide new MCERTS flow meter	Statutory	Named site Provide flow meter	149	FFT compliance monitoring
U_MON6a	Provide EDM monitors at emergency only overflows	Statutory	Sites not named in WINEP, list provided to EA Simple EDM installation	180*	Monitoring of emergency overflows
U_MON6b	Provide EDM monitors at emergency only overflows	Statutory	Sites not named in WINEP, list provided to EA complex EDM installation	13*	Monitoring of emergency overflows
U_MON6c	Provide MCERTS flow meter and EDM at combined emergency and storm overflows	Statutory	Sites not named in WINEP, list provided to EA Complex EDM installation	131*	Monitoring of emergency overflows

*Numbers are based on a list of emergency overflows provided to the EA and derive from extensive review of EA and Severn Trent permitting records and databases. The EA have not, at time of writing, populated WINEP with named obligations. We will be working with the EA to produce a list of the 25% of overflows that will be addressed in AMP8.

Nitrate removal trials

A new water quality standard for nitrate is being introduced by the EA that is being applied to lakes and reservoirs through River Basin Management Plans cycle 3. This is expected to drive investment in AMP9 at some WwTWs that discharge into or upstream of these features. The technically achievable limit (TAL) for nitrate was last reviewed over 30 years ago for inclusion in the Urban Wastewater Treatment Directive, and the limits set have only ever been applied to sites serving more than 10,000 PE.

While this is technically described as a non-statutory obligation, the driver guidance provided by the EA states that these trials are mandated by Defra.

Driver code	Description	Legal obligation	Tier 1 outcome
WFD_INV_N-Tal	Investigations to assess treatment options for nitrogen.	NS – Defra approved must do	Water companies action to develop and test nitrogen treatment options.

A technical working group was convened by the EA to co-ordinate company inputs into these trials and to ensure that there is sufficient process variety in the programme. The group agreed that each company should include three process trials in their WINEP submission to ensure that a wide range of technologies can be evaluated. It was also agreed that optimisation and evaluation of some existing nitrate removal processes can form part of the overall programme. All three sites in Severn Trent's nitrate removal trials programme discharge into areas where a water quality nitrate standard is expected to be set. Two of these sites will require construction of new assets as part of the trial; the third is a site that already delivers very high levels of biological nitrate removal, and we will further optimise this process during AMP8.

Table 4.9: Breakdown of the AMP8 nitrate trials programme

Primary Driver	Driver description	Driver status	WINEP Agreed Action	Number of obligations	WINEP Outcome
WFD_INV_N-TAL	Nitrate removal trials	Defra mandated	Three named sites Treatment process specified	3	New TAL for AMP9 implementation

Note that there is a fourth line in WINEP against this driver. This just covers some data management and reporting associated with production of a national trials evaluation report.

Investigation Programmes

There are four investigation programmes within our PR24 WINEP programme:

- **Chemical Investigations Programme 4.** Continuation of the chemical investigations work that started in AMP5, improving the industry's understanding of the sources and prevalence of a wide range of chemicals of potential concern and informing future control strategies.
  The CIP4 programme has been developed nationally through the existing Programme Steering Group, which includes representatives from the EA and Defra. Many elements of the agreed programme are national level investigations that will be procured centrally via UKWIR. To manage uncertainty around pricing of these elements against as yet incomplete technical specifications, it has been agreed that these elements will be procured on a fixed price basis. Individual company contributions have been agreed (some based on wastewater customer base and others are equal share).
  The key components of this programme are:
    - Investigation into sources of PFOS in 22 named catchments, including trade effluent sampling. We have proactively engaged with the EA's national Chemical Compliance Team to produce a list of trade premises to include in this investigation to refine pricing;

- Chemical sampling and hydraulic modelling in the Severn and Humber Estuaries (joint with other the WaSCs that cover these areas). **Fixed Price Element**;
- National investigation into constructed wetland treatment solutions for hazardous chemicals. **Fixed Price Element**;
- Quantification of accumulation of microplastics in soil, and propensity to migrate into groundwater, resulting from application of biosolids to agricultural land. This is being run jointly with the Microplastics investigations programme. **Fixed Price Element**;
- Investigation into prevalence and abundance of hazardous chemicals in biosolids. **Fixed Price Element**;
- Investigation into hazardous substances in effluents that discharge to groundwater;
- National investigation into prevalence of Anti-Microbial Resistance (AMR) at sewage works. **Fixed Price Element**;
- 'Emerging substances of concern' investigations at sewage works; and
- Prevalence of endocrine disruptors in biota. **Fixed Price Element**.

- **Microplastics Investigations.** There are three sub-elements within this investigation, all of which will be centrally procured on a fixed price basis:
  - Quantification of the potential for WwTWs to generate microplastics through abrasion of plastic components. **Fixed Price Element**;
  - Quantification of accumulation of microplastics in soil, and propensity to migrate into groundwater, resulting from application of biosolids to agricultural land. This is being run jointly with the CIP4 programme. **Fixed Price Element**; and
  - Research and trial work on alternative sludge treatment technologies that can produce an end product that does not contain microplastics. **Fixed Price Element**.
- **Nitrate Investigations.** Twelve source apportionment assessments to establish the proportion of nitrate entering lakes and reservoirs that has come from Severn Trent WwTWs. These assessments will also identify improvement options and assess the cost-benefit of interventions to inform our PR29 WINEP programme.
- **Storm overflow investigations.** We have a WINEP obligation to provide investigation reports to the EA for our AMP8 storm overflow improvement projects, to demonstrate that the solutions will deliver the 'eliminate harm' SODRP requirement. No cost is assigned to these investigations: as the outputs are identical to the feasibility work in solution design, the obligation is effectively a reporting requirement only.

Table 4.10: Breakdown of the AMP8 investigations programme

Primary Driver	Driver description	Driver status	WINEP Agreed Action	Number of obligations
WFD_INV_CHEM 4a	PFOS investigations	Statutory	Named sites	22
WFD_INV_CHEM 4a	Water company contribution towards national constructed wetland chemical investigations	Statutory	Joint WaSC investigation	1
WFD_INV_CHEM 4a	Chemical investigation to develop model at Severn Estuary	Statutory	Joint, with Welsh and Wessex	1

WFD_INV_CHEM 4a	Chemical investigation to develop model at Humber Estuary	Statutory	Joint, with Yorkshire and Anglian	1
WFD_INV_CHEM 4a WFD_INV_MP	Water company contribution to chemical investigations to complete sludge/groundwater trials	Statutory	Joint WaSC investigation	1
WFD_INV_CHEM 4b	Water company contribution to chemical investigations into sludge	Statutory	Joint WaSC investigation	1
WFD_INV_CHEM 4c	Groundwater Investigations	Statutory	Named sites	5
WFD_INV_CHEM 4d	Water company contribution to chemical investigations into AMR	Statutory	Joint WaSC investigation	1
WFD_INV_CHEM 4e	Emerging substances investigation – endocrine disruptor	Statutory	Joint WaSC investigation	1
WFD_INV_CHEM 4e	4e Emerging substances investigation – impact to the environment	Statutory	Named sites	5
WFD_INV_CHEM 4e	4e Emerging substances investigation – surface and groundwater emerging substances	Statutory	Sites identified to EA but not named yet	3
WFD_INV_CHEM	Ancillary costs (to cover UKWIR and consultant support to overall programme)	Statutory	Joint WaSC investigation	1
WFD_INV_MP	Contribution to industry research project into sludge thermal conversion investigations and trials	Statutory	Joint WaSC investigation	1
WFD_INV_MP	Contribution to industry research project into microplastic generation within STWs through attrition of plastic-based equipment	Statutory	Joint WaSC investigation	1
WFD_INV	Nitrate (source apportionment) investigations	Statutory	12 named catchment investigations	12
ENV_Act_INV2	Storm overflow 'eliminate harm' investigations (to confirm AMP8 solution will deliver required outcome)	Statutory	Named sites	352

River quality monitoring

There are some remaining uncertainties relating to the new Environment Act duty to implement continuous river quality monitoring. While Defra and the EA published guidance in August 2023, it has not been possible to fully apply the technical guidance before business plan submission. A data collection exercise for the EA is in progress that will ultimately confirm the priority installation sites for AMP8.

There are three WINEP driver codes relevant to our programme. Env_Act_INV1 covers statutory investigations into the monitoring of discharges into estuaries. This will be superseded in due course by two named investigations covering the Severn and Humber estuaries. Env_Act_MON4 covers monitoring of qualifying discharges into inland watercourses and Env_Act_MON5 covers provision of the statutory near real time data reporting system.

Table 4.11: Breakdown of driver codes

Primary Driver	Driver description	Driver status	WINEP Agreed Action	Number of obligations

Env_Act_INV1	***holding line*** Near real time river monitor data reporting	Statutory	TBC	1
Env_Act_MON4	***holding line*** River monitor installation	Statutory	TBC	1,000
Env_Act_MON5	***holding line*** Near real time river monitor data reporting	Statutory	TBC	1

5. Robust & efficient costs

5.1 Cost robustness

This is a large programme of improvements, given the scope is statutory and confirmed as final by the EA, demonstrating that our costs are robust and efficient is critical to make sure our customers get the best possible deal.

Our estimates are based on a large and relevant bank of data comprising around 120 of our own completed projects over the last five years and around 550 of the sector's projects completed since 2020/21. This data has been used and combined with market testing where historic data is not available to challenge ourselves to be the most efficient deliverer of WINEP obligations. This section sets out the key evidence to demonstrate this. Full details of our costing methodology and overall efficiency can be found in Annex 4a.

5.1.1 Cost derivation

We have a well-established cost estimating approach and long history of cost data from completed projects over the last 20 years. There are seven sub-programmes of work that have all been costed using the same estimating approach (explained in full in Annex 4a), but the source data has varied depending on the availability of suitable data. Table 5.1 provides an overview of the primary source of the cost data and shows that we have used over 120 past projects to inform nearly 70% of this programme. For the 26% of costs that have been built bottom up without the benefit of a large historical project dataset we have undertaken additional assurance and benchmarking to ensure the costs are efficient – see section 5.2. This provides a high degree of confidence that the costs are robust.

Table 5.1: Cost derivation of key elements of waste WINEP

Basis of estimate	ST unit cost database – STUCA (outturn past projects)		Market tested/ independently sourced	Non-standard bottom up build	Totex £m
	% of value derived using STUCA	Number of observations in cost curve			
Storm overflows	80%	87		**20%**	**£1113m**
Phosphate removal	100%	178			**£683m**
Ammonia and BOD	60%	99		**40%**	**£215m**
Chemical removal	100%	9			**£81m**
Flow monitoring	100%	n/a			**£57m**
River quality monitoring			30%	**70%**	**£127m**
Nitrate trials	100%				**£32m**
AMP8 investigations			100%		**£7m**
Total as %	**68%**		**6%**	**26%**	**£2315m**

For each sub-programme listed above we now provide a cost breakdown and describe the key assumptions that make up the costs and where relevant we present the cost data overlayed on the cost curves.

Storm overflows

There are three main solution types within this programme which have been costed separately – network storage, treatment works storage, and surface water separation. Our Drainage and Wastewater Management Plan (DWMP)[28] sets out the method we have taken to derive the scope split. The cost breakdown is provided below for each solution type.

Table 5.2: Breakdown of key cost components of treatment works and network storage

Description	Network storage £m	Treatment works storage £m	Origin
Infrastructure (stormwater storage tanks, blue-green SuDS assets, static screens)	475.66		STUCA 3 Curves 87 Observations
Non-infrastructure (sewage works storm tanks)		312.02	STUCA 2 Curves 46 Observations
Curve Price	**475.66**	**312.02**	
Threat/risk/contingency*	33%	33%	
Project total (current price base)	632.63	414.99	
Project total (overhead and burdening) 6.25%	39.54	25.94	
Project total (2022/23 price base)	**672.17**	**440.92**	

** Including: % based on review of 15 past projects to establish costs relating to service diversions, unknown ground conditions, unknown highway restrictions, unknown environmental restrictions, power supply restrictions, etc.*

We have used asset level cost curves to derive these estimates, Figure 5.1 includes the four most material curves representing 93% of the cost to illustrate how this has been done.

Figure 5.1: Asset level cost curves

Grey storage Solutions ✂	Blue-Green Solutions ✂
Sewage works storm tanks (civils) ✂	Sewage works Activated Sludge (civils) ✂

Our cost estimates for blue-green infrastructure incorporate learning from our Mansfield Green Recovery project and are representative of all types of sustainable urban drainage systems.

For a small number of very large sewage works stormwater storage solutions we have priced using the activated sludge civils STUCA curve rather than the sewage works storm tanks curve. This is because the latter tops out at 10,000m3 of storage whereas the ASP allows units up to 50,000m³ to be costed without exceeding the recommended range. We have taken the view that, as large storm tanks are typically constructed as rectangular units, akin to ASP tanks, the ASP curve will generate a far more accurate cost than costing a large number of individual units using the storm tanks curve.

[28] https://www.severntrent.com/about-us/our-plans/drainage-wastewater-management-plan/

These costs have been derived on a consistent basis with our DWMP but updated to reflect another six months of data which was not available when we submitted the DWMP. See Annex 2a LTDS for a full mapping between DWMP and our PR24 submission.

Phosphate removal

Phosphorous removal has played a substantial part of the WINEP programme in the two previous AMP WINEPs and the Green Recovery, and this is set to continue into AMP8. Our STUCA cost curves are therefore based on a significant number of previous projects. We also have a substantial library of previous non-standard item costs to draw upon.

There is a discernible shift in AMP8 towards P-removal at smaller sewage treatment works. This is our fourth major phosphate removal programme tackling WFD/Environment Act drivers, and over previous programmes we have addressed many of the larger WwTWs. For AMP8 (as noted in Section 3.3) we have consciously focused on smaller sites and left some of our biggest remaining sites to AMP9, resulting in a programme with a greater bias towards smaller sewage works. Opportunities for economies of scale are diminished at smaller treatment sites and for some key assets (e.g. chemical dosing equipment) there is a de-minimis asset cost.

Table 5.3 shows the median populations served by sewage works included in our recent phosphate removal programmes.

Table 5.3: Median PE

Investment programme	Median PE served
AMP6 WINEP	4,451
AMP7 WINEP	2,825
Green Recovery	6,948
AMP8 WINEP	1,377

Table 5.4 shows the main components that make up the £683m programme.

Table 5.4: Breakdown of costs in P-removal programme

Description	Capex (£m)	AMP 8 Opex (£m)	Origin
Infrastructure solutions (final effluent transfer/crude effluent transfer)	35	2	STUCA Curves
Non-infrastructure solutions (tertiary solids removal, chemical dosing, interstage pumping, etc.)	612	34	STUCA Curves Market tested rates
Project total (22/23 price base)	647	36	CPIH
Totex (22/23 price base)	**683**		

We have used asset level cost curves to derive these estimates, the cost curves below represent the four most material curves.

Nutrient removal (Chemical dosing)

Tertiary solids removal (Mechanical) – Non-cloth filter

Tertiary reedbeds

✂

Tertiary solids removal (Mechanical) – Cloth filter

✂

Ammonia and BOD

We have a similarly sized programme in AMP8 to continue to respond to tighter permits for ammonia and biological oxygen demand.

The solutions proposed for our ammonia removal obligations are very site specific in that the best technical solution is dependent upon the existing treatment processes, current works performance, and the new permit standard. The optimal process solution is also influenced by forecast population growth. In addition, we have four sites where we have both ammonia and phosphate removal obligations and, for these sites, the optimal technical solution takes both needs into consideration to maximise synergy and minimise cost. The attributed costs have come from our cost data base of completed projects (STUCA).

BOD costs lie almost entirely with the U_IMP7 driver to uprate septic tanks to secondary treatment. These are complicated projects to price as many of the existing assets are in customers' gardens or very close to the curtilage. Each estimate therefore has to include elements of infrastructure to convey the sewage to a new location for treatment, with the current working assumption of them being nature-based solutions. The costs associated with the nature-based solutions are predominantly based on market tested rates.

Table 5.5: Breakdown of costs in Ammonia and BOD removal programme

Description	Capex (£m)	AMP 8 Opex (£m)	Origin
Ammonia	182	4	STUCA
BOD	27	1	STUCA Market tested rates
Project total (22/23 price base)	210	5	
Totex (22/23 price base)	**215**		

Chemical removal

This is a more difficult sub-programme to estimate because we have not completed any similar schemes and the technology required to remove the two specified chemicals (dissolved nickel and dissolved zinc) to the levels required is relatively novel in a wastewater context. The chosen solution for all three proposed projects is Granular Activated Carbon (GAC) adsorption. As this is routinely deployed as a clean water treatment process we have used a 'nearest equivalent' approach in STUCA and priced these interventions using our clean water GAC cost curve.

Table 5.6: Breakdown of costs in Chemical removal programme

Description	Capex (£m)	AMP 8 Opex (£m)	Origin
Non-Infrastructure (GAC adsorption)	79	2	STUCA (clean water) GAC curve
Totex (22/23 price base)	**81**		

Granular Activated Carbon (M&E)

Granular Activated Carbon (civils)

Flow monitoring

There are two main elements to our flow monitoring programme: FFT monitoring (U_MON4 driver) which comprises the installation of flowmeters and Emergency Overflow monitoring (U_MON6 driver) which comprises the installation of both EDMs and flowmeters. We have a lot of experience with installing flow monitoring and we have updated the cost curves to reflect our recent AMP7 cost data.

A breakdown of the capital cost elements of the programme is shown below. There is an additional £0.55m over the five year operating cost:

Table 5.7: Breakdown of Flow Monitoring capital costs

Element	Number of units	Capex cost £m
U_MON4 FFT flow meters	149	43.68
U_MON6 flow meters on network PS	119	7.87
U_MON6 flow meters on WwTW PS	12	1.52
U_MON6 EDM monitors	205	2.80
Total		55.87

The cost estimates for the FFT monitoring programme (U_MON4c driver) included in our WINEP submission are drawn directly from scope identified during site-specific investigations undertaken in AMP7 at each of the applicable sites. These were regulatory investigations undertaken as part of the AMP7 WINEP programme. Each site is unique, and the surveys have identified site-specific scope for cost estimating purposes. There are a large variety of required interventions, ranging from relining of flumes, relocation of returns pipes and access modifications to significant civil engineering modifications to the structure of the inlet works. The cost estimates have been produced using cost curves for standard items such as chamber modifications together with manufacturer quotes.

The costs for the Emergency Overflow monitoring programme (U_MON6 drivers) were derived from AMP7 installation rates for the EDM installations and also for flowmeters at network pumping stations and sewage treatment works pumping stations. The costs for flowmeters contained within open channels at sewage works were derived using information from comparable sites obtained during the site surveys for the FFT flow measurement programme described above.

Table 5.8: Breakdown of costs in flow monitoring programme

Description	Capex (£m)	Opex (£m)	Origin
Non-Infrastructure (flow monitoring device, civils structures and EDM)	56	1	STUCA Supplier quotations
Totex (2022/23 price base)	**57**		CPIH

River quality monitoring

This has been a difficult programme to estimate due to the lack of historic outturn data, the newness of the technology that will be needed to measure the five (minimum) parameters required by this legislation. We also note the current absence of detailed technical specifications from the EA and Defra. The equipment and installation costs are based on a supplier quote for the monitoring equipment (obtained from the EA's framework supplier and based on the legislative requirements) and the units we have recently installed under Green Recovery. However, these Green Recovery units installed to date have been in 'simple' locations where we had a co-operative landowner and no complicating factors (e,g. no Areas of Outstanding Natural Beauty, conservation areas, National Parks,

World Heritage Sites, etc.) that will require non-standard installations. Our Property Land and Planning teams have provided expert input on costs for securing land, planning permission and legal access agreements.

Table 5.9: Breakdown of costs in river quality monitoring programme

Description	Capex (£m)	AMP8 Opex (£m)	Basis of cost
River quality monitoring equipment Includes telemetry and power	34	19	Supplier quote inflated to 2022/23 prices
Feasibility, design, procurement, contract management and flood risk assessment	11		
Data management and real-time publication systems	5		
Land purchase and legal access Agreements	12		Assumes 33% on our land, 33% on third-party land (cooperative owner) and 33% on third party land (uncooperative landowner)
Planning permission	6		
Optimism bias*	33		
Overhead and burdening @ 6.25%	7		
Project total	108	19	
Project total totex (2022/23 price base)	127		

* We have used the Treasury Green Book Optimism Bias for a standard engineering project for which no risk mitigation has been undertaken. We have very limited reference data and, in the absence of a confirmed delivery requirement from Defra, it has not been possible to undertake any site specific investigations.

Nitrate Removal trials

The £32m nitrate trials costs are based on a combination of our cost data base of completed projects (STUCA), and non-standard costs from AMP7 projects which are in current commercial negotiations, and supplier-based quotes.

Table 5.10: Breakdown of costs in nitrate removal trials programme

Description	Capex (£m)	Opex (£m)	Origin
Non-Infrastructure (secondary treatment)	31	1	STUCA Supplier Quotations
Totex (22/23 price base)	**32**		CPIH

AMP8 Investigations

A total of £5.7m of this £7m sub-programme comprises the national Chemical Investigation and Microplastics programmes. The remaining £1.3m is accounted for by 12 named nitrate source apportionment and options assessment investigations.

Many of the elements of the £5.7m CIP4 and Microplastics Investigations are to be procured centrally by UKWIR on behalf of the water companies. To minimise cost uncertainty, and to reflect the fact that the detailed technical specifications are still being developed, it has been agreed nationally to adopt a fixed price approach to costing these elements. Costs for each element are apportioned either on an equal share basis or split by wastewater population served (the apportionments for each company were considered and agreed on a case-by-case basis). £2.7m of our £5.7m total is covered by this fixed price approach.

The remaining £3m is a collection of monitoring and sampling programmes. This cost has been based on similar investigations undertaken in AMP7, supplemented with a fresh sample analysis cost estimate from a specialist laboratory (ALS). As the investigation also requires sampling of certain trade

effluents for the substance PFOS, advice has been received from the EA's Chemical Compliance team to identify the specific sites to include in the programme.

The £1.3m nitrate source apportionment costs have been based on a series of very similar investigations undertaken in AMP7 on phosphate source apportionment and options assessment.

5.1.2 Key assumptions

There are a number of programme wide assumptions that have been made as part of the build-up of costs. We provide a brief overview of each assumption.

Table 5.11: Overview of key assumptions

Issue	Summary of assumption	Cost impact	Cross ref to more info
Alignment to cost adjustment claims	We have made a cost adjustment claim to represent significantly higher opex costs that will be incurred because of the AMP7 (and Green Recovery) P-removal projects, a number of which will only become operation in 2024/25 and therefore the costs are not reflected in the historical cost base. We have used the same assumptions to estimate the AMP8 opex costs	Following Ofwat's decision on the 'P REOC' cost adjustment claim (see Annex 4a, section 2) the total opex allowance needs to be aligned to avoid double counting of the AMP8 opex	Annex 4a
Implicit allowance	All investment presented in this case relates to new statutory obligations and therefore there is no overlap with the base funding derived from the econometric models. Therefore, our IA estimate is zero	0	n/a
Proportional allocation	We have applied proportional allocation rules to all our WINEP solutions to ensure that any elements of scope that entail provision of new capacity for growth and/or replacement of existing capacity are removed from our enhancement costs and allocated to base expenditure		Appendix H
Risk and optimism bias	Due to the large historical cost base, we have reduced the Green Book guidance (for complex projects) of 66% down to 5% (for all elements other than river quality monitoring) based on a review of over 50 projects with outlier costs to help us estimate the percentage impact of unknow unknowns. This is incredibly ambitious given the scale of the programme and in many cases the fact that the technical solutions we are striving for are at the limit of currently proven technology	5%	Annex 4a

5.1.3 Assurance and independent challenge

We have sought challenge and reviewed costs at several stages throughout the development of the solutions along with more formal assurance. The key inputs include:

- Arup review of costs and methodology in 2021;
- Review of our STUCA process:
    - System calculations – PR09 by PwC when the STUCA was built, PR14 by Atkins;
    - Process of data collection and allocation to curves PR09 and PR14 by Atkins;
    - Benchmarking of outputs:
        - AMP5 and AMP6, various benchmarking by EC Harris/Arcadis;

- PR19 Mott Macdonald; and
- PR24 Jacobs, Aqua benchmarking of AMP7 projects.

- Turner and Townsend review of approach against published Cabinet Office and HM Treasury best practice;
- Mott Macdonald bottom-up and top-down benchmarking review of over 60% of the programme;
- Jacobs as part of our formal three lines of assurance; and
- Internal review and challenge – through senior management review of the cases, CRAM process, Governance through enhancement steerco, activities such as Gemba to get broader view.

External challenge and review

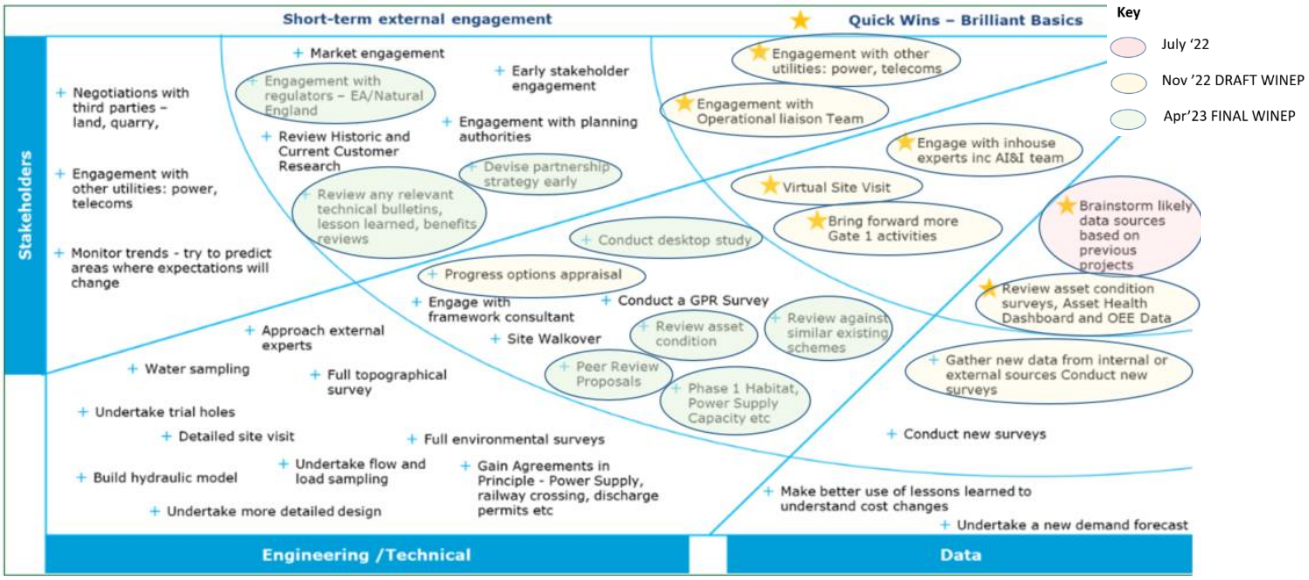
Appendix G summarises some of the key challenges (including cost and efficiency) we have received from our regulators during the development of our plan. The actions we have undertaken to response to the challenges are also listed.

Internal challenge and review

As described in Annex 4a, as part of our commitment to continuous improvement we commissioned cost consultants Turner and Townsend to assess our approach against best practice[29]. We mapped our approach to the eight steps described through the Cabinet Office and HM Treasury best practice and found it aligned well in most places. The key improvement we have made is to formalise the cost estimating reporting and to track the change in the estimate and corresponding improvement in the estimate maturity as we developed both the costs and the solution over time.

Figure 5.2 illustrates the activities we have undertaken to improve the quality of our proposed interventions and hence improve the accuracy of our cost estimates.

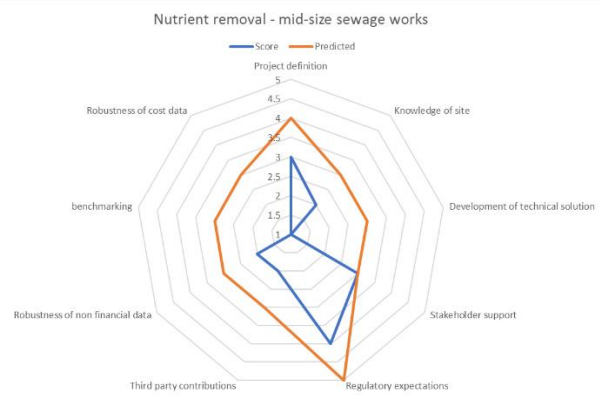
Figure 5.2: Cost Estimating Improvements



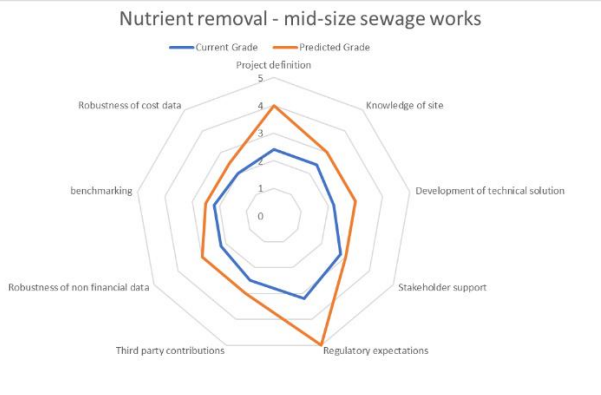
[29] Government cost estimating guidance https://www.gov.uk/government/publications/cost-estimating-guidance

For our largest value projects with multiple AMP8 investment needs, physical site visits were undertaken to plan how the new assets will be delivered without one element of the project compromising delivery of another.

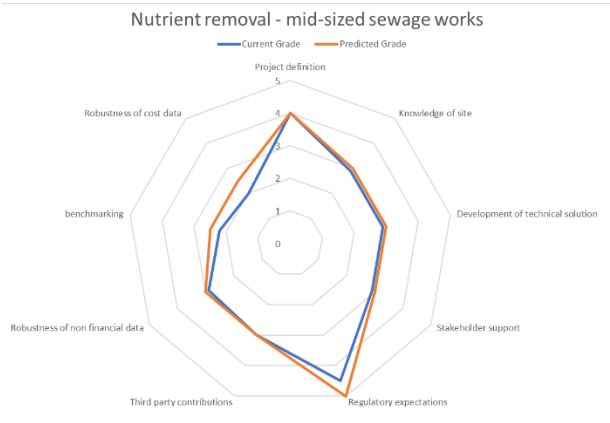
We have utilised Cost Robustness and Maturity (CRAM) assessments to identify areas where improvements in our cost estimating process could be made to improve data quality. The charts below illustrate how the maturity of our phosphate removal costs improved, starting from the data used for the original (November 2022) WINEP submission through to our final PR24 submission. The examples below are for nutrient removal at medium-sized sewage treatment works, the same approach was followed for nutrient removal at large and small works, and for other elements of the programme with material costs associated.



July 2022



January 2023



April 2023

5.1.4 Data table mapping

The costs associated with this business case are located in the following CWW3 data table lines. Transition spend is outlined in Appendix F:

Table 5.12: Totex mapping to CW3/CWW3 data tables

WINEP driver	Data Table Reference	Data Table Description	Capex	Capex total	Opex	Opex total	Totex
Storm overflow improvements	CWW3.16	Increase storm tank capacity at STWs – grey solution	401.86	1112	0.21	1	1113

	CWW3.19	Increase storm system attenuation/treatment on a STW – green solution	30.01		0.05		
	CWW3.22	Storage schemes to reduce spill frequency at CSOs, etc. – grey solution	472.69		0.13		
	CWW3.37	Storm overflow – source surface water separation	139.71		0.27		
	CWW3.46	Storm overflow - new/upgraded screens	68.16		0.16		
Phosphate removal*	CWW3.64	Treatment for phosphorus removal (chemical)	681.65	699	36.09	41	740
	CWW3.79	Catchment management – nutrient balancing	17.37		5.38		
Ammonia and BOD removal	CWW3.91	Septic tank replacements – treatment solution	27.49	209	0.58	5	215
	CWW3.73	Treatment for tightening of sanitary parameters	182.00		4.6		
Chemical removal	CWW3.49	Treatment for chemical removal	78.51	79	2.06	2	81
Flow monitoring and emergency overflow monitoring	CWW3.10	MCERTs monitoring at emergency sewage pumping station overflows	12.19	56	0.55	1	57
	CWW3.4	Flow monitoring at sewage treatment works	43.68		0.65		
Nitrate removal trials	CWW3.61	Nitrogen technically achievable limit monitoring, investigation, or options appraisal	30.94	31	1.26	1	32
River quality monitoring	CWW3.7	Continuous river water quality monitoring	108.16	108	19.43	19	127
Future hazard investigations	CWW3.103	Investigations, other (WINEP/NEP) – desk-based studies only	0.12	7	0	0	7
	CWW3.106	Investigations, other (WINEP/NEP) – survey, monitoring or simple modelling	4.10		0		
	CWW3.109	Investigations, other (WINEP/NEP) – multiple surveys, and/or monitoring locations, and/or complex modelling	2.55		0		

*****Note Packington cost is not included in this business case – see CWW3 table commentary document

We have compared our final PR24 cost estimates back to the provisional totals provided on 26 July in response to Ofwat's request for WINEP cost information. We noted in our covering email that we were in the process of conducting final rounds of assurance on our PR24 plan and that there could be some changes to our costs in our final submission. We also promised to explain any material differences, which are set out below. It is important to recall that the cost data submitted in July was in the standard WINEP Price Base Date (PBD), not the PR24 PBD – in making the comparison below, the July figures have been inflated to enable a like for like comparison.

- The data submitted in July did not include costs for the river quality monitoring duty as we were still waiting for implementation guidance from Defra and associated WINEP driver guidance from the EA. This guidance was received in August and has driven an increase in our WINEP programme totex of £127m;

- The data submitted in July did not include our proposal to add a further 198 storm overflow improvements at a cost of £100m. This cost is now included within the totex requested in this business case;
- There has been a reduction of £26m in our U_MON6 (monitoring of emergency overflows) programme. This is attributable to an instruction from Defra to reduce the size of the programme by 75%. The actual totex reduction is marginally less than 75% due a minor change in our cost estimate for installing EDM monitors;
- A final round of assurance on our cost estimates has resulted in a totex increase of £70m (7%) on our WINEP storm overflow improvement programme. There have been no cost changes to all the other elements of our wastewater WINEP programme arising from our final rounds of assurance; and
- Excluding the addition of river quality monitoring and the additional 198 storm overflows, the net change between the cost data supplied in July and our final submission is approximately 2%.

5.2 Demonstrably efficient costs

As described above, the scale of this programme means that ensuring efficiency is an important part of keeping costs down for customers. At PR19, our costs were found to be the most efficient across the sector and we have sought to maintain this sector-leading position through comprehensive benchmarking. To do this we have considered efficiency through three lenses:

- **Continuous improvement** – demonstrating efficiency improvements over time;
- **Top-down benchmarking** – evidence to show we are delivering the environmental outcomes efficiently. This method of benchmarking is good because it captures three key forms of efficiency, i.e. we are choosing the right solutions (productive efficiency) and then delivering them efficiently (allocative efficiency) and getting more efficient over time (dynamic efficiency); and
- **Bottom-up benchmarking** – especially where top-down benchmarking cannot be done we have challenged ourselves to ensure the individual components are being delivered efficiently.

We provide the evidence to support our view that our costs represent demonstrably efficient costs through each of these lenses.

5.2.1 Continuous improvement

In Annex 4b we describe all the components of our approach to ensuring continuous improvement. During the delivery of the AMP7 WINEP programme we have taken learning from previous AMPs to continually improve our solutions and so become more efficient. Some examples are provided below:

- After monitoring performance, we have changed our design standards to remove the requirements for flocculation chambers ahead of cloth filers (used for tertiary solids removal) and replaced with static mixing; and
- We have sought opportunities to transfer final effluent to larger or less environmentally sensitive watercourses, particularly in cases where we would need to treat Technically Achievable Limits. Where feasible we have taken this learning and incorporated such solutions into our WINEP.

We have also sought to extract all possible learning from the AMP7 and additional Green Recovery schemes to ensure efficiencies are built into our forecasts. Section 2.3 sets out the areas of innovation we have been developing to both improve the efficacy of the technology and drivers of efficiency.

5.2.2 Top-down benchmarking

For the two most material parts of this programme (covering nearly 70%), storm overflows and phosphate reduction, it is highly likely that a top-down benchmarking approach will be possible. The PR19 models were simplistic and based on the programme-wide cost, which means it was based on a maximum of 10 observations. Since then, the sector has delivered a large programme of phosphate removal and storm overflow reduction and will have an even larger forecast AMP8 programme. Therefore, we commissioned Mott Macdonald to take the additional reported data and seek to improve the predictive capabilities of the model.

Phosphorous removal

Using the 387 project level costs and cost driver data submitted by all companies in the APR covering projects completed between 2020 and 2022, the project level data reveals two key trends:

1. The size of the works is the dominant cost driver with a very steep relationship for works below 9,000 population equivalent, as shown in figure 5.4. This is likely to be because the smaller works require installation of phosphate removal assets for the first time, whereas the larger sites already have treatment processes that can be bolstered. Also, there is generally less scope for economies of scale at smaller works.

Figure 5.3: Cost per PE for treatment works size

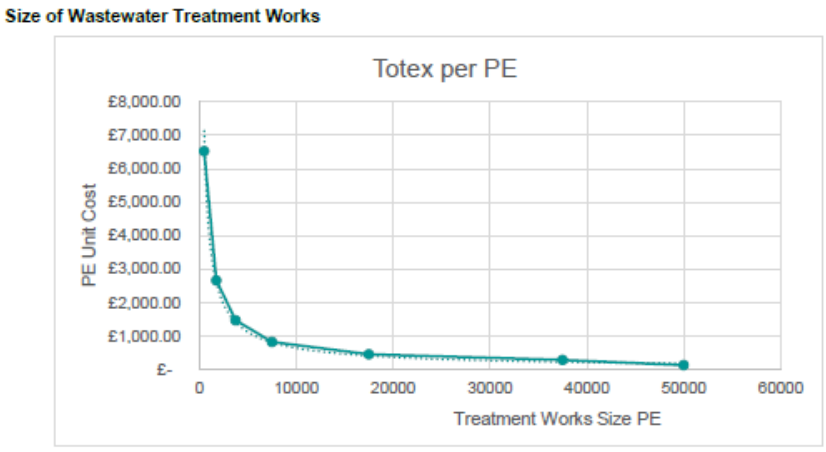


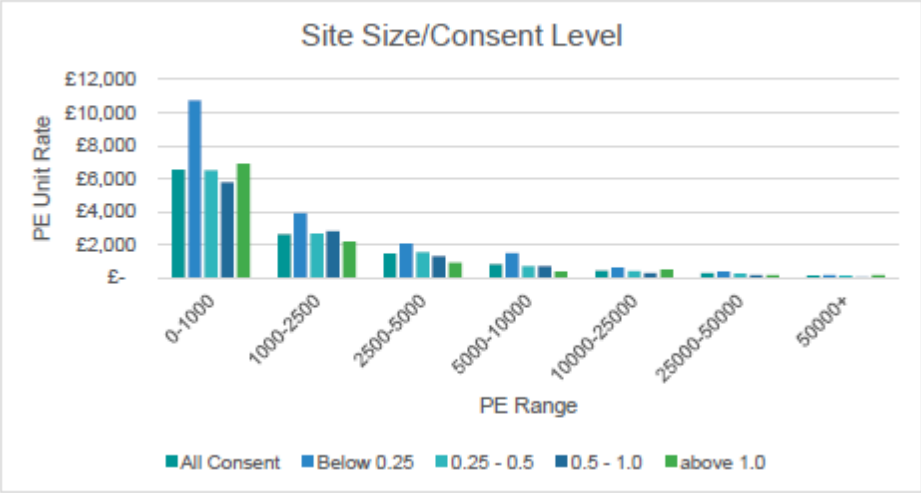
Chart 5: Unit Cost per PE for Treatment Works Size

2. The second most important cost driver is permit standard. At PR19 the model included a pivot point at consent levels below 0.5mg/l, but the project level data shows two significant inflection points – below 0.25mg/l and observable but less significant at 0.5mg/l.

Consent	Cost Factor
All Consent	100%
Below 0.25 mg/l	157%
0.25 to 0.5 mg/l	99%
0.5 to 1.0 mg/l	90%
above 1.0 mg/l	91%

When combining these two factors it is clear that the model needs to have more granularity to reflect the costs associated with tight consents at very small works.

Figure 5.4: PE range and unit rates per site consent level



Mott MacDonald created multiple possible models; the unit rate models which take into account size of site and/or permit level drive a significant improvement in the statistical significance of the relationships and engineering logic.

Table 5.10: Statistical performance of a range of potential P removal models

Model form	AMP7 data from APR Tables	
	Number of observations	R^2
Project level single variable (permit standard) – linear regression $y=2{,}315{,}954.80x^{-0.43}$	387	0.07
Project level single variable (size of works - population equivalent) – linear regression $y=74.25x+3{,}053{,}616.06$	387	0.42
Unit rate level single variable (size of works – population equivalent) – linear regression $y=1{,}063{,}826.39x^{-0.81}$	387	1.00
Unit rate level multi-variable with two pivot points for consent level		
Consent level below 0.25 $y=1{,}656{,}241.80568x^{-0.79893}$	5	0.99
Consent level 0.25 to 0.5 $y=1{,}776{,}011.28616x^{-0.84820}$	211	0.99
Consent level 05. To 1	87	0.94

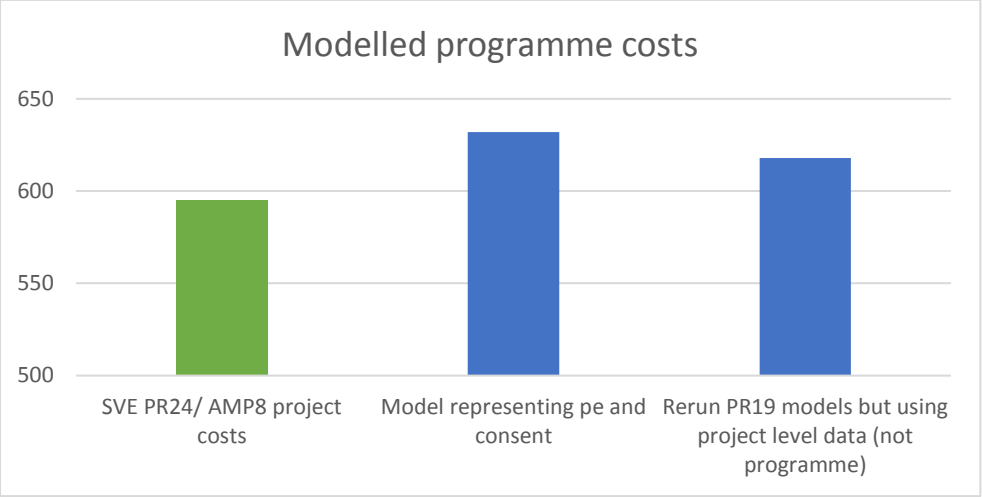
$y=4{,}525{,}039.42308x^{-1.00388}$		
Consent level above 1 $y=854{,}919.04996x^{-0.80603}$	84	0.99

All unit rates models offer improvements compared to the PR19 models in terms of number of observations, statistical performance and engineering logic. We feel the multi-variable one is the most reflective of the cost drivers. When plotted as a whole data set, with the two variables, the R^2 value is not strong, and this doesn't appear to be a viable model.

The ranges selected do however act to provide good predictors of where the costs should land, in our testing. When Ofwat has access to a full data set, the overall level may improve

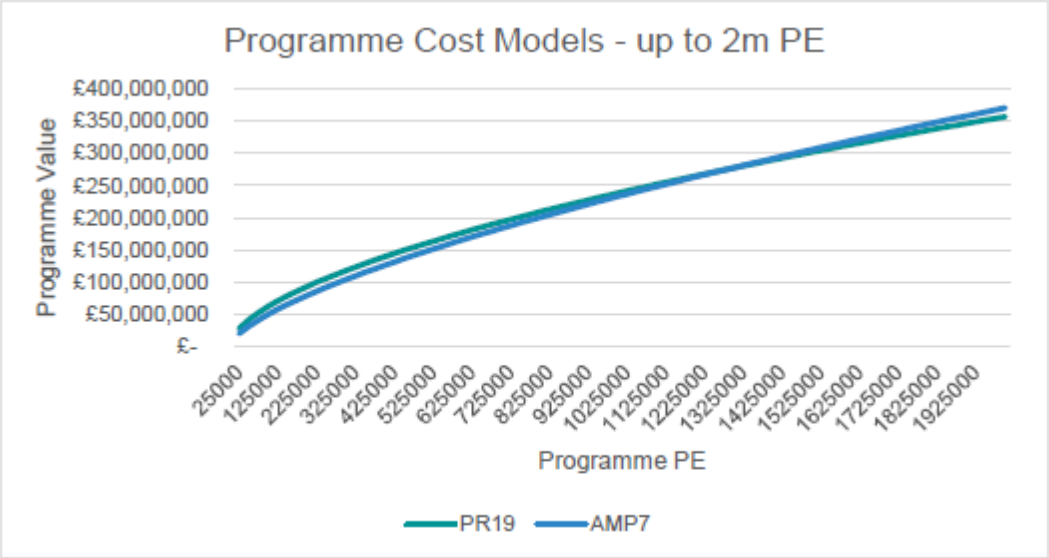
We used these models to then benchmark our AMP8 proposed costs and found our costs are efficient compared to the others. This benchmarking exercise took place in May at the time we were finalising costs and around 10 projects could not be included because we did not have finalised totex, PE, and consent values available. We have since reviewed and these projects are typical of the rest of the programme.

Figure 5.5: Benchmarked SVE costs against AMP7 sector costs



This shows that our forecast AMP8 costs are 6% more efficient than the multi-variable model and 4% more efficient compared to the updated PR19 model (using project data not programme). We have also considered the overall shift in costs from PR19 to AMP7 actuals to date by re-running the PR19 programme level model and have found that AMP7 costs are out-turning broadly similar to the PR19 final determination. Given the make-up of our programme is 90% lower than 50,000 p.e., even if you assume a 2% continuing efficiency, that still means out costs are between 2% and 4% more efficient than the benchmark.

Figure 5.6: Programme Cost Models – PR19 vs AMP7



This model improvement is particularly important for Severn Trent due to the model up of our programme. The proportion of our programme taking place on works less than 1,000 p.e is increasing from 25% to 35%, compounded to that we have 12% of our programme required to meet consent less below 0.25mg/l.

Storm overflows

At PR19 costs were compared using two main models:

- Storage at Treatment works (cost drivers were both tank capacity and number of sites)
- Network storage (cost drivers were storage volume and number of sites)

After triangulation across the models, our costs were found to be efficient – almost 55% more efficient than Ofwat's benchmark for storage at treatment works and 8% more efficient for network storage. The models are all stable and with high statistical significance (R^2 of 0.98 and 0.96 respectively)

At PR24 even more granularity of data will be available which means it will be possible to add further explanatory factors into the model, as shown in the table below.

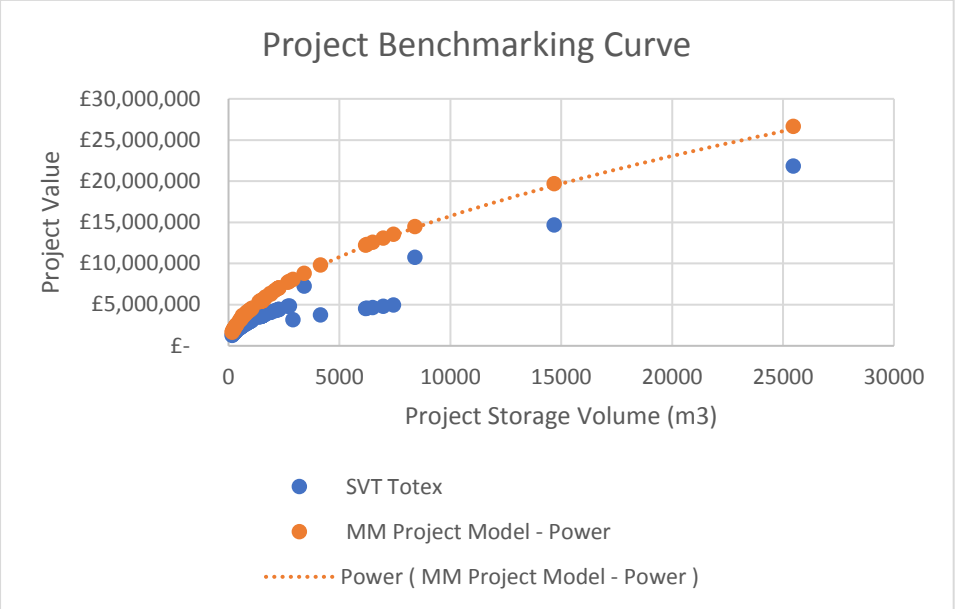
Table 5.11: PR24 Cost Driver Granularity

Data Item (Potential Cost Driver)	Used at PR19	Available for PR24
Volume of Stored Water	Programme level	Programme and Project Level
Number of Sites	Total	Total
Number of Pumped Sites	Not Available	Available
Solution Type	Grey	Grey and Green

It is important to consider the make-up of the potential AMP8 programme in relation to AMP7 when considering if AMP7 outturn data can be extrapolated to avoid the use of company forecast data. Given the significant increase in storage volumes and numbers of sites likely to be seen across the sector in AMP8, care will need to be taken not to extrapolate beyond valid data ranges.

We commissioned Mott MacDonald to create updated models using their anonymised cost database for AMP7 actuals and AMP8 forecast data, which for treatment storage included 53 comparable projects from across four comparable companies and for network storage included more than 700 projects across four companies (i.e. our costs plus three others).

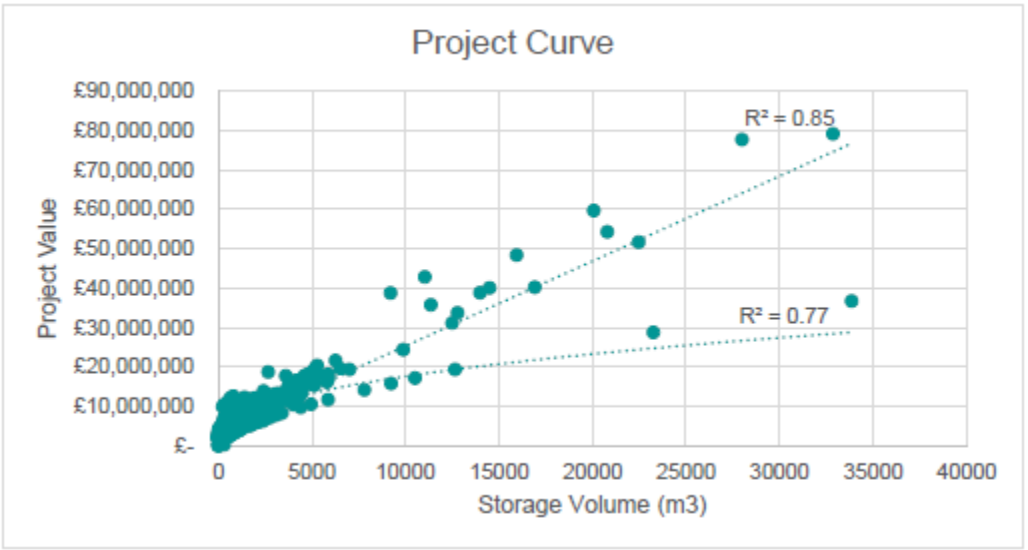
Figure 5.7: Treatment works storage using five companies' data, using power regression



This shows that our costs ae consistently lower than the available benchmarks. Across the sample of 55 projects, our costs were 58% lower overall.

This was repeated on network storage using 700 project level observations, comparing power and linear regression.

Figure 5.8: Treatment works storage, using power regression



The project level model showed a weaker R^2 than the PR19 programme level model. There should be enough data to establish a relationship, but it may be weaker due to costs being draft (taken in May 2023). A stronger relationship is likely to be present in the company submitted costs. Using the current, limited and draft input data, we do not consider it to be robust enough to base our current view of relative efficiency on.

Therefore, we have compared our PR24 forecast costs to the PR19 (uplifted to be in 22/23 prices) plus the additional four company (programme) observations from Mott Macdonald. These relationships

have high R^2 values. In all cases it shows our costs are efficient for treatment works and slightly more efficient than average for network storage.

Figure 5.9: Treatment works storage modelled allowance – PR19 vs PR24

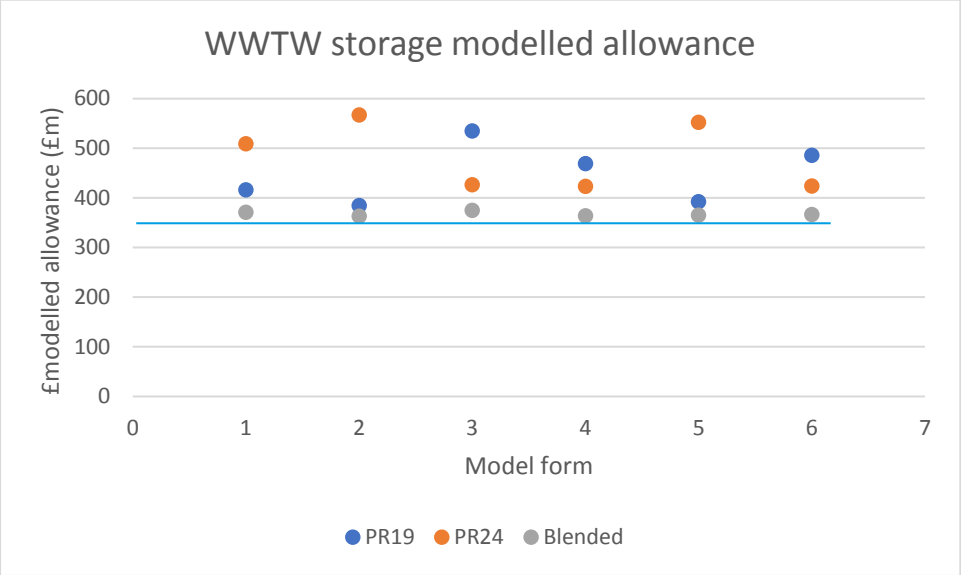


Table 5.12: Treatment works storage model overview

Model 1	Model 2	Model 3	Model 4	Models 1 and 2 triangulated	Models 3 and 4 triangulated
Log-Log	Log-Log	Linear	Linear		
Storage volume	Storage volume and number of sites	Storage volume	Storage volume and number of sites	25:75 as per PR19	25:75 as per PR19

Our WwTW storage cost is marked by the horizontal blue line, showing we are more efficient than the comparators using all model combinations and all input data. This result is consistent with the project level models where our costs tracked below the benchmark.

Network storage

We repeated this approach with the network storage models.

Figure 5.10: Treatment works storage modelled allowance – PR19 vs PR24

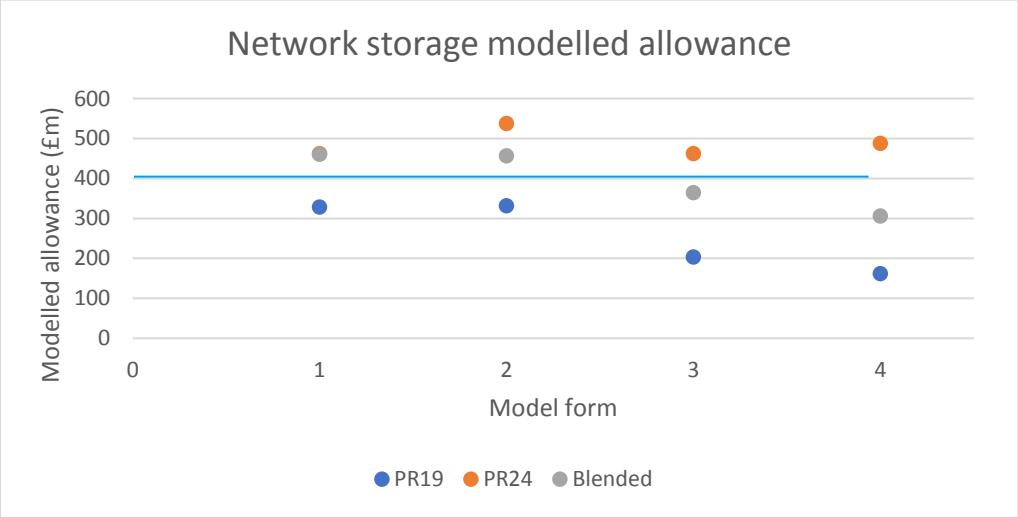
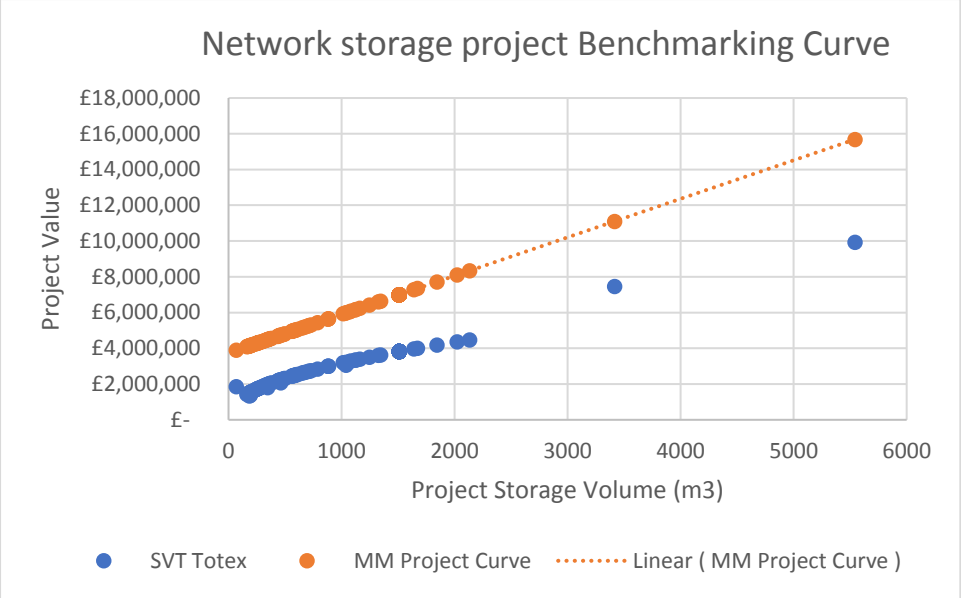


Table 5.13: Network storage model overview

Model 1	Model 2	Model 3	Model 4
Linear	Linear	Log-Log	Log-Log
storage volume and number of sites	Storage volume	storage volume and number of sites	Storage volume

At a project level our costs are noticeably lower than the benchmark

Figure 5.11: Network storage benchmarking curve



We think there is significant merit in considering a combined model as we feel there is a large degree of choice about which solution is selected if whole catchment modelling is undertaken. This is an important driver of cost as typically the unit cost per m^3 of storage at WwTWs is slightly less than 50% of the cost of providing storage within the network. This is due to factors such as:

- Storage structures at WwTWs are almost invariably open, ground level structures and often partially above ground reducing the need (and cost) of excavation, reinstatement and providing a reinforced cover structure;
- Land access and availability is better (usually at no or little extra cost) enabling structures to be significantly shallower than is possible within the network; and
- There is less disruption to the public and need for roadworks or diversions resulting in lower cost to construct.

We have worked hard to maximise the amount of storage that could be provided at the works driving an overall split of 58%:42% WwTW:network. Noting that this is a careful balance between the lower cost of storage within the confines of the WwTW and the cost of additional infrastructure potentially required to convey extra storm flows to the WwTW. By considering the whole system it enables us to identify the best balance.

Ammonia

Our cost estimates for ammonia improvements have been generated using our STUCA cost curves, which are based on previous project outturn costs. We typically use up to 12 costs curves that are pertinent to ammonia removal and which cover different process types.

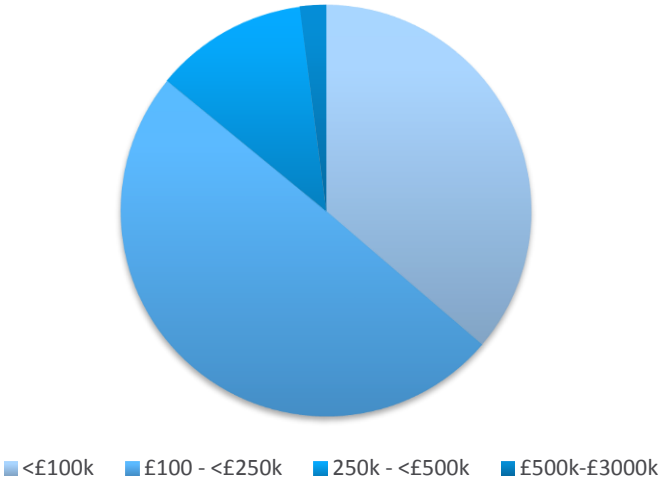
The solutions proposed for our ammonia removal obligations are site specific as the best solution depends on a variety of factors, such as existing sites assets and performance, which need to be considered alongside base plan requirements to address population growth. Where possible we have compared solution types and costs to our most recent AMP7 obligations. However, the majority of our AMP7 ammonia obligations also have phosphorus removal drivers which makes direct comparison more challenging.

We have not been able to externally benchmark these costs and have opted not to compare to the Ofwat PR19 model as we understand the model was unused in the PR19 determination due to significant variance to companies' submitted costs.

Flow monitoring (FFT)

As set out in our response to Defra's request to accelerate investment, the remaining flow to full treatment sites are significantly more complex than those previously installed. U_MON4 FFT flow meters are almost invariably open channel type flow meters which have a very wide range of costs, driven primarily by the suitability of existing inlet works civils structures to be retrofitted with a certifiable flow measurement structure. Owing to the site-specific nature of each installation, and the large variation in costs across the programme, we do not therefore believe it is possible to use top-down unit cost benchmarking. The chart below shows the range of installation costs across the 149 sites.

Figure 5.12: FFT installation cost ranges



In our Defra acceleration submission we estimated £355,000 per installation, to tackle 69 sites. Now that we have undertaken additional design work and further analysis of the programme we have derived and included within this submission an average unit cost across the programme of £293,000. This demonstrates are continuous improvement culture.

Emergency Overflow monitoring programme

At PR19, Ofwat created a unit cost per installation for EDMs of £20,400 per installation (inflated to 2022/23 prices and inclusive of the permit costs) which we have used as a benchmark for this small element of the programme (205 EDMs), which shows our unit cost of £13,700 per EDM is considerably more efficient than the PR19 view of efficient costs.

As with the U_MON4 FFT flow monitoring programme there are inherent difficulties with benchmarking the costs of the remainder of the U_MON6 programme (flowmeters in the network and at treatment works) due to the range of types of installation and complexities relating to suitability of existing assets to be retrofitted. Whilst U_MON6 flow meters on network pumping stations are invariably flow monitors fitted onto the rising main, which require relatively simple civils intervention (essentially a chamber into which the flow meter is installed), complexities arise from space constraints (a minimum length of straight rising main is required) and the amount of time that the pumping station can be offline to enable the meter to be fitted. Flow meters on emergency overflows on inlet pumping stations at sewage works are a mix of relatively simple 'rising main' type installations and more complex open channel installations (e.g. where the inlet pumping station is screw pump installation and has no rising main).

5.2.3 Bottom-up benchmarking

We have benchmarked three key areas using bottom up analysis: nature-based surface water separation, P-removal, and septic tanks.

Nature-based solutions have been benchmarked against three comparable water companies. It shows that while there are two solution types than appear less efficient than the average at a programme level (based on our estimated make up), our costs are 9% more efficient than the benchmark.

Table 5.14: Nature-based benchmarking results

Intervention	SVT Cost (£)	Average Benchmark Cost	Difference (£)	Difference (%)
Detention Basin	556.58	531.35	25.23	5%
Bio-swale	812.90	670.60	142.29	18%
Verge rain garden	3,563.39	4,146.38	-582.99	-16%
Street rain garden	3,674.90	4,146.38	-471.48	-13%
Tree pits	3,730.40	4,146.38	-415.97	-11%
Permeable pavement	3,517.27	3,697.18	-179.91	-5%

Phosphate removal bottom-up benchmarking also showed overall efficiency of 4.2% when compared to six other companies.

5.2.4 Direct Procurement for Customers (DPC)

To ensure we satisfy Ofwat's 'Minimum Expectation' of 'considering DPC by default', we have comprehensively applied Ofwat's criteria to the entirety of the capital programme proposed at PR24, including our enhancement cases. Eligibility for delivery through DPC is assessed against the Size and Discreteness tests set by Ofwat. Schemes with a whole lifecycle totex greater than the eligibility threshold of £200 million passed the size test and were put forward for Discreteness testing by default. We also considered the possibility of creating work packages to meet the £200 million DPC eligibility threshold, for example by combining smaller schemes below the eligibility threshold. These schemes were also then put forward for the Discreteness test. Schemes or programmes passing both these tests have been proposed by us as suitable for delivery by DPC at PR24. KPMG has acted as an objective third-party in interpreting and applying Ofwat's guidance on DPC and, where appropriate, we have followed their recommendations.

In this enhancement case, the schemes ‘Finham Sewage Treatment Works’ and ‘Coleshill Sewage Treatment Works’ were considered but subsequently discounted as suitable for delivery through DPC. More information can be found in Annex 4d Supporting Markets and Direct Procurement for Customers.

6. Customer protection

6.1 Holding ourselves to account for delivery

We have been careful to protect customers from:

- **Paying twice.** Many of the actions in our AMP8 WINEP programme have multiple benefits and are linked to more than one statutory duty. We have applied proportional allocation rules to all WINEP activities to ensure that they are funded through base expenditure where appropriate (see below), and prioritised activities that deliver wider environmental benefits while ensuring there is no double-counting;
- **Paying without experiencing the intended benefits.** We have structured our AMP8 WINEP programme to take full advantage of the opportunities presented by WINEP reform, which aims to link all activity to the environmental outcomes that customers want to see. Large segments of our programme have been entered as Tier 2 outcomes, allowing us to design better interventions that ensure customers experience the intended environmental benefits; and
- **Paying for an unfair share compared to future customers.** Our AMP8 WINEP programme for wastewater will deliver our statutory obligations to protect and improve the environment, and is therefore composed of 'no-regrets' investment only. This means that customers are only paying for those actions we are certain are needed during AMP8. Where options exist within the regulations to phase delivery over multiple AMPs, we have aimed for a smooth financial profile.

6.2 Overlap with other statutory instruments

Delivery of WINEP obligations is a measure included within the EA's annual Environmental Performance Assessment (EPA). From this year, Green status against this metric has required 100% delivery of all WINEP obligations within that financial year, with less than a 98% delivery resulting in Red status. Defra is in the process of setting the targets within the SODRP into statute. We anticipate, and are planning for, annual reporting on the delivery of these plans. Notwithstanding the fact that both the EA and Defra will be tracking delivery of the WINEP programme, there would be huge reputational damage to Severn Trent (and the wider water sector) associated with non-delivery of the largest programme of environmental improvements in the last 30 years.

6.3 Proposed Price Control Deliverable

We have developed price control deliverables (PCD) which set out the outcomes customers can expect as a result of this enhancement expenditure and we have taken into account overlap with common performance commitments and Outcome Delivery Incentives where appropriate. Our aim is to ensure customers are protected from under- or late delivery through easy to measure, track and verify deliverables. We have taken account of existing regulatory reporting mechanisms and have aligned our deliverables with these mechanisms where appropriate. Our proposed PCDs for this enhancement will have an impact on performance in relation to the common performance commitments related to storm overflow spills and river quality. We will continue to develop the detailed measurement methodology which will include third line assurance review to ensure there is sufficient specificity in the definition to meet the repeatability and reporting accuracy required as part of the APR requirements.

PCD 1 - EPA Waste WINEP delivery Status Not covered by other PCDs	
Description	Our Waste WINEP will be delivered by 316 obligations, excluding the Storm overflow, P removal and RQ monitoring programmes that are covered by other PCDs, and 621 'permitting only' obligations relating to existing flow monitors These permitting only obligations have been excluded to avoid an unrealistically low unit rate being applied to obligations where significant investment is proposed. The EA will track the delivery of these schemes according to the agreed WINEP delivery program and complete an annual assessment of performance as part of the Environmental Performance Assessment. (EPA)
	Measure Delivery of obligations in the Wastewater Industry National Environment Programme (WINEP) **Measurement** Each financial year we will evidence EA sign-off of WINEP obligations completed against the planned schemes up to that point in the 5-year plan.
Conditions on scheme	
Assurance	Assessment and assurance of program deliverables and completed milestones in line with EPA process. The company will ask the Environment Agency to confirm that performance has been correctly reported. The view of the Environment Agency will be definitive.
Cost sharing incentive payments	Cost sharing incentive rates have been calculated using the Ofwat PCD payments model using the following assumptions: • A cost-sharing rate of 50/50 is used for underspends and overspends • WACC = 3.23% • The time incentive rate is set at 3.5% of totex • Totex = £564m • Deliverables = Obligations completed (316) **PCD rate** = £0.8m/obligation **Time Incentive rate** = £0.062m/obligation
Impacts on performance In relation to performance commitments	**None**

Deliverable	Unit	2025/6	2026/7	2027/8	2028/9	2029/30
Number of Obligations completed as part of 5 year plan	No.	77	137	69	0	33

PCD 2 River quality Monitors	
Description	Our plan assumes a central estimate of the number of assets and locations that meet the Defra-defined priority areas where monitors must be installed within AMP8.
	Measure Number of monitors delivered in line with DEFRA River Quality Monitoring guidance **Measurement** Each financial year we will measure the cumulative number of monitors installed and commissioned.
Conditions on scheme	The current programme is conditional on confirmation of the statutory requirement for river quality monitoring from DEFRA. The proposed PCD rates are based on our best estimate of this requirement (1000 monitors) and this PCD will need to be recalibrated once DEFRA requirements are confirmed. The monitors will be reported as complete when they have been installed and certified in line with DEFRA guidance. The start of reporting of River Quality data will be in line with the regulatory obligation date set out in the WINEP program.
Assurance	Assessment and assurance of program deliverables and completed milestones in line with EPA process. The company will ask the Environment Agency to confirm that performance has been correctly reported. The view of the Environment Agency will be definitive.
Cost sharing incentive payments	Cost Sharing Incentive rates have been calculated using the Ofwat PCD payments model using the following assumptions: • A cost-sharing rate of 50/50 is used for underspends and overspends • WACC = 3.23% • The time incentive rate is set at 3.5% of totex • Totex = £128m • Deliverables = Number of monitors installed (1000) **PCD rate** = £0.064m/monitor **Time Incentive rate** = £0.0045m/monitor
Impacts on performance in relation to performance commitments	**None**

Deliverable	Unit	2025/6	2026/7	2027/8	2028/9	2029/30	Total
Number of monitors installed	No.	0	250	250	250	250	1000

There are some uncertainties relating to the implementation of the new Environment Act duty to provide continuous river quality monitoring. Defra issued its draft technical guidance document on the 9 August 2023 which provides details on which discharges are within the scope of the duty and which are exempt. The EA then published its WINEP driver guidance document on 18 August 2023.

The proposed exemptions from the duty, which are subject to parliamentary approval of the secondary legislation, are:

- Discharges to lakes, canals, groundwaters and coastal waters (these are not covered by the definition of the term 'watercourse' used in the primary legislation);
- Storm overflows that discharge fewer than 10 times per year on a five-year average;
- Sewage treatment works that have descriptive permits; and
- Any discharge to a watercourse with a depth permanently <4cm.

The guidance document also states that where discharges are within close proximity to each other, they can be monitored as a cluster rather than individually. Defra has also stated in the technical guidance document that 25% of the remaining qualifying discharges should be monitored by 2030, with the initial focus being on high priority sites.

It has not been possible to apply all of the proposed exemption criteria in detail so it may be necessary to review the number of outputs covered by this PCD before the final determination once this exercise is complete (and the secondary legislation has received parliamentary approval).

We also note that in a limited number of instances, it will be possible to close off a storm overflow (and surrender the associated permit) for a cost broadly equivalent to that of providing upstream and downstream monitors. Where storm overflow closure offers the best whole-life cost solution, this will be treated as being equivalent to delivery of two monitor units for the purposes of applying the PCD.

PCD 3 Storm Overflows	
Description	Our plan includes improvements at 562 storm overflows in AMP8; 364 through the WINEP and 198 additional overflows. The EA will track the delivery of the WINEP schemes according to an agreed delivery program and complete an annual assessment of performance as part of the Environmental Performance Assessment. We will track the delivery of the additional overflows through a process that follows the WINEP approach. DEFRA will also track delivery through our Storm Overflow Discharge Reduction Plan which will set a trajectory for reducing harm and achieving no more than ten spills.
	Measure Number of storm overflow sites improved **Measurement** Each financial year we will measure the number of storm overflows improved against the planned schemes up to that point in the 5-year plan. Completion will be evidenced by contract completion documentation for individual projects.
Conditions on scheme	We have completed the information required in Annex 3 of IN23/05 but believe that number of sites is the most robust metric. WINEP program comprises 364 overflows which will be tracked via the EA EPA process. We have also included a further 198 overflows in our plan and will apply a similar in-house tracking process to the WINEP overflows process for these overflows. If these additional 198 overflows do not proceed this performance commitment deliverable must be reviewed
Assurance	Assessment and assurance of WINEP program deliverables and completed milestones will be in line with EA's EPA process. The company will ask the Environment Agency to confirm that performance has been correctly reported for the WINEP program and the view of the Environment Agency will be definitive. For other overflows we will commission an Independent third-party assessment and assurance of completed schemes.
Cost sharing incentive payments	Cost Sharing Incentive rates have been calculated using the Ofwat PCD payments model using the following assumptions: • A cost-sharing rate of 50/50 is used for underspends and overspends • WACC = 3.23% • The time incentive rate is set at 3.5% of totex, • ODI incentive rates are in line with Ofwat guidance • Totex = £1113m

	• Deliverables = No. Overflows improved (562) ***PCD rate*** *= £ 0.973m/overflow* ***Time Incentive rate*** *= None* ***ODI link*** *= Storm Overflows Spill Reduction*
Impacts on performance in relation to performance commitments	The impact on the Storm Overflow Spill reduction ODI upon completion of the programme will be 4.

Deliverable	Unit	2025/6	2026/7	2027/8	2028/9	2029/30	Total
WINEP number of storm overflow sites improved	No.	6	14	129	128	87	364
Additional storm overflows	No.	4	30	60	60	44	198
Storm overflow spill reduction for ODI	No. Spills reduced	0.790	0.790	0.800	0.800	0.810	4

PCD4 P removal	
Description	Our plan includes 170 phosphate reduction obligations in AMP8. The EA will track the delivery of these obligations according to an agreed delivery program and complete an annual assessment of performance as part of the Environmental Performance Assessment.
	Measure Delivery of P removal obligations in the Wastewater Industry National Environment Programme (WINEP) **Measurement** Each financial year we will evidence EA sign-off of WINEP P removal obligations completed against the planned schemes up to that point in the 5-year plan.
Conditions on scheme	The phosphate load removal stated in table OUT5 (135,439 kg/y) is different to the load removal stated elsewhere in the business case (164,000kg/y). this is attributable to different baselines being used:- the Ofwat methodology uses actual works performance for year 2020 as a baseline whereas the EA use a 2020 'at permit' baseline. As the 'at permit' baseline is the EA's stated approach for assessing delivery of the Environment Act 80% reduction target, the WINEP programme was compiled using this approach. However, the PCD has been calculated to be consistent with the Ofwat OUT5 methodology.

Assurance	Assessment and assurance of program deliverables and completed milestones in line with EPA process. The company will ask the Environment Agency to confirm that performance has been correctly reported. The view of the Environment Agency will be definitive.
Cost sharing incentive payments	Cost Sharing Incentive rates have been calculated using the Ofwat PCD payments model using the following assumptions: • As the legal obligations fall on the final day of AMP8 we have assumed there will be no ODI impact in AMP8 or any Time Incentive penalty • A cost-sharing rate of 50/50 is used for underspends and overspends • WACC = 3.23% • Totex = £661m • Deliverables = P removal Obligations (170) *PCD rate = £1.9 m/obligation* *Time Incentive rate = None* *ODI Link = River Quality*
Impacts on performance In relation to performance commitments	*The impact on the River Quality ODI is 135,439Kg for AMP9*

Deliverable	Unit	2025/	2026/7	2027/8	2028/	2029/30	2030/31	Total
WINEP P removal obligations	No.	1	-	1	-	168	-	170
Kg P removed	Kg P removed						135,439	

Note that the 2025/26 P removal obligation has a WFD no deterioration driver so will not be delivering a load reduction – the obligation is to ensure no increase in loads discharged. The 2027/28 obligation is delivering a river improvement through relocation of the discharge point, so the project will not deliver a reduction in load.

Further note that there will be an apparent mismatch between this phosphate load removal in the data table OUT5. This is because the data in OUT5 also includes the benefits arising from our Green Recovery programme, and because some benefits of AMP7 year five WINEP projects are fully realised in 2025/26.

6.4 Managing uncertainty

Tackling uncertainty with our regulators

Severn Trent's WINEP ambitions form a significant programme of investment across the next 25 years. That means we need to balance our commitment to delivering environmental enhancements (in line

with our statutory obligations and, wherever possible, incorporating wider environmental benefits) with protecting our customers from unnecessary spend.

Throughout the development of our WINEP programme, we have worked closely with the EA and other regulators to ensure that our AMP8 activities will deliver the outcomes that we, our regulators and our customers want to see. Where the delivery of the outcome is uncertain – for example, the requirements relating to treatment of chemicals such as cypermethrin – we have discussed the challenge with our regulators to find the best outcome. This has led to the use of Operating Technique Agreements (OTAs) at seven sites that will enable us to assess the performance of new assets that are being installed in AMP7 (under our phosphate removal programme), before committing to any further improvement works. The monitoring included under these OTAs will be used to inform the possible need for further work at PR29. We have also worked with the EA to secure agreement to the use of OTAs as being the most cost-effective way of monitoring for the prevalence of PFOS (perfluorooctanosulphonate) at 22 of our WwTWs.

Note: An Operating Technique Agreement (OTA) is an annex to the formal part of a discharge permit. They set out additional performance targets and/or monitoring. An OTA will also outline courses of action to be taken if the conditions are not met. Because the OTA is not a formal permit condition, failure to meet the terms does not equate to the works being formally classed as failing. They are used by the EA and water companies to introduce additional environmental regulation without creating undue compliance risks.

Some uncertainties remain over the new river quality monitoring duty, as outlined in Section 6.4. Technical guidance issued by Defra and the EA in August has provided sufficient information upon which to base an informed estimate of programme size but there has been insufficient time to apply this guidance to generate a precise number of monitors required in AMP8. We are therefore proposing a PCD to protect customers from these uncertainties.

6.5 Deliverability

All solutions are expected to be deliverable by the existing industry supply chain. There is likely to be the need for specialist equipment suppliers for elements of the scope, but the delivery interfaces are expected to be no different from current delivery of WINEP.

We also re-confirm the various assurances given over the course of WINEP development that this is an affordable and deliverable WINEP programme. These assurances include:

- The Board assurance statement provided to the EA which accompanied our initial WINEP submission on 30 November 2022;
- The verbal assurances given at the joint Defra/Ofwat/EA meeting of 25 May 2023;
- Letter from Bob Steer (Severn Trent Chief Engineer) to Helen Wakeham (EA Director of Water Transformation) dated July 19 2023; and
- Letter from Liv Garfield (Severn Trent CEO) to the Defra Water Quality Team dated July 24 2023.

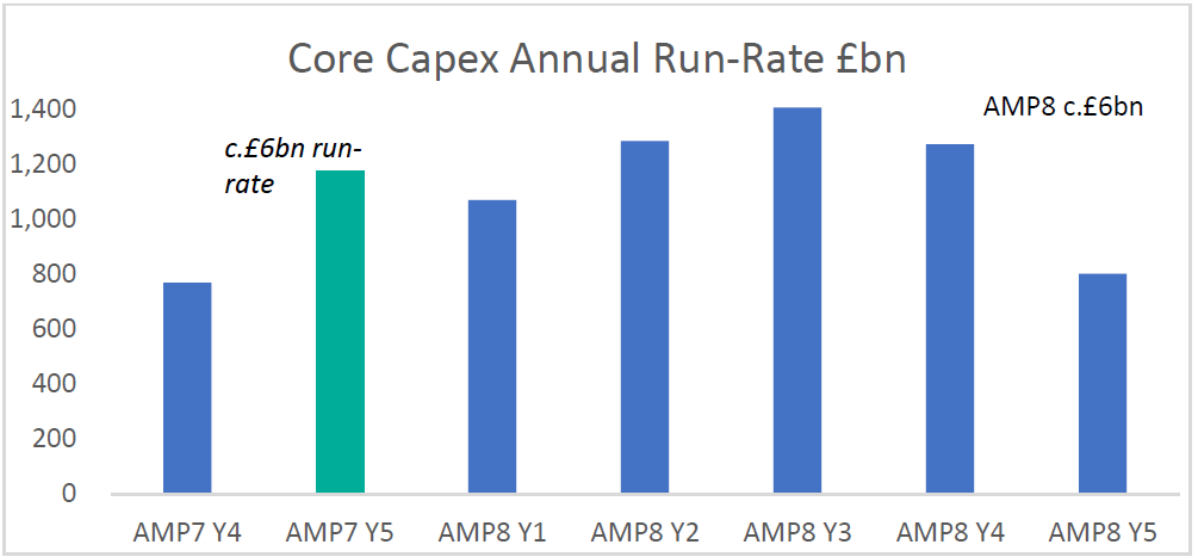
Our plans for AMP8 are ambitious and will be challenging to deliver but we believe we are in a unique situation in terms of deliverability. Our conviction is based on three key differences of our approach:

Demonstrating capacity at the required run rate

Due to the additional Green Recovery capital spend, we are already operating around the equivalent annual capital spend profile to deliver the AMP8 ambitions. We are on track to deliver around £1bn

of improvements this year. In October we will be announcing an acceleration of our AMP8 plans, pulling forward up to £400m of planned AMP8 delivery into 2023-24 to 2024-25. This is made possible by our low gearing and excellent financeability. This means we will be investing at a forecast £1.25bn per year from March 2024, which is beyond the expected run rate throughout AMP8.

Figure 6.1: Core Capex Annual Run-Rate



In-house design expertise removes a key bottleneck

In AMP6, we took the decision to insource our design capabilities and we now have access to 280 engineers. This means we are not competing for scarce engineering resource – a significant constraint for other water companies and across wider infrastructure projects. Due to the time window from design to delivery we have also accelerated our process and we are targeting promotion of around 80% of the £6bn capital investment into the delivery teams by the time we exit AMP7.

Confirmed supply chain capacity

We are not competing with the rest of the market for the majority of our capital projects. We plan to source more than 60% of our capital programme outside the current Water UK supplier routes. This means that, although our total spend equates to 13% of sector-wide spending, we will only be drawing on the traditional supply chain for around 6%. Our alternative plan is based on:

- 26% from Severn Trent employed labour;
- 27% from additional supplier capacity that we have developed in our region and upskilled to work in our sector, of which at least 5% will be delivered through a new manufacturing factory facility which we have developed in partnership with the Manufacturing Design Centre; and
- To deliver the world's first waste treatment Net Zero hub we are sourcing suppliers outside the traditional supply chain

We further acknowledge that concerns about the deliverability of the sector's ambitions is also in part a reflection of the pressures caused by wider UK infrastructure plans. Recognising this, we have removed ourselves from the fight for resource and support the outlook for others. Specific actions include:

- We have a decided not to patent our new factory facility design expertise and will instead share the learning with the sector, allowing others to gain from our investment and enhance their own routes to delivery;
- Over the next 12 months, we will be insourcing around 1,000 roles to further reduce reliance on the market. This will cover a wide range of roles, including additional engineers, project managers, wastewater technicians, and mains renewal pipe laying gangs;
- We have invested heavily in a framework management team to reduce wasted time on construction sites, including up-to-date design and construction standards, the use of pre-fabricated elements, and digital construction rehearsals as standard practice. Activities such as these improve efficiency and improve safety of the build phase. All these steps mean that our draw on the supply chain will be less, which frees up more resource for others; and
- We have invested heavily in artificial intelligence to reduce rework, and as such reduce capital costs. We aim to share our learning with other companies to help them increase their rate of delivery and so reduce re-work. Wider scale adoption of these tools would reduce pressure on resources for the whole sector.

7. Appendices

Appendix A

Storm Overflows – Increasing our pace

Moving further and faster than the SODRP targets

Appendix A: Executive summary

Within the new water industry action plan designed to improve storm overflow performance in England there is a clear focus on those rivers defined as high priority areas. We have embraced this approach, as outlined in our own Get River Positive[30] scheme and within our PR24 WINEP programme for storm overflows. However, there are some unique opportunities across our waste catchments to respond to the urgent and unwavering need to do more.

The case for this additional activity on storm overflows is based on three key drivers:

- Societal imperative that we do more to reduce spill frequency. The statutory programme rightly focuses on high volume high impact sites which delivers significant river quality benefit but it will not satisfy the consistent message for urgent action to reduce spill frequency. This view is echoed through the media, through correspondence with policymakers, though our customer research and daily correspondence, through the unfaltering stream of environmental information requests, and from friends and family and neighbours – who are all looking to us to respond to the shift in views about what is acceptable from a 21st-century drainage service;
- The unanimous desire for more nature-based solutions – across customer groups, stakeholders and through government policy. Extensive cost-benefit analysis concludes that, for the network solutions across our statutory WINEP, the most cost beneficial solution is a predominantly traditional (grey) programme. By tackling smaller volume overflows we can significantly increase the number of nature-based solutions and therefore accelerate the benefits they bring. All of this proposal is based on nature-based solutions to reduce spill frequency; and
- This is an extremely cost-effective way of driving reductions to the spill frequency. At £15,200/spill reduction compared to the WINEP unit cost of £117,300/ spill reduction this is a low cost way of driving the improvements. This is in the context that our benchmarking already shows our WINEP is efficient compared to the rest of the sector and therefore these low value, low cost solutions will drive efficiency even further.

From our Drainage and Wastewater Management Plan (DWMP) option assessment we have identified 198 storm overflows where we are able to move at a faster pace to meet the targets set out in Defra's Storm Overflow Discharge Reduction Plan (SODRP). These sites are partially (65%) within high priority areas as our WINEP-defined storm overflows and partially (35%) at locations where we see **very good opportunities to implement nature-based improvements like sustainable urban drainage systems (SuDS) to reduce storm overflow spills in a cost-effective manner**.

By investing an additional £100m in nature-based solutions at these 198 storm overflows, we will:

- **Reduce storm overflow spills by a further 1.94** by 2030;
- **Improve 12% of high priority overflows and 11% of all storm overflows** needing upgrades by 2030;
- **Remove around 58,458m^3 of rainfall by separating 10.4ha of hardstanding from our system**;
- Improve the wider catchments' **resilience in a nature-based approach**; and

[30] https://www.stwater.co.uk/get-river-positive/

- Help widen our **research and innovation on nature-based solutions** installed in urban environments.

We recognise that the use of storm overflows is of critical importance to Defra and the EA. For this reason, we wrote to both organisations in the summer of 2023 to explain our intention to drive further reductions in overflows and to tackle an extra 198 sites in AMP8. Neither the Government nor the EA has expressed any concern with our proposal to reduce the use of overflows faster than our original intention in WINEP.

Appendix A: Content

A.1 The case for acceleration

In this WINEP business case we have already set out the context of the legislative changes through the Environment Act 2021, which places a legally binding duty on water companies to progressively reduce the adverse impacts of discharges from storm overflows. The SODRP, announced in September 2022, sets the targets that water companies are required to meet to reduce their impacts on the nation's rivers. Within our WINEP programme we have outlined a plan to not only meet the targets within the new legislation but also to ensure that all reasons for not achieving good (RNAGs) linked to storm overflows are removed by 2030. This means our WINEP programme has been focused on river reaches with RNAGs to ensure we can successfully resolve harm caused by some of our largest and most complex storm overflows in just five years. While that meets our statutory obligations, it does not go far enough. There are some unique opportunities across our waste catchments to respond to the urgent and unwavering need to do more.

The case for this additional activity on storm overflows is based on three key drivers:

- Societal imperative that we do more to reduce spill frequency. The statutory programme rightly focuses on high volume high impact sites which delivers significant river quality benefit but it will not satisfy the consistent message for urgent action to reduce spill frequency. This view is echoed through the media, through correspondence with policymakers, though our customer research and daily correspondence, through the unfaltering stream of environmental information requests, and from our friends and family and neighbours – who are all looking to us to respond to the shift in views about what is acceptable from a 21st century drainage service;
- The unanimous desire for more nature-based solutions – across customer groups, stakeholders and through government policy. Extensive cost-benefit analysis concludes that, for the network solutions across our statutory WINEP, the most cost beneficial solution is a 62% traditional (grey) and a 38% nature based (blue-green) programme. By tackling smaller volume overflows we can significantly increase the number of nature-based solutions and therefore accelerate the benefits they bring. All of this proposal is based on nature-based solutions to reduce spill frequency. This will deliver significant learning to inform the rest of the SODRP; and
- This is an extremely cost-effective way of driving reductions to the spill frequency at £0.5m/m³ of water stored compared to £2.8m/m³ across our WINEP (or £15,200/spill compared with £117,300/spill in the WINEP) this is a low cost way of driving the improvements. This is in the context that our benchmarking already shows our WINEP is efficient compared to the rest of the sector and therefore these low value, low cost solutions will drive efficiency even further.

The additional improvement work outlined in this case is designed to complement our large-scale WINEP programme by tackling smaller storm overflows that are not linked to river harm issues. We have additionally already set aside £273m to make necessary improvements around our storm overflows within AMP7 and have outlined further maintenance improvements within our base plan for AMP8 that will complement our full enhancement case for storm overflows. Figures 1 and 2 below show how the two programmes combine to deliver the overall improvements expected from us.

Figure 1: The combined effect of WINEP and additional activity

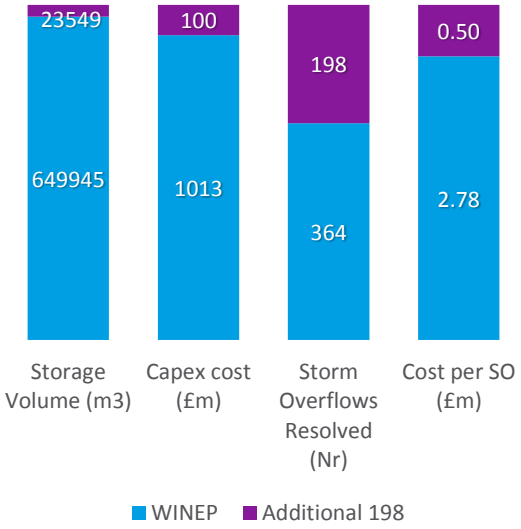
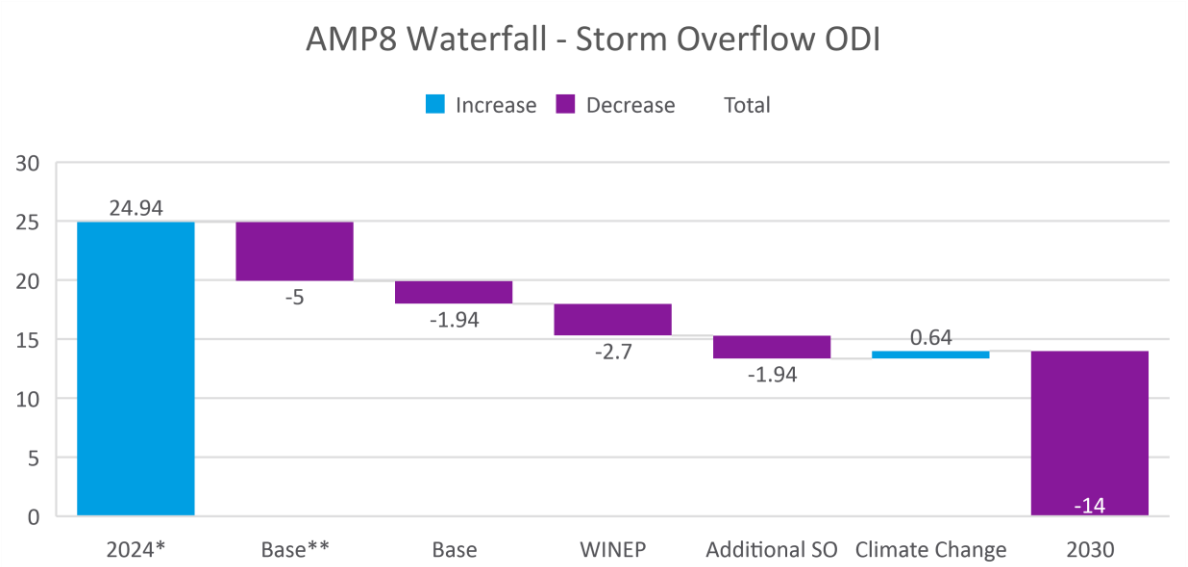


Figure 2: Contribution of spill reduction from different components of our plan



*Note – 2024 is the calendar year projection of the average storm overflow count, including the operability adjustment requirement from EDM reported value to ODI quantified value.

**Base - unmonitored adjustment

In the remainder of this section we provide more detail on each of these drivers.

A.1.2 Society expects a significant reduction in spill frequency

A.1.2.1 Customers

Within our customer engagement on reducing storm overflow spills and improving river quality, we received feedback that *'if more money was to be invested to go beyond the proposed plan,*

customers often say that they would like this money to go towards reducing storm activations, which is seen as more of a priority than reducing phosphates'.

Our research shows customers would prefer, if we were to go beyond the WINEP plan, that money to be spent on reducing storm overflow spills and focusing more on improving storm overflows, over and above other elements of our WINEP programme.

Our WINEP programme will mean we will meet the required 38% target for the highest priority sites. By adding in the additional 198 storm overflows outlined in this case, this will increase that figure to 50% (and to 38% of the full asset base requiring improvements to reduce spills).

Putting this option to accelerate our plan in front of our customers (via our Long Term Delivery Strategy (LTDS) research) our customers said that they viewed Severn Trent's goal of surpassing the Government targets as positive. Many view government targets as a '*bare minimum*' that should be surpassed. Some believe that setting a higher target would allow a 'buffer'. Specifically, *"This means that they've got a bit of spare time in case they fall behind'* (NHH customer, Worcester).

A.1.2.2 Society more broadly

Public expectation is exceeding the statutory timeline on the subject of storm overflow spill frequency. The roll out of comprehensive monitoring is an important step in transparency and the response to this information is a clear message that the current drainage system does not meet the public's expectations. This trend will continue to grow as more data is put in the public domain – such as the Water UK SODRP maps which are due to be published this Autumn. We regularly see calls for action in the media and from sector commentators that the only acceptable number of spills is zero. This message is also echoed in the March 2022 letter from David Black[31] to water company Chief Executives.

We have seen an increase in press coverage on storm overflows and river health. It has become a hot topic in the national press, with many of the titles including opinion pieces on the subject. Every week, we are seeing more and more coverage on topics ranging from the recent decision by the Government to scrap nutrient neutrality rules which had previously forced developers to protect Britain's waterways, the Leigh Day legal case against Severn Trent and other water companies, campaigners and activists such as Feargal Sharkey commenting on 'raw sewage spills', and investigations into EA data by the media and groups such as Greenpeace. It has also become a political issue with many MPs and councillors weighing in on the topic. The examples below provide links to recent national and regional coverage which illustrate the scale of public interest and dissatisfaction with the current pace of progress. It also demonstrates the fact that the public do not differentiate between spill frequency and impact on the river.

Nutrient Neutrality stories:

Scrapping pollution rules is 'backward step' for rivers – BBC News

'Unacceptable': how raw sewage has affected rivers in England and Wales – in maps | Water | The Guardian

Leigh Day stories – from a national and regional press perspective we had in excess of 400 cuttings on the Leigh Day story, and dealt with 37 media enquiries in the first 24 hours of the story being live:

[31] https://www.ofwat.gov.uk/wp-content/uploads/2022/03/Letter-from-David-Black-to-CEOs-on-Environment-Act-duties.pdf

Severn Trent faces US-style class action lawsuit over sewage spills | Financial Times (ft.com)

Water bills: Fight for money back over sewage leaks begins – BBC News

Millions of Brits could get compensation in £800m legal action against water companies – Mirror Online

Regionally, we have had numerous media enquiries around river health and spill data, with a clear message that people want more urgent action. Below are a few examples:

The Shuttle – Severn Trent: Hundreds of storm overflows used in Wyre Forest | Kidderminster Shuttle

Birmingham World – Hundreds of sewage overflows in Solihull last year (msn.com)

A.1.2.3 Environmental groups

We have heard loud and clear the call for faster and more ambitious progress on storm overflows. The following examples are representative of the views held by many environmental advocates.

In Blueprint for Water's response[32] on the SODRP consultation response they consider

> *"The plan is well-intentioned, but utterly fails to capture the severity and urgency of the water quality crisis"*

In the Rivers Trust response[33] to the SODRP, they comment:

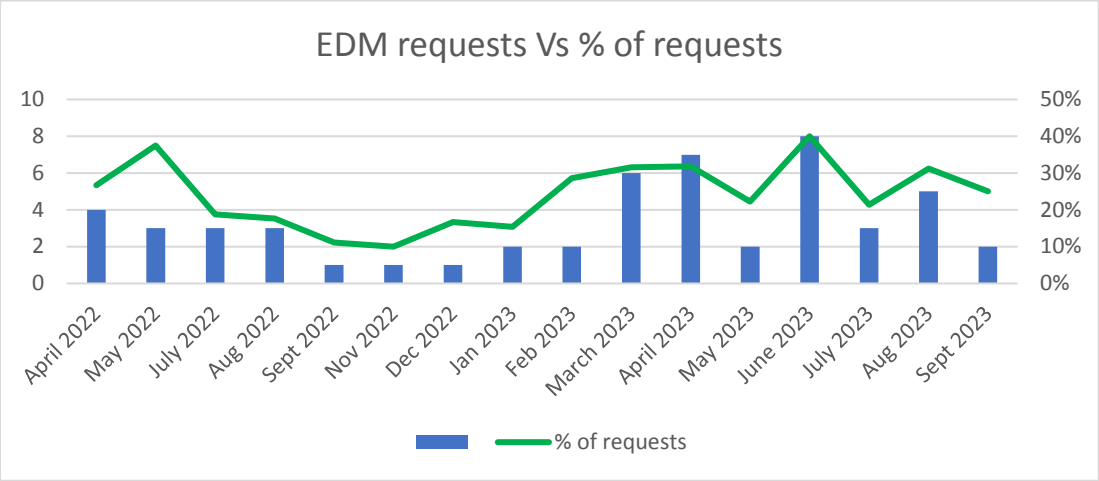
> *"We are incredibly disappointed by the plan, because:….. The timeline for action lacks ambition and is out of step with other proposed government environment targets on pollution reduction and nature's recovery"*

We have seen an increase in the number of demonstrations across the UK by environmental activists such as Surfers Against Sewage and Extinction Rebellion, with two demonstrations taking place at our headquarters in Coventry, in March and July this year.

Figure 3 shows the number of environment information requests (EIRs) received on storm overflow spill frequency over the last 18 months, which remains fairly constant at around a quarter of all EIRs. This gives a clear indication of the persistent demand for information on this subject. This is also likely to underestimate the interest as the majority of EIRs contain multiple questions (on average there are three to five questions/data requests in each EIR). This does not include general media enquiries, which have also remained a regular feature of recent years.

[32] https://www.wcl.org.uk/docs/Blueprint_for_Water_SODRP_Consultation_Response_12_05_2022.pdf
[33] https://theriverstrust.org/sewage-reduction-plan

Figure 3: Number of EIRs on storm overflow data



A.1.3 There is a desire for more nature-based solutions

Customers and policymakers are both keen that nature-based and more sustainable solutions are utilised. Extensive cost-benefit analysis concludes that, for the network solutions across our statutory WINEP, the most cost beneficial solution is a 62% traditional (grey) and a 38% nature based (blue-green) programme. By tackling smaller volume overflows we can significantly increase the number of nature-based solutions and therefore accelerate the benefits they bring.

The learning from this will be used to create a blueprint for lower cost ways of adapting our drainage system to the impact of climate change. It will enable us to gather data on modular nature-based solutions that can adapt as the climate changes far better than grey solutions, and so enable us to improve the way we collaborate with other organisations and communities to help speed up rollout of the improvements in the future. Alongside these 198 storm overflows and our WINEP storm overflow programme we are developing our next innovation hub dedicated to finding ways to eradicate storm overflows. We will draw together established and new technologies, nature-based solutions and AI to help us get the very best out of our existing assets.

We explain these points in more detail below.

A.1.3.1 Customers support nature-based solutions

For both our DWMP and PR24 plans we have conducted in-depth research to better understand customer views on the long-term challenges we face to ensure the sustainability of our drainage network and how we make decisions on the future of the services we provide to them and to the environment.

We have discussed potential drainage solutions with customers across two different pieces of research (see Annex 3a for full details of our customer engagement), presenting them with summary information on various options, including the relative cost, the carbon impact, and the potential disruption. To address drainage challenges, customers tend to favour options that have the least impact in terms of cost, carbon, and disruption, with natural, sustainable options typically emerging as a higher priority.

They also felt solutions should be long-term and address underlying issues. Short-term solutions (such as sewer jetting) might be required in urgent situations but, overall, customers indicated a preference

for long-term solutions, as well as early investment to reduce risks and to prevent higher costs in the future when problems potentially become larger.

> "*Longer term solutions that could result in a better system… if there was a clear strategy, I would be happy to pay more*"
>
> Household customer, DWMP research

In addition, in a survey conducted on Tap Chat, our online customer panel, 76% of those who responded agreed that where '*there is a choice, and where the two types of solutions would be equally effective, they would prefer Severn Trent to adopt sustainable solutions to manage surface water drainage*'.

A range of solutions have high to medium appeal for customers, including using sustainable solutions (providing they are effective). Separating sewer pipes is also a popular solution despite the cost and carbon ramifications, as well as the potential disruption because it is seen as having a permanent impact.

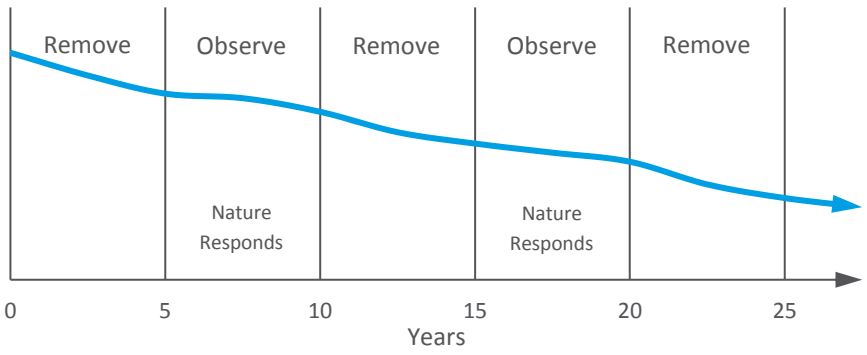
We have specifically discussed SuDS solutions with customers in multiple research projects and have typically found that, compared to more traditional solutions, customers view sustainable options more positively. While supportive of SuDS, customers do have some concerns and would welcome further consultation with Severn Trent if the solution were to be built near their property. They also recognised that other solutions may still be required, particularly in specific scenarios, e.g. if there was a lack of space.

A.1.3.2 Learning how to integrate modular NBS into our catchments

From our DWMP assessment and using the learnings from our Green Recovery project in Mansfield, we have developed cost benefit curves which outline that, when the flow reductions within the system (to reduce storm overflow spills) are small, nature-based solutions are the most cost-effective solution that also gives us stronger resilience to increased rainfall.

But nature takes time to adapt. By accelerating ahead of the statutory back stop dates we can seek to incrementally improve the drainage system with time to review impact and to further innovate our future nature-based approach.

Figure 4: an example timeline showing the results of modular/incremental nature-based solutions over time



We would focus on specific elements of innovation and learning, specifically:

1. Increasing the **visibility and acceptance of retrofitted nature-based solutions** like SuDS with our customers. Our customer insights showed that, although customers welcomed the idea

of SuDS they wanted more involvement in their creation in their communities. By spreading the installation of nature-based solutions throughout our region we can showcase their ability to enhance the local environment and community;

2. Expanding our learnings, alongside our drainage partners, of installing **retrofitted nature-based solutions like SuDS in heavily urbanised environments.** From our learnings from Mansfield, we can take our new stock of standard designs and amend these in agreement with local councils to ensure they align naturally with individual best practice requirements around health and safety, maintenance, and their own regeneration plans;
3. Increasing industry awareness and guidance on how **effective evapotranspiration and infiltration** to ground is for retrofit SuDS within geographically variable urban environments. **Working with research partners like Sheffield University,** we have an ongoing PhD in place following our Mansfield improvements. This PhD, and other follow-on research, as part of this programme of work, will continue into AMP8, where further publication of findings will be made available to the wider industry;
4. Within the 198 storm overflows, two are located at treatment works where we feel undertaking further updates to increase treatment levels will improve our ability to handle higher levels of flow alongside more **nature-based treatment improvements** which would work hand-in-hand with our current assets; and
5. **How retrofitting can support water efficiency** – by fitting rainwater harvesting, greywater, or blackwater treatment and re-use on site, as well as smart management of surface water at a property level.

A.1.3.3 Developing more effective ways of working in partnership

Within our AMP6 and AMP7 programmes we have taken a collaborative approach to build nature-based solutions to help resolve flooding. This has been undertaken through our bespoke performance commitments and has allowed us to build a variety of solutions, at different scales, jointly with other drainage owners (i.e. LLFAs, local councils, the EA, etc.).

Each council has different maintenance approaches, together with different policies and regeneration plans for future improvements within their respective urban areas. Within the Severn Trent region we have 27 LLFAs, together with several local councils with which we work to build nature-based solutions. To date, as we have only built one or two urban nature-based solution within each council area, we have created unique individual designs and maintenance plans for each scheme. To move forward at pace and scale we, alongside our partners, intend to move to a more standardised approach. This will use our ‘plug and play’ design and build approach with balanced amendments to work for the unique geography and ecology of each region within our drainage boundaries.

A.1.3.4 Learning how to address regulatory barriers on NBS

Within the WINEP driver requirements for storm overflow improvements (EnvAct_IMP4) the requirement is that, for sign-off for completion, we can categorically show, through hydraulic modelling of our system, that the future spill frequency will be fewer than 10 in a typical year, utilising a 10-year rainfall series. Additionally, the EnvAct_IMP2 driver for resolving harm at storm overflows also needs appropriate river water quality investigations to be completed on top of the sewer modelling to again show that the solution has a high confidence in removing harm in a ‘fair share’ approach.

We support the need for investigations to ensure solutions are correctly sized to manage current and future sewer demand, this approach inherently drives a focus on known solutions that are proven in previous projects, but which limit innovation where outputs are less known. Without the WINEP drivers specifically linked to these storm overflows we will still strive to achieve less than 10 spills in a typical year but use a more survey-led approach as we have with the Mansfield Green Recovery project. That means we will focus on area removed upstream of each storm overflow.

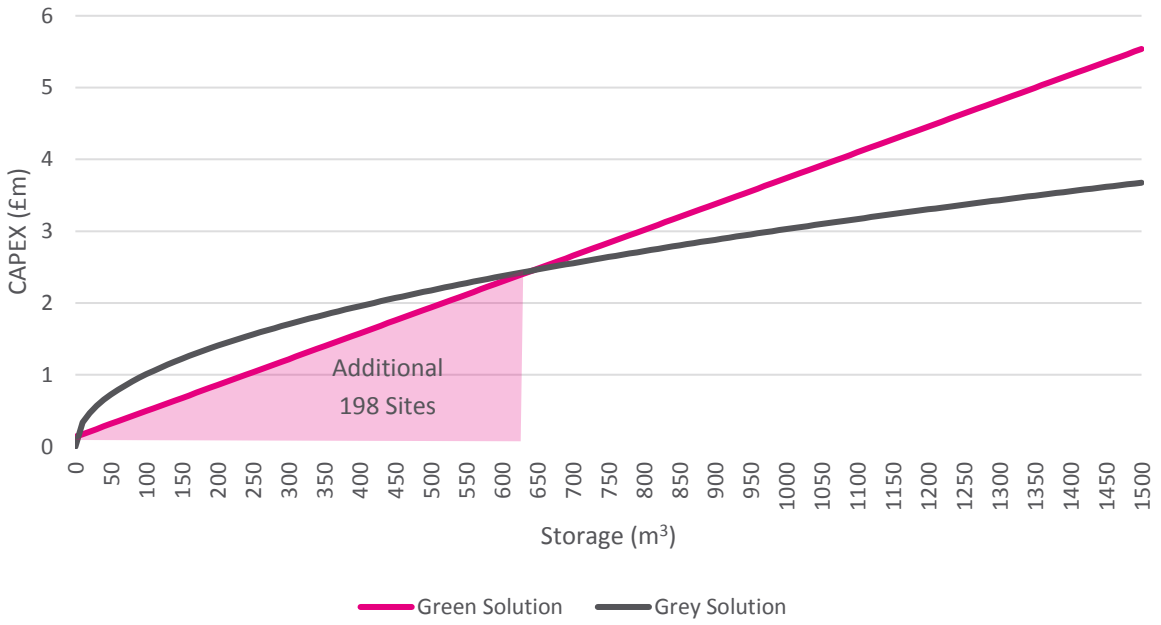
On top of undertaking upstream nature-based solutions to redirect storm response away from the sewer system we will also undertake nature-based treatment solutions at two treatment works. Our analysis shows that building on our existing treatment processes and expanding them to have additional nature-based treatments for storm situations is potentially the cost-effective approach to reducing our storm overflow spills.

A.1.4 Cost effective solution for reducing spill frequency

This is an extremely cost-effective way of driving reductions to the spill frequency. At around £15,200/spill reduction compared to around £117,300/spill reduction this is a low cost way of driving the improvements. This is in the context that our benchmarking already shows our WINEP is efficient compared to the rest of the sector and therefore these low value, low cost solutions will drive efficiency even further.

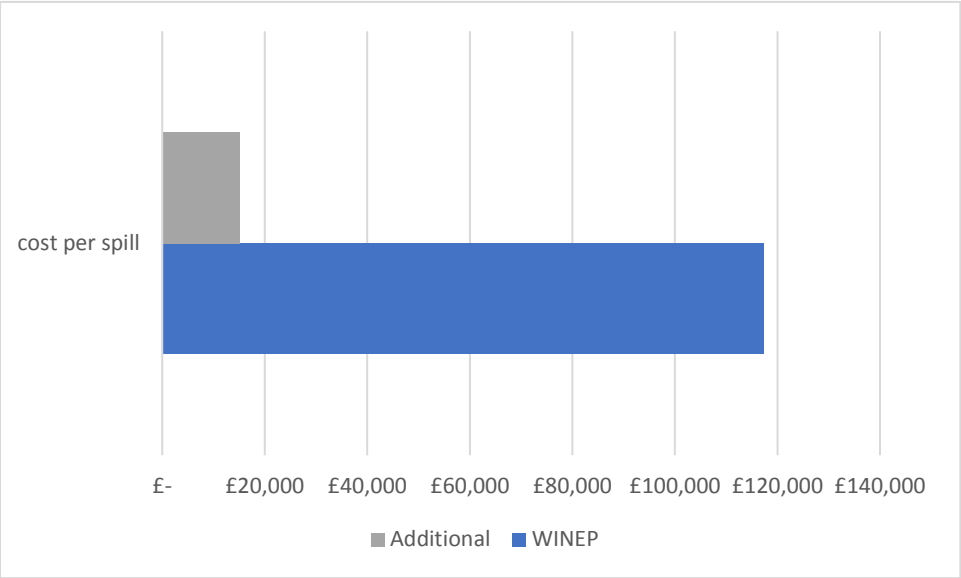
Our analysis shows that, within our enhancement plan, above a certain volume the most cost beneficial solution tends to be grey, storage solutions. Due to the makeup and focus on river quality/environmental harm the majority (over 60%) of our WINEP will be based on traditional solutions.

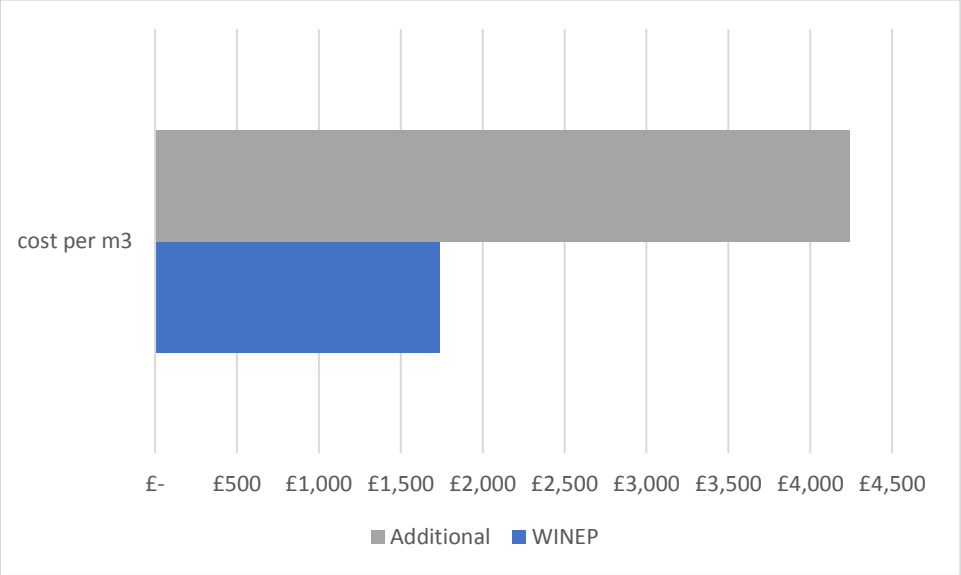
Figure 5: Relationship between cost and volume

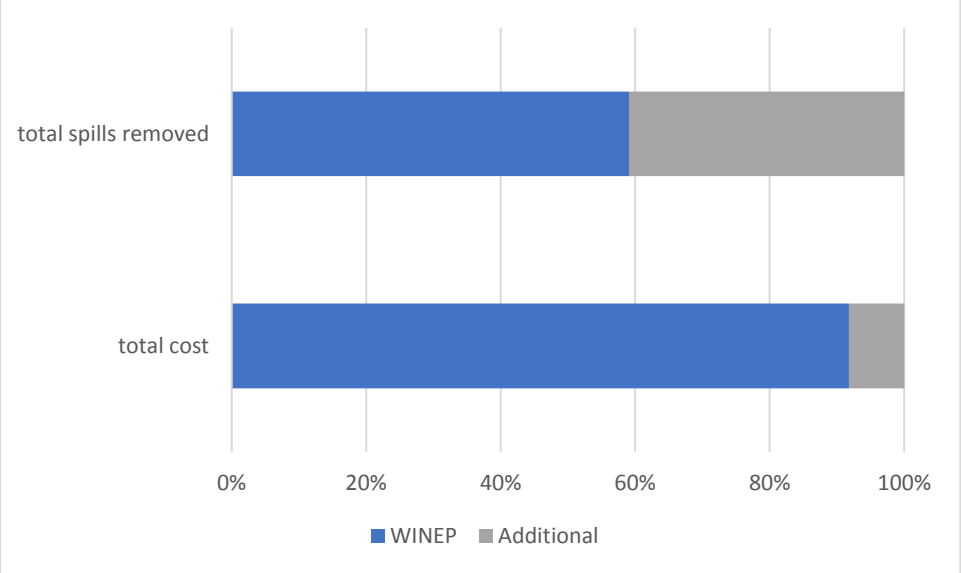


Figures 6 below outlines the comparison of cost per m³ and per spill basis between these 198 and the WINEP programme, to demonstrate the significantly low cost of these low volume, nature-based opportunities.

Figure 6: unit cost comparisons between WINEP and additional spill reductions







A.2 Finding the best option for customers

Our DWMP best value plan has been at the core of our cost benefit analysis to outline the balance of investment between green and grey solutions using the best available data on what additional natural and social benefits would be obtained from implementing one over the other.

As outlined within our DWMP submission, for a two-degree climate change scenario our best value plan focuses far more on traditional grey drainage features than green. From interrogating our analysis this is due to a number of reasons:

1. From years of experience, we have become very efficient at building traditional grey drainage features;
2. We have incurred high unit costs for the initial solutions in our existing programmes, i.e. Green Recovery in Mansfield and our Green Communities partnership projects, as we have developed our tools, processes and design standards;
3. Our supply chain is also only at the embedding stage for building urban nature-based solutions; and
4. We are still building the research needed to fully quantify the wider natural and social capital benefits in a robust approach.

This means, collectively, we feel we are under-projecting the wider benefits and potentially over-projecting the potential cost difference between grey and green solution types. This potential improvement on green (nature-based) unit cost can only truly be realised if we continue to improve our processes, work together with our supply chain, and build more nature-based solutions so we can monitor their true potential over future years. With this improvement there is an underlying expectation that the green unit cost and become more equivalent to our efficient grey unit cost.

Table 1: Programme split between green and grey solutions

	AMP8
WINEP Storm overflow solution ratio	38% green hybrid 62% grey
Total programme ratio with this additional activity	60% green hybrid 40% grey

A.2.6 Optimum Scope

Within our full DWMP we assessed all our waste system catchments against more than 40 options to determine how feasible a range of different interventions would be in each area. This enabled us to develop a shortlist of plausible schemes which would best address the identified needs of a catchment or an individual asset.

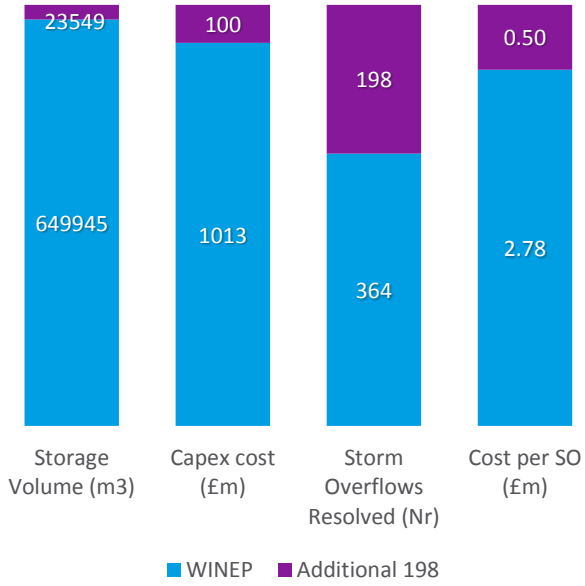
The options were split into four main themes based on:

- Optimising existing capacity (i.e. silt management);
- Removal of inflow (i.e. reducing demand and increasing headroom);
- Increasing capacity (i.e. through building bigger sewers); and

- Use of localised treatment (i.e. build small treatment works to manage excess flows at critical system locations).

Within this, we are able to establish the most cost beneficial solution for each storm overflow by comparing nature-based green solutions against more traditional grey solutions. Our analysis showed that, at sites requiring smaller improvements to reduce storm overflow spills, there was an opportunity to focus completely on nature-based solutions. Specifically, within these 198 sites, and using our standard cost curves and benefit assessment, we were able to show that, as a minimum, 187 should have green-focused solutions, with the other 11 showing an initial focus on a grey solution. When further investigating the green to grey solution costs at these 11 locations, we found that the green solution was broadly equal in cost.

Figure 8: Contributing costs and benefits from WINEP and the additional reductions



A.2.7 Opportunity mapping

To identify these 198 overflows, we have utilised the learning from our Mansfield project. For each of our storm overflows, we have assessed the opportunities for surface water separation of the foul/combined system through nature-based solutions. We have used the same mapping of surface water connectivity which underpins our hydraulic sewer models. This not only identifies the run-off source (i.e., whether from a roof, road, footpath, car park, etc.) but also its discharge point (i.e. combined sewer, surface water sewer, soakaway, etc.) and where we have identified connections to third-party assets (e.g. highway drains, culverted watercourses, etc.) these will also be recorded. We are utilising the learning from Mansfield on opportunity mapping to link where there is high density of hardstanding area to solution types for household and non-household customers alongside roads discharging into the sewer system. From this mapping, we can follow the same fast track approach for building nature-based solutions within these urban areas by working with our supply chain and stakeholders to amend the drainage system, as well as improving the natural and social capital within our customers' communities.

Figures 9 and 10 outline an example site from the 198 where we have collated the source of hardstanding which we can then translate into specific SuDS interventions based on the local geography.

Figure 9: This plan shows the contributing area upstream of a storm overflow. The purple areas indicate opportunities to separate out hardstanding surfaces which currently contribute surface water runoff to the system

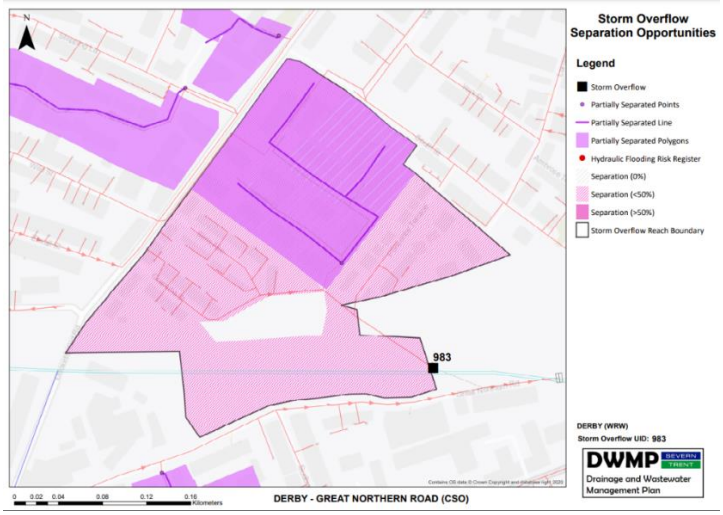
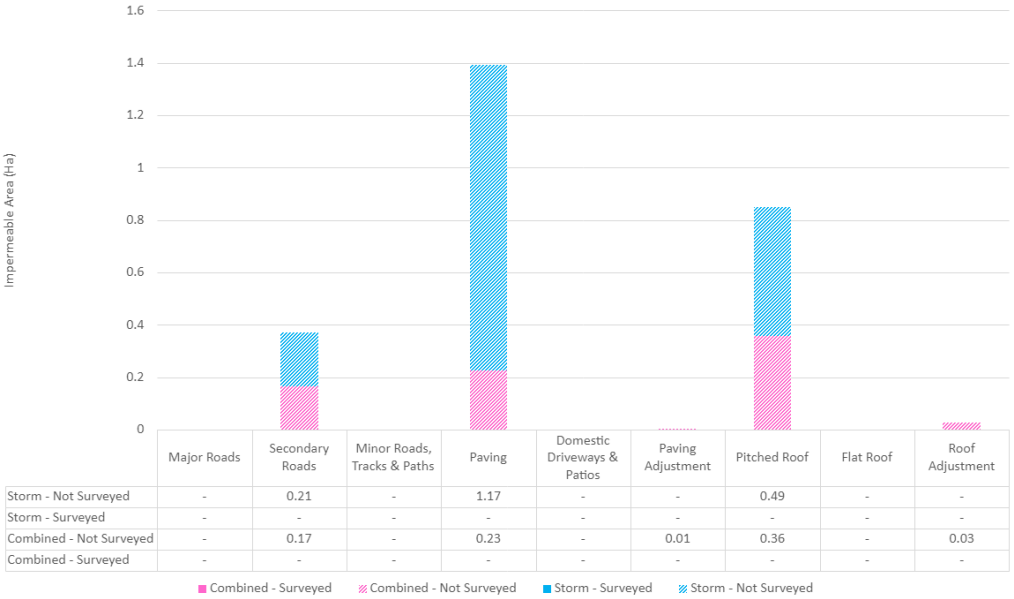


Figure 10: Following on from figure 9, this chart shows the characteristics of hard standing surfaces contributing surface water runoff to the storm overflow



	Major Roads	Secondary Roads	Minor Roads, Tracks & Paths	Paving	Domestic Driveways & Patios	Paving Adjustment	Pitched Roof	Flat Roof	Roof Adjustment
Storm - Not Surveyed	-	0.21	-	1.17	-	-	0.49	-	-
Storm - Surveyed	-	-	-	-	-	-	-	-	-
Combined - Not Surveyed	-	0.17	-	0.23	-	0.01	0.36	-	0.03
Combined - Surveyed	-	-	-	-	-	-	-	-	-

A.2.8 Options under investigation

As outlined above, the key focus for these 198 storm overflows is on building nature-based solutions. In a small number of cases this will be 'end-of-pipe' at our treatment works. However, in most cases we will be focusing on amending the drainage system to ensure surface water flow does not enter our foul/combined system. At the same time, it will help towns by improving the natural surroundings for our customers, by replacing paving with plants, trees, and other natural solutions. These include

building basins, planters, raingardens, permeable paving, and swales, while ensuring all four pillars for SuDS design and implementation are included in the town's future development (i.e., water quality, water quantity, amenity and biodiversity, etc.).

These solution types can then be built in a variety of land use areas. By focusing not just on solution type but also on land use, we can bring in the right stakeholders and ensure our designs incorporate the other amenity uses our customers want and need. For instance, in central areas of towns, the retrofitted SuDS need to take into consideration any council regeneration plans which could include elements like day-to-day use for shoppers through to specific day requirements, i.e., when there are markets or memorial days. Specific areas we will be focusing on include non-household customers, council-managed estates and non-major roads. This will ensure we focus on a balance of the larger hardstanding areas and incorporate nature-based solutions in more deprived areas. We will also work with our local household customers to help them become more aware and engaged on the impact of urban creep. This will include installing household smart 'Hurcombe' water butts alongside small scale raingardens, planters and rainwater harvesting systems. We will also hold local drop-in sessions with customers in these areas to help create further links to local charities and action groups that can help in-site selection and management of the newly created systems.

In addition, for two specific locations, the storm overflows are at treatment works, so we will build further nature-based treatment solutions for improving, or even eliminating storm overflows. This will include solution types such as aerated reed beds, wetland treatment systems and reactive media reed beds.

A.3 Customer Protection

A.3.1 Performance Commitment

While there is no specific new performance commitment for these additional storm overflows it does link to two wider performance commitments. There are

- Storm Overflow improvements completed PCD; and
- Surface Water intercepted and managed sustainably PCD.

As part of the wider implementation of our Storm Overflow Action Plan we have outlined to Defra and the EA that these storm overflows are intended to meet the 10 spills per average year target by 2030. Each financial year we will report the number of storm overflow improved against the planned schemes. Completion will be evidenced by contract completion documentation for individual projects.

To ensure transparency between the WINEP programme and these additional 198 storm overflow improvements we have summarised the improvement programme based on site completion in the table below and we will report against both programmes.

Deliverable	2025/6	2026/7	2027/8	2028/9	2029/30	Total
WINEP number of storm overflow sites improved	6	14	129	128	87	364
Additional storm overflows	4	30	60	60	44	198

Within this programme of work, around the 198 storm overflows we aim to sustainably manage up to 58,458m^3 of rainfall by separating 10.4ha of hardstanding from our sewer system. The mix of interventions we will employ will be determined by local conditions and our partnership approach with local authorities. We will report progress on this programme in terms of the area of hardstanding connected to our network through sustainable surface water management approaches. The programme for hardstanding is being managed in a sustainable approach and is outlined in the table below.

These 198 storm overflows alongside the 364 in the WINEP and all of our base investment improvements will help us reach our targets on the new common commitment based on the average storm overflow spill count as outlined in Section 1 of this Appendix. Based on this programme of works, we envisage this business case will deliver a total reduction in our spills of 1.94 by 2030 which will help us reach our target of 14 for the average storm overflow spills by 2030.

Deliverable	Unit	2025/6	2026/7	2027/8	2028/9	2029/30
Area of hardstanding managed sustainable – 198 storm overflows	Ha	2.07	2.07	2.07	2.07	2.07

Monitoring plan

In addition to the PCDs and the common PCs that also relate to this investment we have developed a monitoring plan which includes a series of indexes to help us update our adaptive plans. This is set out in Annex 2 LTDS.

A.3.2 Deliverability

As previously discussed, we recognise the sheer scale of investment required on our waste system in the coming AMP. To help manage this we have already started to identify the right supply chain partners to support our programme.

The approach for these specific storm overflows is to focus on removing the storm-based flows entering the foul/combined system that is causing the specific storm overflow to spill. We intend to build on the approach of a bespoke internal team focused just on these projects that will work with local communities, trusts and charities, non-household customers, household customers and councils. This will mimic the fast-paced delivery approach from the Mansfield project, which is proving to be a significantly faster approach than previous collaborations.

For instance, we have shown that working on large-scale non-household drainage systems has additional benefits for the site owners. As most of these sites include people visiting the location (i.e. visitors to hospitals) we believe there are strong amenity benefits for the site owner and that most of our major non-household customers have their own climate/sustainability strategy we can align objectives with. This therefore ensures both stakeholders are willing to work together at pace. This is an approach we are trialling in the Mansfield project where we have collaboratively worked with major retailers within the catchment to design and then build SuDS in their property line.

We have also worked with our consultants and contractors to improve our design approach for a variety of sustainable drainage assets, with design standards now in place for permeable paving, tree pits, bioswales, rain gardens (verge and street), and detention basins. These designs have been developed with other drainage partners (i.e. local authorities) to ensure maintenance agreements are in place. For example, in Mansfield these are in place (for permeable paving) with Nottinghamshire County Council and Mansfield District Council.

We have streamlined our procurement processes to facilitate tenders from smaller organisations directly with us, so ensuring we have expanded our workforce with fewer external bottlenecks.

Conclusion

In this appendix we have set out the reasons why urgent additional activity is needed to reduce spill frequency. We provide a summary of the extensive analysis that has been carried out to reassure ourselves and our stakeholders that we have identified both the best option and the most efficient cost to drive the much-needed improvements at an affordable cost. We have set out proposals for how we will transparently report progress and protect customers in the event of non or late delivery. The addendum below sets out our response to the potential challenges that could be made as reasons not to push ahead with these additional improvements.

A.4 How we've addressed the challenges

In this final section we tackle head on the potential challenges and reasons not to go further given the already large statutory programme and overall bill impact.

A.4.1 Can our customers afford it?

We recognise that the much-needed investment to make ambitious environmental improvements in AMP8 will increase the average water bill. In preparing our plan, we have used extensive cost benchmarking to keep the costs down. We have also run our most extensive customer engagement programme for a price review to understand their needs and views, and to make sure that our proposed support packages are commensurate with bill impacts. The key findings from this research include:

- The vast majority of participants supported our proposed plan. While this is a qualitative sample, 59 out of 60 household customers, seven out of seven financially vulnerable customers, and seven out of 10 non-household customers found our business plan to be plan 'completely acceptable' or 'acceptable';
- The area with the most support from customers for us to go further was achieving net zero emissions; and
- Customers support the environmental investment and associated bill increase and prefer it to a least cost plan with smaller environmental improvements.

They also consider their water bills to be more affordable than many other household bills. This point was echoed in Ofwat's cost-of-living research, which showed water bills did not feature in the top five bills people worry about.

However, we are also acutely aware of the difficult financial circumstances some of our customers face. We are proposing the largest affordability package in the sector, worth around £600m and supporting up to 640,000 customers per year through bill discounts, payment breaks and payment plans.

As a result of the additional support we are providing in AMP7 and because our customers support a larger cross-subsidy, we will be able to provide an additional 300,000 customers with a discount of around £262 per year by 2029/30 (in 2022-23 prices). This will make their bills 31% lower than the average bill even after customers have funded the large environmental investment programme in AMP8.

A.4.2 Is it fair across generations?

Our LTDS analysis outlines that reducing the programme further would risk storing up problems for the future, particularly in areas such as greenhouse gas emissions reduction and improved climate-change resilience – both of which our customers have told us they expect substantial progress on in the next five years.

Our core pathway for storm overflow improvements aligns with a two-degree climate change scenario. Our climate change analysis from the DWMP outlines that there could be a further 9% increase in average spill count utilising our hydraulic analysis following the UKCIP18 outputs. Our DWMP best value plan shows that focusing more on nature-based solutions like SuDS will help manage the uncertainty of climate change impact far more than traditional grey solutions. Therefore, investing

an additional £100m on more nature-based solutions will help ensure we are ready for further expansion in this solution type in 2030.

A.4.3 Is it deliverable?

We recognise that our main WINEP programme is larger than any other storm overflow programme we have had in the past. As part of our mobilisation and transitional expenditure, we have focused on identifying the right supply chain partners to support our programme. To help manage the focus on these additional 198 storm overflows, our approach is to create a bespoke team that will focus on working with local communities, wildlife trusts, charities, non-household customers and councils to remove the required hard standing from the upstream system, as well as working with niche sustainable design companies. This will build on our existing programme team that is focusing on our AMP7 Green Communities performance commitment where we have installed local SuDS features, creating £374k of wider natural and capital benefit using our CIRIA defined B£ST light tool.

Our plans for AMP8 are ambitious and will be challenging to deliver but we believe we are in a unique situation in terms of deliverability. Our conviction is based on four key differences in our approach:

- We have streamlined our design and build approach for nature-based solutions. Reducing our lead time from initial concept to completing construction;
- We have created standard designs for all main nature-based solutions that have been reviewed by external stakeholders like Mansfield Council;
- We have streamlined our procurement process to facilitate small organisations to tender directly with us ensuring we have expanded our workforce with minimal external bottlenecks; and
- Our Mansfield and Green Community teams have the skills available and will be ready to move over onto our AMP8 nature-based solution programmes across these 198 sites and the elements in the WINEP 364.

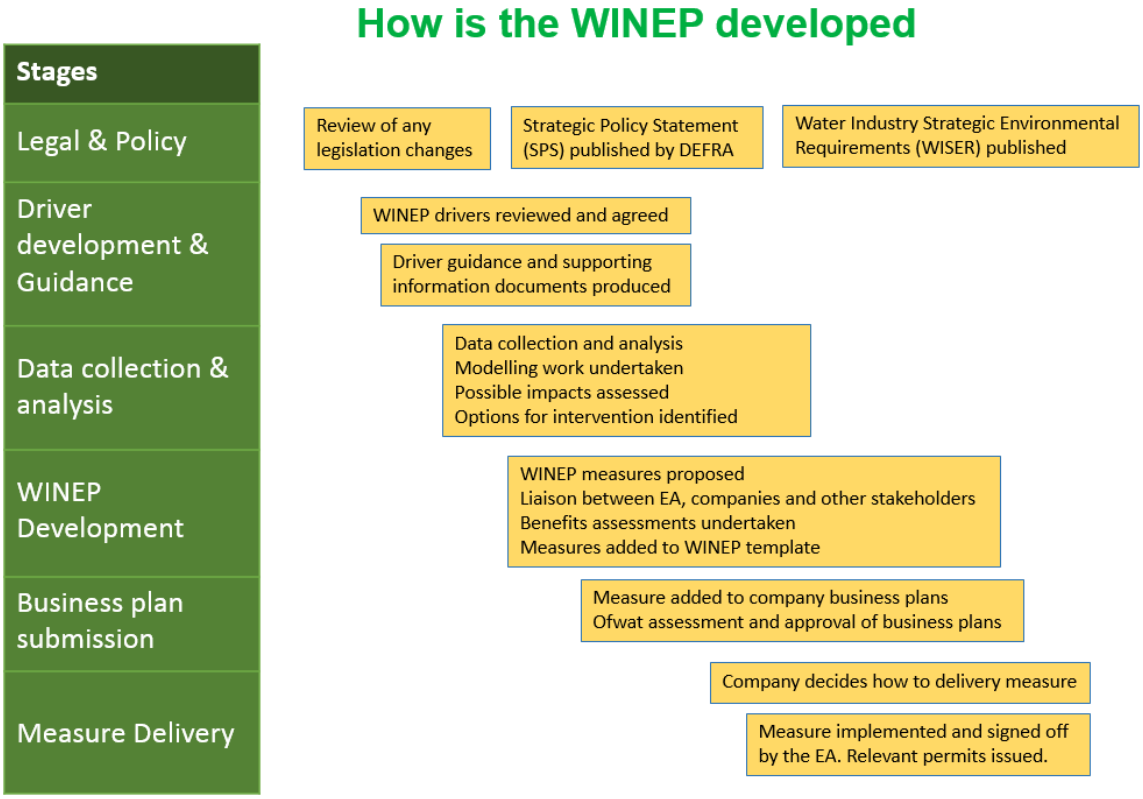
We further acknowledge that concerns about the deliverability of PR24 schemes is, in part, a reflection of the pressures caused by wider UK infrastructure plans. Recognising this, we have undertaken a number of actions, including:

- Sharing our urban nature-based solutions (SuDS) with the wider industry, including our drainage partners like LLFAs, the Environment Agency and local councils. On top of this we will share them as part of our new development engagement approach, ensuring the learnings from our retrofitted designs can be utilised in new developments; and
- Investing heavily in artificial intelligence to reduce rework and, as such, to reduce capital costs by, for example, creating in-house tools to speed up the site selection process for nature-based solutions. We aim to share our learning with other companies to help them increase their rate of delivery. Wider scale adoption of these tools would reduce pressure on resources for the whole sector.

Appendix B: WINEP reform

The role of the WINEP is to turn the statutory obligations for water companies, as set out in environmental legislation and government policy, into actions. Historically, it has done this by setting out a programme of measures that companies must include in their business plans to deliver environmental improvements. Figure B.1 below outlines the stages of development of a water company's WINEP programme.

Figure B.1: How WINEP programmes are developed



WINEP reform

Although WINEP and its predecessors have delivered significant environmental improvements over the last 25 years, the approach has been adapted for PR24 in order to deliver wider benefits and maximise value for money. Water companies have also expressed the desire for a more sophisticated WINEP approach that recognises their significant capability to contribute to enhancing the UK's natural environment.

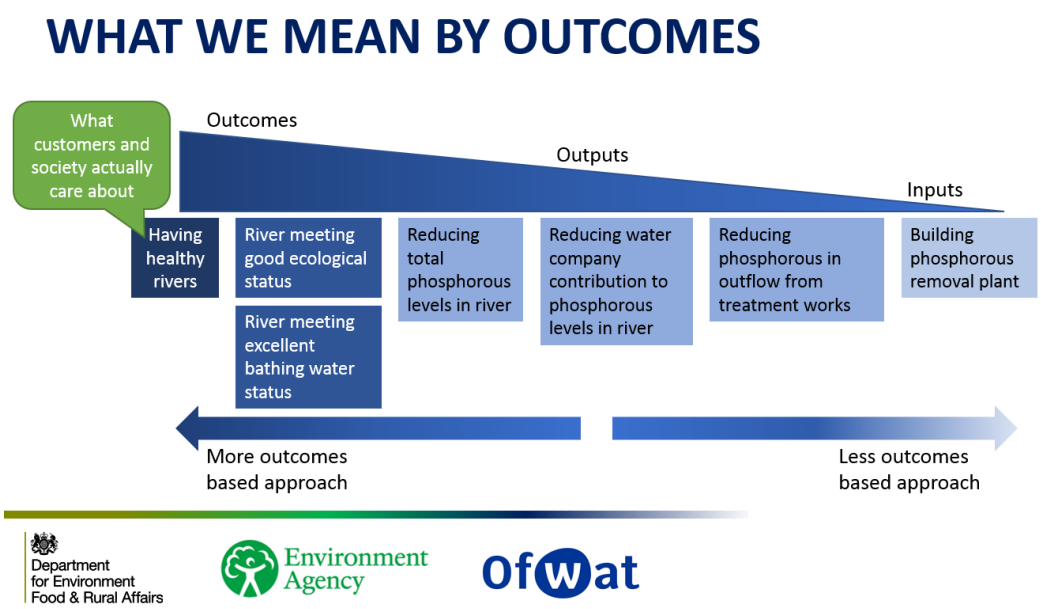
The WINEP Reform Taskforce ran from late 2020 through to mid-2021, with the overall goals of enabling a step change in the quality of the water environment and delivering greater value for money. The taskforce identified six key objectives for WINEP reform that will deliver these goals:

1. Outcomes-driven with less prescription;
2. Enables wider environmental outcomes to be supported;
3. Accommodates longer-term planning horizon;
4. Accommodates a more systems and catchment oriented approach, including facilitating a greater use of nature-based solutions, which accommodates more innovation and company collaboration;

5. Allows relevant parties to co-design, co-deliver and co-fund; and
6. Makes the best use of, and improves, available data.

The first key objective of the agreed reforms was to make the WINEP more outcomes-driven and, ultimately, more meaningful to customers. What our customers actually want to see is a healthy, thriving environment, and WINEP therefore needs to be more explicit about how the measures included deliver this outcome. In the reformed WINEP, actions can now be expressed as outcomes using a three-tiered approach that illustrates how outputs build up into the outcomes that we, our regulators and customers want to see. Figure B.2 below outlines the new tiers.

Figure B.2: WINEP outcomes



Severn Trent's contribution to WINEP reform

Severn Trent has been at the forefront of WINEP reform and outcomes-based regulation, and an active member of the regulators' WINEP Reform Taskforce. We provided evidence throughout the process to help shape the PR24 approach to long-term, risk-based environmental improvement.

We have sought to structure our WINEP programme in a way that takes full advantage of the opportunities presented by the reform process. Large segments of our WINEP programme have been entered as Tier 2 outcome measures, where several interventions are grouped together under a single WINEP action to deliver a defined environmental outcome. Entering WINEP actions at Tier 2 has key benefits for everyone: customers have a clearer view of what they are getting for their money and water companies have greater flexibility to explore alternative interventions that deliver the outcome.

WINEP reform in practice

An example of a Tier 2 outcome from our AMP8 WINEP programme for wastewater is 'Address harm caused by storm overflows in the River Cole catchment', which includes several proposed sub-actions that, together, will deliver this outcome. This links up to a Tier 1 outcome defined by the EA as 'Protect the environment from the effects of intermittent discharges.'

Our Tier 2 outcome covers four separate WFD waterbodies and includes proposed improvements at six storm overflows, as well as some blue-green infrastructure measures. If detailed feasibility work identifies that a seventh storm overflow improvement is required to deliver the outcome, we will add

this to the programme in order to deliver our commitment. If additional blue-green infrastructure interventions are identified that negate the need for a traditional greywater solution at one of the six named storm overflows, we can remove the action from our programme without changing the outcome.

Ultimately, our commitment to customers remains the elimination of harm – in this instance, the elimination of four RNAGs linked to intermittent discharges of sewage.

Appendix C: Case studies of WINEP reform benefits

WINEP reform enables holistic measures to be taken at far greater scale than would have been possible under the previous methodology. In total, we have identified 8,393 hectares of catchment nutrient balancing (CNB) opportunity, and have calculated that these measures will deliver the equivalent of 10.75 tonnes per year of end-of-pipe phosphate removal. As noted in the Draycote Water case study below, the partnership match-funding approach will roughly double the overall phosphate load removed from the environment.

The 13 CNB interventions outlined in Table C.1 are focused on catchment areas around protected areas (SSSIs and SACs) and/or our raw water reservoirs as these are where the greatest wider benefits are available. We will be looking for additional CNB opportunities as we move to delivery of our WINEP phosphate programme.

Table C.1: WINEP ID and location of AMP8 CNB proposals

Action ID	Action Name	CNB cost	Land area benefitting from CNB (Ha)
08ST100067	Phosphate removal in the river Leam and Draycote water	**419,546**	**1486**
08ST100024	Phosphate load removal in the upper Avon + Standford reservoir	**110,168**	**461**
08ST100065	Phosphate load removal Ogston reservoir	**123,918**	**98**
08ST100030	Phosphate load removal in River Dove tributaries	**189,721**	**290**
08ST100141	Phosphate removal in the Peak district (Dove) catchment	**354,233**	**277**
08ST100150	Phosphate removal in Thorsby Lake	**135,721**	**385**
08ST100149	Phosphate removal in Welbeck and Clumber Lakes	**111,314**	**359**
08ST100017	Phosphate load removal in the Cound brook	**223,607**	**664**
08ST100026	Phosphate load removal at Charnwood reservoirs Phosphate load removal in the river Blythe	**193,990**	**768**
08ST100066	Phosphate load removal Shustoke reservoir	**33,054**	**162**
08ST100040	River Teme WFD and SSSI phosphate removal	**549,027**	**1842**
08ST100298	Peak district (Wye)	**370,275**	**794**
08ST100023	River Stour (Avon)	**591,901**	**807**
Total		**17,032,376**	**8393**

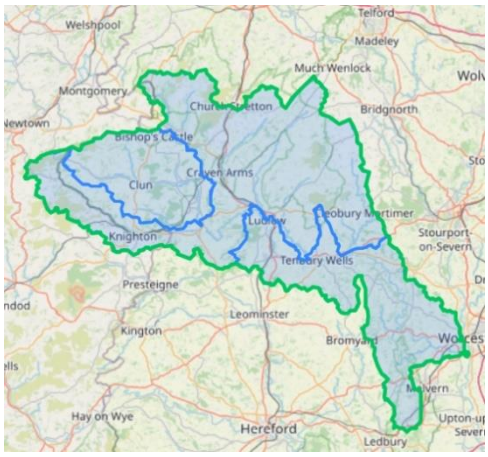
In addition to the direct benefits of phosphate removal from our rivers, CNB interventions deliver wider environmental outcomes. These include habitat creation through construction of wetland treatment systems for improved farm run-off management, and field margin buffer strips alongside rivers that provide space for nature. CNB also offers futureproofing against the introduction of nitrate removal requirements.

Figure C.1: Examples of habitat creation through catchment interventions

Case study 1: Catchment and nature-based approach for the River Teme

The River Teme WFD operational catchment (see Figure C.3 below) covers 1,650km^2, predominantly within Shropshire and Worcestershire, with headwaters in Wales. The River Teme itself is 122km long and is a designated SSSI; the River Clun sub-catchment is a SAC. In total, the catchment comprises 41 individual waterbodies, 33 of which fail to attain WFD Good ecological status for phosphate (not all due to Severn Trent's activities). In addition, the River Teme and the River Clun fail to attain the more exacting common standards monitoring guidance (CSMG) standards for phosphate.

Figure C.2: River Teme WFD operational catchment



The catchment is very rural, with just two WwTWs serving more than 10,000 people (the largest being Ludlow at 12,800). Most of our WwTWs in the catchment serve fewer than 1,000 people. The rural nature of the catchment presents extensive opportunities for partnership working with the agricultural community to deliver some of our nutrient removal through CNB. This will build upon relationships that we already have with farmers through our drinking water protection activities and Green Recovery bathing rivers project. We already know that farmers in this catchment would be interested in working with us on phosphate removal.

We have created a Tier 2 WINEP goal to tackle phosphate removal across the entire River Teme WFD catchment, using a combination of CNB and site-specific end-of-pipe treatment interventions designed to deliver our fair share contribution towards meeting WFD and SSSI river phosphate targets throughout the catchment.

The principles of catchment permitting have been applied to determine load removal requirements for the River Teme itself (to meet the CSMG phosphate standards for SSSIs) and the waterbody-specific WFD targets on the various tributaries that require improvement. An Action Specification Form (part of the standard WINEP methodology) documents the load removal requirements at defined points within the catchment, forming the benchmark against which successful delivery of the obligation is assessed. SAGIS models were used to determine the combination of upstream interventions necessary to meet these targets.

The obligation to which we are committing through WINEP is to make our fair share contribution to delivering phosphate load reductions necessary to meet SSSI and WFD targets (and contribute towards the Environment Act's 80% phosphate removal target). The solution components represent our current best view of the optimum balance of interventions to deliver this outcome, but the Tier 2 commitment leaves us with flexibility to amend the approach if, for example, we are able to deliver additional CNB and reduce reliance on end-of-pipe treatment.

Case study 2: Catchment nutrient balancing at Draycote Water

Severn Trent's long-running drinking water protection scheme in the catchment area of our reservoir at Draycote Water is primarily focused on pesticide control. Independently, significant investment was made in AMP6 at a number of WwTWs within the catchment to address phosphate issues in the associated River Leam.

An AMP7 WINEP investigation has revealed that further phosphate control is required to address eutrophication within Draycote Water (see Figure C.3 below). High levels of phosphate are responsible for excess algal growth, resulting in poor water quality that can impact upon water treatment processes. Further phosphate load reductions are required from Severn Trent, as well as reductions from diffuse sources.

Figure C.3: Eutrophication in Draycote Water reservoir

There is limited scope to deliver significant additional end-of-pipe phosphate removal without either upgrading assets that are over 10 years old or extending phosphate removal to several very small WwTWs, where unit costs for traditional interventions are high. We have therefore opted to deliver the majority of our share of the phosphate load reduction through CNB. This can be delivered efficiently because we already have catchment advisors on the ground in this catchment, and good working relationships with the farming community.

Our standard offering to the agricultural community for drinking water protection and CNB is a 50:50 match-funding arrangement. We will pay for the phosphate load reduction that we require from the farmer to meet our 'fair share' target, on condition that they contribute a similar amount into the project. This match-funding approach means that for every kg of phosphate load removal that our customers pay for, the overall benefit to the environment will be approximately 2kg removed. With the inclusion of agricultural phosphate and nitrate removal targets within the Environment Act (a 40% reduction target), we anticipate a high level of interest in our STEPS (Severn Trent Environmental Protection Scheme) offering. Many farmers have already enquired about working with us on phosphate removal.

A further benefit of this approach relates to nitrate removal. Draycote Water reservoir has been identified by the EA as a waterbody where a new nitrate water quality standard needs to be imposed, and a nitrate investigation obligation is included within our AMP8 WINEP. The CNB measures that will reduce diffuse phosphate loads (reduced livestock stocking levels; field margin buffer strips; better control of fertiliser application) are the same interventions that reduce diffuse nitrate. The CNB approach in AMP8 is likely to reduce the need for nitrate reductions from our assets in AMP9.

Appendix D: System Operator for River Catchments

We fully support the WINEP development roadmap and believe a catchment-system-operator (CaSO) is the best approach to efficiently deliver future WINEPs

We will establish a low cost, low regrets CaSO demonstrator programme which will size the benefits of the approach and deliver a deployment roadmap for wide scale roll out in PR29 through our LTDS adaptive plans

We will build on existing programmes in the Warwickshire Avon and the Nottinghamshire Idle to establish our CaSo programme.

We will use an innovative digital toolkit to shine a light on catchment use, nature recovery opportunities and water related risks

We will establish a CaSO to drive holistic planning and co-funded projects

We are not asking for funding for these demonstrators and believe they have the potential to unlock up to £50m for customers.

Case for change

In their Joint letter of 2 September 2022 regarding advancing environmental improvements through WINEP, the EA and Ofwat's stated an ambition to "develop future WINEP programmes which are set up to achieve the best environmental outcomes for every pound invested". We recognise that this ambition challenges us to address all our core obligations though an innovative approach to ensure our long-term plans are affordable and deliverable.

Water UK[34] report that there are 35 local plans and strategies dealing with the environment at a local level. This patchwork leads to environmental issues being considered in silos rather than as a connected system with complementary outcomes. It propagates complex, overlapping decision and funding processes with different timescales that struggle to deliver efficient and effective outcomes.

We believe that river catchments are the natural unit in which to make decisions on the water environment and Defra recognised the potential of catchment-based thinking in 2013 when it established its Catchment Based Approach (CaBA).

CaBA is now well established as a successful community-led partnership approach to improving river catchments, however it has been observed that it has little influence on top-down priorities set for an area or the approach taken to meeting them. This means the effectiveness of CaBA groups is too often serendipitous, and that consistent results will only be achieved when three challenges are addressed:

- Establish a system operator responsible for co-ordinated action;
- Create a user-friendly data platform for all; and
- Secure leveraged funding to deliver social and environmental benefits.

[34] https://www.water.org.uk/wp-content/uploads/2022/06/Water-UK-21st-Century-Rivers-download.pdf [Accessed 9/2/2023]

Despite the success of the sector's use of catchment interventions to deliver single-issue solutions it has yet to deliver fully integrated catchment focused programmes. The sector has investigated the potential of a system operator for river catchments over many years[35] [36] [37] and has established that the approach could deliver significant efficiencies if the institutional and practical barriers could be unlocked.

If we get this right, it means:

- Cost savings of £1-3bn per year across the UK, helping to keep water bills affordable for customers;
- Delivering more water by improving the quality of existing water sources and improving river ecology through sustainable sourcing of water;
- Reducing flooding and pollution risks by rolling out SuDS and natural flood management across the UK;
- Reducing the pollutants entering our rivers by working with farmers, businesses and others responsible for discharges to waterbodies;
- Reducing carbon emissions, enhancing biodiversity and supporting the growth of the UK's credit-based markets for these benefits; and
- Creating community resources where the public can safely enjoy nature.

If we don't transform our approach, we can expect:

- Continued focus on single-issue outputs as Severn Trent optimises its own adaptive pathways rather than delivering the right approach for all catchment stakeholders; and
- Continued sector-wide discussions about the potential benefits of an integrated catchment management approach without the development of a roadmap that would make it a practical adaptive planning and delivery option.

Our bold proposal

Our AMP8 ambition is to establish two catchment demonstrators that will deliver a blueprint for catchment-based planning and delivery. We propose to trial innovative digital tools and new ways of working in partnership that have the potential to unlock the institutional and practical barriers that have limited the success of CaBA.

We will build on the existing CaBA approach by taking an open by default approach to data and creating a de-facto catchment system operator.

Catchment Insight tools

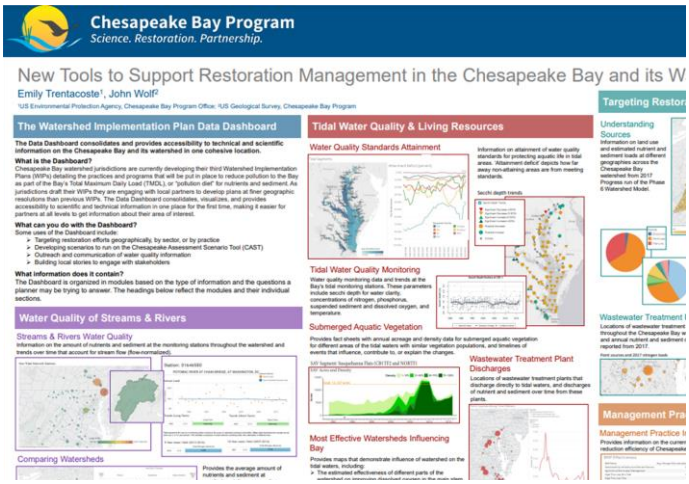
We will establish a catchment insight tool comprising an open data platform, a natural and social capital assessment tool and catchment performance models. We believe this pioneering suite of digital tools is a critical enabler of the catchment-based-approach as it will:

- Provide visibility of the opportunities and challenges from multiple stakeholder perspectives;

[35] Indepen (2014): Discussion paper on the potential for catchment services in England
[36] Indepen (2016): Water works: what else can the water industry model deliver.
[37] https://www.cisl.cam.ac.uk/system/files/documents/the-catchment-management-declaration-update_0.pdf [Accessed 9/2/2023]

- Support decisions on when and how to co-create solutions and how to co-fund schemes; and
- Identify partnership opportunities that address wider environmental and social challenges in the catchment.

The Chesapeake Bay Watershed Dashboard and Assessment Scenario Tool is a clear demonstration of the power of open data and analysis tools to support the work of many different users involved in restoration and conservation of a strategically important water body on the East coast of the USA.



Catchment System Operator

We also believe the System Operator ambition outlined in the Government's Twenty-five Year Environment Plan[38] is the key to unlocking more efficient solutions for broader environmental issues and specifically for driving innovative planning and delivery approaches in river catchments. We will establish an independent broker (i.e. a system operator) to:

- Help us co-create and co-fund catchment solutions for a wide group of catchment users; and
- Work with land managers to deliver those solutions.

Demonstrator catchments

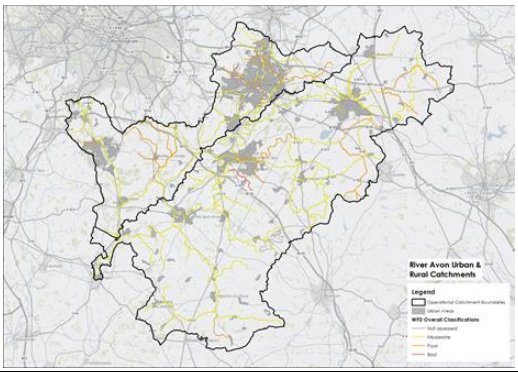
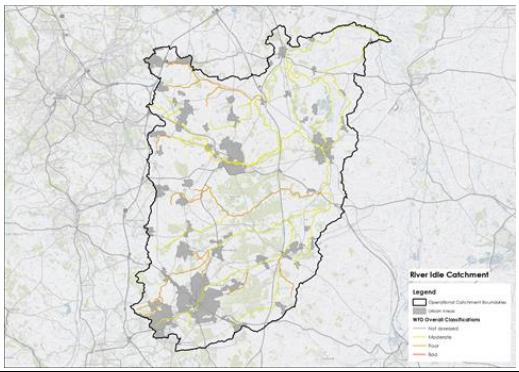
Our two demonstrator catchments, the Warwickshire Avon and the Nottinghamshire Idle, have significant AMP8 programmes covering water resource, flood risk and water quality issues. The EA has identified opportunities in its flood risk programme for both catchments and early work with consultants has identified several potential industrial partners with supply chains in the catchments.

38 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf

The River Avon has also been identified as key demonstrator for integrated water management by the River Severn Partnership which has established a wide-ranging stakeholder group led by the Environment Agency and Warwickshire Wildlife Trust.

The River Idle catchment was a priority catchment for the EA Initial Priority Catchment programme in AMP7 and has strong CaBA group delivering on the outcomes of the EA's work.

We believe these factors make the Avon and Idle the best opportunities to investigate the benefits of a catchment system operator approach.

Warwickshire- River Avon	Nottinghamshire - River Idle
	
• 2100km^2 – 8.5% urban area • 712km of water courses 37 moderate, 15 poor and 1 bad • 60 SSSIs and SACs • RNAGs – 215 inc 48 water industry and 115 agriculture	• 870km^2 – 10% urban area • 300km of water courses 16 moderate and 9 poor • 37 SSSIs and SACs • RNAGs 153 inc 61 water industry and 46 agriculture
• River Severn Partnership (RSP) demo catchment • Catchment protection for Draycote and Stanford Reservoirs • Flood risk – LFA and EA flood risks across urban space • Green recovery – River Leam Bathing Water • ST AMP8 – 6 CSOs, 26 WwTW improvements, Coventry Flood Risk, Catchment Nutrient balancing, 12 water resource improvements and ED investigation – estimated spend c.£300m eliminating water industry RNAGs, eliminating flood risk for 320 properties and securing 9Ml/d of water reouce • EA Programme – Investigations and proposed measures included in 2027 Flood Plan and additional opportuities for 25-year Environment Plan objectives	• EA Initial Priority Catchment • Catchment protection in place for groundwater sources • Flood risk – LFA and EA flood risk across urban amd rural • ST Green recovery – Mansfield SuDS • AMP 8 – 5 CSOs, 14 WwTW improvements, catchment nutient management for SSSIs, 22 water resource interventions and ED investigation – estimated Spend c.£190m eliminating water industry RNAGs and securing 23.5Ml/d of water reources. • EA Programme – Investigations and proposed measures included in 2027 Flood Plan and additional opportuities for 25-year Environment Plan objectives

Building partnerships in our demonstrators

We have started work with key stakeholders in the Avon catchment to redefine our approach to identifying and delivering partnership programmes which enhance the catchment and secure best value for our customers.

In June 2023 we made a consortium bid, with the Warwickshire Wildlife Trust, the EA and Warwickshire County Council, to the Nature for Water facility[39] for a sponsored engagement, worth up to £150,000.

Our aim is to use the 3rd party funding to deliver:

- An assessment of catchment system operator models for the catchment; and
- A plan to evolve Warwickshire County Council's Biodiversity Net Gain market into a wider ecosystem service market targeting improvements in the river.

We have collaborated with our supply chain to identify best practice in catchment thinking and have established a Catchment Assessment Toolkit (CAT) program which is building our capacity to deliver catchment insight that leads to co-developed and co-funded programmes.

Figure D.1: Partnership building workshop

We recognise that effective partnerships will be the key to catchment-focused delivery and have held a series of partnership building workshops with over 15 stakeholder organisations representing commercial entities, eNGOs, local authorities and regulators.

The workshops have produced a blueprint for working in partnership in catchments based on existing relationships and best practice from across the country.

We will continue to develop our partnership plan to deliver effective engagement that fosters the delivery of best value plans for our customers, the environment, and the communities we serve.

Learning from experience

Through AMP6 and AMP7 we have developed our catchment management approach to address water quality issues and learned how to secure additional natural capital benefits while delivering our core obligations. We have used scientific evidence and expert opinion to support the need for changes in a catchment and worked with stakeholders to bring about land management improvements through a range of co-funded and co-designed solutions.

We have used local expertise and insight to deliver our schemes efficiently through partnerships with organisations such as local Rivers Trusts and Wildlife Trusts with complementary objectives for our

[39] https://nature4water.org/

catchments. This gives us confidence that a catchment-focused approach offers best value for customers in the long term and has taught us that the approach takes time, local insight, and shared understanding of the catchment goals.

By selecting the Warwickshire Avon and the Nottinghamshire Idle as our demonstrator catchments we aim to build on our existing partnerships with groups such as the River Severn Partnership. These groups have existing mandates, good local knowledge, practical catchment insight and well-established catchment focused programmes.

Both catchments have been subject to extensive characterisation which will be augmented with insight from our statutory plans (DWMP and WRMP) and Defra's statutory plans (RBMP and FCERM). This gives us a clear understanding of the challenges and opportunities in the catchment and means we will be able to facilitate co-created place-based programmes for each catchment.

How our approach delivers Water Company actions in the WINEP development roadmap

Government has recognised that the WINEP process must evolve to make sure that the water sector can deal with growing pressures from issues including climate change, population growth and pollution.

The WINEP development roadmap issued in May 2022 highlights seven key actions to ensure future WINEPs achieve greater environmental benefits for every pound invested. Our demonstrators will secure the knowledge and experience to deliver on the water company commitments in the future action plan by:

Delivering sector learning to evolve WINEP

We have confidence we can deliver the two demonstrators which, when combined with our existing catchment know-how, will unlock the water company future actions set out in the WINEP development roadmap. See table below:

Table D.1: Alignment to WINEP development roadmap

WINEP Roadmap Action		Water Company Requirement for future WINEPs	Business as usual approach	Catchment System operator approach
1	Introduce a tiered approach for including schemes in WINEP		Tier 2-goals focused	Tier 1-Outcome focused delivering best value for customers and Environment
2	Better incorporate long-term planning in development of WINEP		Focus on next two AMPs	Focus on 25-year statutory plans
3	Clearly establish dependencies between WINEP and other statutory planning frameworks	Water companies will make sure WINEPs are aligned to actions in other planning frameworks	Limited engagement on specific issues	Broad ranging engagement focused on improving the catchment

4	Increase use of catchment- and nature-based-solutions	A natural capital approach will become further integrated into water company decision making	Use of NBS to solve specific obligation with constrained natural capital assessment	Use of NBS to deliver multiple outcomes with comprehensive natural capital assessment
5	Take account of wider environmental outcomes when deciding on solutions		Use of PR24 wider environmental outcome metrics	Use of a broad suite of natural and social capital metrics supported by effective impact assessment
6	Increase water company involvement in the WINEP development process	Water companies should take greater ownership in developing the WINEP	Case-by-case engagement with others to solve specific WINEP obligations	LENs driven engagement with others to ensure WINEP delivers best outcomes for customers and the environment
7	Increase involvement of other organisations and external funding in the WINEP development process		Limited opportunities to secure co-funding of non-statutory actions	LENs driven co-developed and co-funded catchment solutions driving best value for customers and environment

Action 3: Establish dependencies between the WINEP and other statutory planning frameworks

"Water companies will make sure WINEPs are aligned to actions in other planning frameworks."

We have established strong partnerships with the local authorities in the River Idle catchment through our Green Recovery sustainable urban drainage project in Mansfield. We are also working with a wide range of partners in the river Avon catchment through the River Severn Partnership.

We will use these relationships and our digital insight tool to access and assess other statutory planning frameworks, such as the local development plans and local nature recovery plans. This approach will ensure we understand the environmental, social and economic objectives for the catchment from multiple perspectives and use this to inform our adaptive plan for the catchment.

Action 4: Increase the use of catchment and nature-based solutions

"A natural capital approach will become further integrated into water company decision making."

Through the development of our current WINEP programme we have sought to identify options which deliver wider benefits to the environment and society. We have followed best practice guidance on cost benefit assessment from government to develop robust evaluations which consider the carbon impacts of our plans and where practical value the natural and social capital gains they could deliver.

We recognise that a multi-capital assessment approach is a key requirement for catchment planning and delivery. Our use of natural capital accounting has developed in AMP7 through the:

- PR24 WINEP which followed the EA's guidance based on the natural capital register and account tool (NCRAT); and

- Development of natural capital accounts for our land holdings to improve our decision-making on land use.

This experience has highlighted the challenges and opportunities natural capital assessment brings to decision-making. We recognise our approach must evolve through the adoption of a wider set of metrics and effective data collection on the impacts of catchment interventions if the approach is to be further integrated in our decision-making.

We will build a natural capital account for the demonstrator catchments and use it to drive decision making with our partners. We will use our demonstrators to develop digital tools that:

- Support the collection of the natural and social capital data needed to deliver robust multi-capital assessments; and
- Present catchment opportunities and challenges in accessible formats for catchment stakeholders.

Action 6: Increase water company involvement in the WINEP development process

"Water companies should take greater ownership in developing the WINEP"

We have followed the PR24 WINEP methodology to work collaboratively with regulators and stakeholders to review evidence and characterise pressures on the water environment in our area.

We recognise that working with stakeholders allows catchment challenges and opportunities to be defined effectively and options for nature recovery and enhancement optimised. Our well establish record of working in catchments to deliver improvements to water quality and biodiversity has been built in partnership with landowners, local eNGOs and our regulators. We have learned the approach takes time, local insight, and shared understanding of the catchment goals.

Our demonstrators will establish a de-facto system operator to convene stakeholders that impact the catchments. We believe there is much to learn about how to evolve the current fragmented and siloed planning and delivery approach into a catchment-system-operator model and have considered a range of options to deliver our trial including:

- Working with the Environment Agency's Catchment Based Groups;
- Boosting the capacity of existing CaBA groups; and
- Establishing Landscape Enterprise Networks (LENs).

Our summary analysis below confirmed that a LENs for the demonstrator catchments gives us the best opportunity to deliver our objectives.

Option	Governance & planning	Partnership building	Co-funding & Valuation
EA CBGs	✓	✓	✓✓
CaBA Groups	✓	✓✓	✓
LENs	✓✓✓	✓✓	✓✓✓

A LENs requires organisational infrastructure and governance to ensure that trades are equitable, efficient, transparent, and accountable to the local catchment plan. The core of the LENs governance model is a special purpose not-for-profit broker that provides the ongoing institutional mechanisms for managing transactions and building the stakeholder network. It comprises representatives from

statutory bodies, the demand community and solution suppliers. We believe this approach provides an important stepping-stone towards the practical operating component of a future Catchment System Operator in the context of the current complex institutional framework.

Engagement will be a core activity for the broker and our proposal will support this engagement by increasing the capacity of our catchment management and river-ranger teams in the demonstrator areas. Our existing programmes have credibility and traction in the catchments and support the work of the existing CaBA groups. We believe our teams, with appropriate training and development, are a crucial resource to land and facilitate the work of the broker.

Through work with 3Keel, the consultancy which developed LENs, we have identified several partners with a clear interest in co-funding nature-based solutions through a LENs in the demonstrators: for example, Nestle Dairy is interested in input management regimes in its supply chain located in the Avon catchment which overlaps with our catchment management work protecting raw water quality.

Appendix E: WINEP driver codes

Table E.1 below outlines the WINEP driver codes for our activities in this enhancement proposal. Please note that some of these drivers were applied to our WINEP actions as secondary or tertiary drivers.

Table E.1: Wastewater WINEP driver codes

WINEP driver	Description	WISER category
U_IMP1	Schemes to improve discharges from agglomerations that, through population growth, have crossed the population thresholds in the Urban Waste Water Treatment Regulations. This includes newly qualifying discharges within existing sensitive areas.	Statutory
U_IMP2	Schemes to reduce total phosphorus in qualifying discharges (from agglomerations >10,000p PE) associated with new Eutrophic Sensitive Areas.	Statutory
U_IMP7	Provide secondary treatment capable of achieving 40:60 BOD:suspended solids where a septic tank discharges to surface water.	Statutory
U_MON3	Certified FFT event monitors at WwTW or last-in-line SPS overflows.	Statutory
U_MON4	Certified FPF flow monitoring at WwTW or last-in-line SPS overflows.	Statutory
U_MON6	Provision of EDM monitors on emergency overflows.	Statutory
EnvAct_IMP1	Actions to reduce phosphorus loading from treated wastewater by 80% by 2038 against a 2020 baseline.	Statutory
EnvAct_IMP2	Improvements to reduce storm overflow spills to protect the environment so that they have no local adverse ecological impact.	Statutory
EnvAct_IMP4	Improvements to reduce storm overflows spills so that they do not discharge above an average of 10 rainfall events per year by 2050.	Statutory

EnvAct_IMP5	Improvements to reduce storm overflow aesthetic impacts by installation of screens.	Statutory
EnvAct_MON4*	Installation of continuous river quality monitors in priority areas (as defined by Defra).	Statutory
EnvAct_MON5*	Provision of near-real time reporting of data collected by continuous river quality monitors.	Statutory
EnvAct_INV1*	Investigation into provision of continuous water quality monitors in 'non-standard' locations (e.g. estuaries).	Statutory
WFD_IMP	Implementation of measures through a scheme to improve water quality in terms of relevant WFD status objectives.	Statutory plus
WFD_IMP_MOD	Implementation of measures through a scheme to improve water quality in terms in waterbodies that fail to attain at least Moderate ecological status.	Statutory plus
WFD_IMP_CHEM	Improvement to deliver Good ecological status or good Chemical status where an Environmental Quality Standard (EQS) is exceeded downstream of a WwTW discharge.	Statutory plus
WFD_ND	Schemes to meet requirements to prevent deterioration in ammonia, phosphorus, and/or chemical status.	Statutory
WFD_ND_CHEM3	Schemes to prevent deterioration in chemical status because of growth.	Statutory
WFD_NDLS_Chem1/2	Measures related to load standstill requirements for chemicals (where EQS exceedance is predicted, but measures fail cost-benefit assessment).	Statutory
WFD_INV	Investigations for cost-beneficial measures to improve water quality.	Statutory
WFD_INV_CHEM	Investigations for the chemicals programme.	Statutory and non-statutory
WFD_INV_MP	Investigations into microplastics.	Non-statutory but mandated by Defra
WFD_INV_N-Tal	Investigations to assess treatment options for nitrogen removal.	Non-statutory but mandated by Defra
WFD_MON_CHEM	Hazardous substances trend monitoring.	Statutory and non-statutory
BW_IMP4	Improvements to non-designated waters where there is evidence of customer support.	Non-statutory
HD_IMP	Action to contribute to restoration of a European site or Ramsar site to move towards meeting the site conservation objectives.	Statutory
HD_IMP_NN	Action to reduce total phosphorus and/or total nitrogen levels to the technically achievable limit (TAL) from discharges which drain to catchments where nutrient neutrality is advised.	Statutory

SSSI_IMP	Action to contribute to restoration of a SSSI to favourable condition (note these actions are referred to as 'Remedies' by Natural England).	Statutory plus

Appendix F: Transitional Expenditure

We have identified a number of WINEP schemes that meet the criteria for accelerating capex through the transition programme, outlined in Table F.1 below. These schemes will be accelerated either because they have early AMP8 delivery dates, or because they relate to technology trials where the findings are needed by 2027 at the latest in order to feed into the water industry's PR29 WINEP.

Table F.1: Transitional capex expenditure proposals

Scheme Name	AMP7 acceleration	AMP8 balance	Total scheme cost
Barston and Blymhill nitrate removal trials	20	11	31
FFT monitoring UMON 04	23	21	44
Storm overflow programme early design	20	1092	1112
Phosphate removal programme early design and procurement*	70	612	682
Total	**133**	**1,736**	**1,869**

***Note Packington cost is not included in this business case – see CWW3 table commentary document

Appendix G: Responding to Stakeholder challenge

We asked for feedback on our enhancement plans from a variety of key stakeholders, including customers, regulators and our own Expert Challenge Panel (ECP). The challenges ranged from the specific to the more general and caused us to take another look at our thoughts to make sure we had either covered off the concern or taken advantage of the suggestion. We have summarised our responses to their challenges below.

Who	They said	We did
EA	Which parts of the WINEP are you confident can be delivered in AMP8?	We met with the EA, Ofwat and Defra on May 15 to discuss the affordability and deliverability of our WINEP programme and provided assurances that the entirety of version of WINEP issued on 31 March is both deliverable and affordable. There were no material changes in the updated version issued on July 3 so we stand by our previous assertion.
EA	Do you have deliverability, affordability, or other concerns on your WINEP/WRMP. If so, which parts of the programmes would you choose to phase beyond AMP8 if you could and why?	In response to the EA letter of 5 July, and supplementary guidance provided on 14 July through the WINEP Phasing FAQs document, we have proposed the phasing of 75% of the Event Duration Monitoring of Emergency Overflows programme. We have proposed this phasing (which equates to £7m being moved into AMP9), to allow time for data returns to be fully investigated and any remedial interventions to be delivered.
EA	Are there WINEP/WRMP actions that you could start early to better ensure delivery during AMP8?	We have utilised the transitional expenditure opportunity to make an early start on: • N-TAL Nitrate removal trials; • U_MON4 flow to full treatment monitor installations (part of this is also utilising the Defra accelerated expenditure route as well); • Feasibility work on our Storm Overflow improvement programme; and • Feasibility work on our phosphate removal programme. Please refer to Appendix F for further details.
Ofwat	Water and sewerage companies have commonly highlighted storm overflows, nutrient reduction, and the continuous water quality monitoring programme as significant spend areas. However little detail on potential scope was provided for some other drivers, for example, sewage sludge, chemicals, biodiversity, and flood resilience. We expect companies to provide sufficient detail for all drivers in their submissions to enable best value choices, allow benchmarking of efficient costs, and to ensure compliance with relevant legislation and guidance	We discuss our WINEP chemicals programme in section 3.5 – Hazardous Chemical Removal and section 4 – Robust and Efficient Costs. We have discussed our chemicals programme with the EA and agreed that most of the obligations can be delivered without the need for capital investment. In the three instances where investment is proposed, the EA has marked our obligations as 'proceed' in the latest WINEP spreadsheet, indicating their acceptance of our proposed intervention. Other elements of this challenge are covered in other business cases.

Ofwat	We encourage companies to work closely with the supply chain to explore what can be done to address constraints. Companies should embrace the opportunity to innovate where possible, and to work collaboratively to secure delivery. Coordinated knowledge sharing is essential to help drive improvements through efficiency and innovation	We address supply chain capacity in our section 5.6 on programme deliverability
Ofwat	To limit affordability risks for customers due to the increased scale of investment we encourage companies to consider the scope for profiling investment over multiple AMPs, where possible whilst complying with their statutory obligations. For example, on storm overflows and some of the phosphorus removal drivers	We discuss our approach to the phasing of our Environment Act Storm Overflow and phosphate improvement programmes in sections 3.2 and 3.3. We have sought to balance affordability risks against the need to meet statutory obligations.
Ofwat	Where there is customer support and it is affordable, then Ofwat supports companies accelerating elements of their programme	We have utilised the transitional expenditure opportunity to make an early start on: • N-TAL Nitrate removal trials; • U_MON4 flow to full treatment monitor installations (part of this is also utilising the Defra accelerated expenditure route as well); • Feasibility work on our Storm Overflow improvement programme; and • Feasibility work on our phosphate removal programme. Please refer to Appendix F for further details.
Ofwat	Companies should ensure that general learning from PR19 WINEP6 and outputs from delivered PR19 investigations are incorporated in their PR24 WINEP to make it as efficient and effective as possible. It is key that, where PR19 investigations have identified the need for an implementation scheme, this is progressed at PR24 to maximise environmental improvement across AMPs	Please refer to section 2.3 Maximising innovation and learning.
Ofwat	It is important that scheme identification and option appraisal starts with a clearly defined environmental need to be addressed. This ensures the most appropriate options are identified, prioritised, and optimised. For most drivers, we expect clear evidence of robust option identification and	All of our proposed WINEP interventions have been assessed by the EA against their WINEP options development and assessment methodology and have been marked as 'Proceed'. This indicates that the EA confirm that there is an environmental need that needs to be addressed, and that they agree to our proposed intervention.

	appraisal across a range of traditional and non-traditional options, with the best value option clearly compared to least cost	
Ofwat	Where investigations are proposed in the PR24 WINEP there needs to be sufficient evidence of an environmental need and how the company activity would contribute to addressing this	We have discussed the need for investigations in PR24 with the EA and concluded that these can be limited to four key areas: • Chemical Investigations Programme (statutory – scope agreed nationally); • Microplastics Investigation (Mandated by Defra – scoped nationally); • Named lake/reservoir nitrate investigations; • These were reviewed locally and the list limited to locations where nitrate from sewage works is likely to be a material contribution. Some sites on an EA long list were excluded; • Storm overflow investigations; and • These are required by the EA to demonstrate that AMP8 projects will deliver against the Environment Act 'eliminate harm' requirement. A light touch approach is being developed with the EA to minimise the costs associated with this work.
Ofwat	it is essential that companies include sufficient detail in submissions to allow assessment of all options and give confidence that the preferred option provides the best value. We recognise for a small number of drivers, such as some of the monitoring drivers, there is limited scope for multiple options. However, for most of the programme, companies should provide evidence that they have followed good optioneering processes and the best value approach, considering a range of options and utilising wider environmental metrics. This should include consideration of catchment and nature-based solutions where possible, including where these form part of a combined approach with more conventional solutions	We have provided details on our approach for option development in section 2.2 Process for identifying options. The options development and assessment process is as defined by the EA for WINEP development and our initial WINEP submission (made in November 2022) was subject to external assurance.
Ofwat	We reiterate the need to demonstrate customer support for any extra expenditure. There was mixed customer feedback in different regions for some programme areas that are NS, such as inland bathing waters. We expect companies to consider what further engagement is required to robustly inform decisions on the scale of any	We have not proposed any non-statutory WINEP obligations. We have taken the view that the size of the statutory programme means that inclusion of further non-statutory measures is not in customers' interests. Where investment comes under 'statutory plus' drivers, and inclusion is subject to cost benefit criteria, the EA has assessed our proposals to confirm the need to proceed. We note that the economic assessment for WFD improvements is not done on a scheme by scheme basis – this is an

	NS or S+ elements, and to consider how third-party funding may support	overarching cost benefit assessment undertaken as part of the River Basin Management Plan cycle 3 economic assessment.
Ofwat	Working with customers, communities and partnerships is key to achieving best long-term outcomes for many WINEP drivers and we expect company submissions to include information on this. As per our public value principles, companies should consider where and how they can collaborate with others to optimise solutions and maximise benefits, seeking to align stakeholder interests where possible, and leveraging a fair share of third-party contributions where needed. We encourage companies to continue seeking partnership funding and learn from other companies who are more advanced in this area	We have proposed an extensive Catchment Nutrient Balancing programme across several large catchment areas where we will work with farmers to collectively reduce nutrient loading on our rivers. We are also anticipating that 6% of our storm overflow improvement programme will be externally funded partnership work on surface water separation/sustainable drainage solutions that will yield wider societal benefits.
Ofwat	We expect companies to demonstrate a best value programme, including a best value WINEP. In your WINEP submission to the EA you have considered and provided costs and wider environmental benefits for more than one option under several WINEP driver areas, both in options assessment reports (OARs) and options development reports (ODRs), where available. However, we have concerns that there is still a proportion of your WINEP programme where there is no evidence that more than one option has been considered, or where cost and/or wider environmental benefits data is not available	We have provided details on our approach for option development in section 2.2 Process for identifying options. The options development and assessment process is as defined by the EA for WINEP development and our initial WINEP submission (made in November 2022) was subject to external assurance.
Ofwat	We are concerned that you cannot always demonstrate best value choices where this is the case. We expect you to provide evidence in your business plan to demonstrate that option choices consider both costs and wider environmental benefits, and an explanation when C or NBS options have not demonstrated best value or been able to meet the statutory requirement. We encourage you to continue to develop options to include for C or NBS, including	We have followed the standard WINEP methodology to develop a best value programme. This ultilises the EA's Natural Capital Register and Account Tool to quantify natural capital benefit. Through our Benefits Assessment Tool (BAT), we have extended the assessment to consider greenhouse gas impacts and customer preferences in the form of willingness to pay (WTP). This identifies our best value and least cost options, and supports decisions on where additional benefits justify the selection of options that are not least cost

	potential hybrid solutions, which combine grey and green solutions	
Ofwat	Your business plan should be clear on how you have accounted for base activities in your WINEP enhancement requests, and clearly outline the amount of expenditure that has been allocated to base expenditure instead of WINEP in supporting narrative	We explain our approach to protecting customers from paying twice in our business case. (Executive summary – subsection on putting customers first, and section 5.1 on application of proportional allocation rules)
Ofwat	It is also vital that there is no double counting in your business plan for expenditure also identified and requested under other enhancement areas, such as expenditure related to water resources management plans. You should be clear in submissions that any schemes that solve multiple objectives have only been requested once, with splits across enhancement lines/drivers explained	
Ofwat	we have found that evidence of customer support and willingness to pay for some non-statutory actions is not provided in sufficient detail. We expect non statutory schemes included in business plans to meet our enhancement investment criteria. This includes sufficient and convincing evidence of customer support for the need and a robust cost–benefit appraisal to be undertaken to select the proposed option. We expect company evidence to include customer support and that the proposed solution represents best value for customers, communities, and the environment over the long term and that benefits outweigh costs	We have not included any non-statutory projects in our WINEP programme.
ECP	Can you explain the government [river quality] targets?	The government requirements are set out through the WISER - https://www.gov.uk/government/publications/developing-the-environmental-resilience-and-flood-risk-actions-for-the-price-review-2024. The guidance is set out driver-by-driver which often means there are several drivers that need to be considered across a site or asset group. We will be bringing the WINEP business case to the ECP which will hopefully give you a better understanding of the interaction between the drivers.
ECP	Are we planning to reduce phosphates by more than the government target and earlier?	The percentages in the bottom row of the table are total P-removed (ever), but the 80% reduction is from the 2020 baseline. We confirm we are targeting the 80% reduction so

we are working to hit the Gov target not exceed it. In terms of P-load removed we are broadly splitting it equally between AMP8 and AMP9 (refer to section 3.3) with a broadly even expenditure profile.

We have applied relative weightings to the views expressed by our customers, stakeholders and regulators. For example, where proposed investment is to address defined statutory obligations we have assigned a high weighting to the views expressed by our regulators. For more details on our approach to triangulation see Annex 3a – Customer and stakeholder engagement, challenge and assurance.

Customers tell us they care deeply about the environment, and the ensuring the sustainability of our service is one of our three customer imperatives. Customers are concerned about the impact of our operations on the natural environment, and they want the rivers they enjoy to be clean and healthy.

This is a statutory area of our plan, but we have still undertaken a significant amount of customer research to understand customer views on the need for (and the desired pace of) environmental improvements, with a particular focus on improving river water quality and reducing storm overflow spills. For this area we see a lot of consistency in customer views, however where certain customer groups have significantly different views we have highlighted it here.

Overall, investment to protect and enhance the environment (and in particular to improve river water quality and reduce overflow spills) is a high priority for customers, and there is a high level of support for our plans. Some improvements however, such as delivering further bathing quality rivers, are seen as a lesser priority.

In this Appendix we summarise the key insight we have drawn from our triangulation of customer research, the research sources we have drawn the insight from, and we provide more detail on each of the themes coming from our research.

Key insight

- Customers care about the environment and want rivers to be clean and healthy.
- Investing in environmental improvements is a high priority.
- Customers care about SSSIs and believe that Severn Trent should invest to protect them and other environmentally sensitive areas.
- Customers expect us to deliver our statutory requirements. Some customers want us to go beyond this as well.
- Customers are concerned about overflows and the impact on rivers, and want us to invest to reduce spills. Longer term they ideally want to see spills reduced to zero, and question why the Government isn't more ambitious.
- Whilst customers support investment improving river water quality, delivering further bathing standard rivers isn't such a priority right now. As a result we haven't included any additional bathing rivers in our plan.
- Our proposed plan is considered acceptable to customers, but if we were going further investment in reducing overflows is a priority.

How this has shaped our plan

Our plan in this area is largely driven by meeting our statutory obligations, as defined in the Water Industry Environmental Improvement Programme (WINEP), and aligned with our longer-term strategy and publicly stated ambitions in Get River Positive.

The Tables show how we have weighted the inputs from customers, stakeholders and taken into account the external context, including any relevant regulatory requirements for both the waste water WINEP and reducing storm overflows.

We then summarise how the key insight in this area has shaped our plan.

Environment (waste water WINEP) (excluding storm overflows which is covered separately)

	Relative weighting	Summary of view
Majority customer preference	Low	Customers care deeply about the environment and want rivers to be clean and healthy. As a result, investing in environmental improvements is a high customer priority.
Specific customer segments	Low	Those who use rivers themselves for recreation are more likely to want a faster rate of improvement.
Stakeholder / expert view	Medium	Environmental Regulators (EA and Natural England) are naturally supportive of measures to improve the environment. The EA has confirmed all schemes included in our PR24 plan as statutory.
Regulatory requirement	High	Government guidance is provided through the WINEP driver guidance documents issued by the EA (which are subject to DEFRA sign-off). Wider expectations are also set out in the WISER (Water Industry Strategic Environmental Requirements) document issued by the EA and Natural England.
How this has shaped our plan	As this part of the plan is dictated by regulatory requirements we give a relatively low weighting to customer views on the need for statutory investment, although where possible we have used customer feedback in our options identification and sequencing. We have profiled the activity to share the costs evenly between AMP8 and AMP9 but sequence the activity to get benefits sooner and our plan will deliver 70% of the Environment Act phosphate load removal by 2030, with virtually all the remaining 30% in AMP9. Based on customer feedback we have also not included any further bathing rivers in our plan. As this is not statutory, we give customer feedback a high weighting in this area.	

Reducing storm overflow spills

	Relative weighting	Summary of view
Majority customer preference	High	Increasing awareness of the operation of storm overflows and the visible impact on rivers means the majority of our customers now believe their operation under any circumstances - even as designed into the sewage network for over a century - is not acceptable. In our research, 70% of respondents agree that no sewage should enter rivers, no matter how dilute, 63% agree that investment is urgently needed to reduce the use of storm overflows, and 49% believe they should stop being used regardless of cost. In terms of the long-term ambition, there are mixed views on whether the target of 10 spills is acceptable. In the LTDS research, ideally, customers want to see overflow spills reduced to zero, and question why government targets aren't more ambitious. However, others feel that going further would require even more investment on an already large amount.

Reducing storm overflow spills		
		When it comes to solutions, customers overall support nature based solutions but there are some customers however who have concerns about sustainable solutions, including effectiveness, maintenance, safety and impact on street parking.
Specific customer segments	Low	River users are more likely to be concerned about river water quality and river health, and are particularly concerned about overflow spills. As river users represent a small portion of the customer base we have given a relatively low weighting to the views of this segment compared to the majority of customers.
Stakeholder / expert view	Medium	Environmental Regulators (EA and Natural England) are naturally supportive of measures to improve the environment.
Regulatory requirement	High	Government guidance is provided through the WINEP driver guidance documents issued by the EA (which are subject to DEFRA sign-off). Wider expectations are also set out in the WISER (Water Industry Strategic Environmental Requirements) document issued by the EA and Natural England.
How this has shaped our plan		Customers want to see urgent progress on reducing storm overflow spills – we propose to do this 5 years ahead of the 2050 government target. Based on a combination of customer and stakeholder feedback we have proposed an additional reduction in storm overflows that goes beyond the statutory minimum for AMP8. This programme will enable us to introduce a higher proportion of nature based solutions across many catchments. Not only does this acceleration bring benefits to customers sooner but it is a critical step in defining the optimum adaptive plan over the long term. The sites we have selected are smaller and more suitable for nature based solutions than the sites required in the statutory programme (due to their size, complexity and locations). We think it is important to both build evidence base of nature based solutions but also to give more customers access and experience of SUDs to build confidence and evidence base of how they perform during high rainfall events to help improve the longer term plan. Our plan will: - Eliminate harm from overflows that discharge into high priority areas by 2040, with the remainder addressed by 2045 (in both cases 5 years ahead of the government's target). - Remove 37,500m3 of surface water from the statutory programme and an additional 22,700m3 from the additional accelerated improvements. - Improve 560 storm overflows (362 form the AMP8 statutory programme and 198 accelerated from future AMPs). Based on customer feedback we have made the following changes to our options identification process: - Prioritising SSSIs and other environmentally sensitive sites in our storm overflow improvement programme going beyond the EA driver guidance. - Including measures to address all remaining impacts from our continuous discharges into environmentally sensitive areas.

Independent assurance

On this area of the plan Sia Partners have stated that this document clearly meets the requirements for demonstrating line of sight.

1. Synthesis of engagement		2. Demonstrating use	3. Evidence views on strategic investment	
Engagement sources used to inform plan	Evidence of link between narrative & engagement source	Customer views' influence on the PR24 plan	Evidence of engagement on Need	Evidence of engagement on Solutions
A wide range of sources across all phases of engagement have been used to inform this view: • Storm overflow tracker boost • River users research • **Social barometer tracker (Wave 1 -5)** • **Strategic priorities research** • Social Listening 2022 • River health research • Tap Chat – investing to protect SSSIs • **Strategic investment choices research** • **DWMP customer consultation research** • **PR24 Affordability and acceptability testing** • **Long term delivery strategy research**	In addition to the review of Severn Trent's Annex 3a: Customer and stakeholder engagement, Sia Partners has reviewed the original engagement source documents. The narrative provided surrounding customer views on protecting and enhancing the environment clearly originates from the engagement sources given. This narrative is aided by the provision of direct quotes from customers and the use of data and graphics from the research.	This area is largely driven by statutory requirements; however, customers have clearly influenced Severn Trent's plans where possible. As an example, customers deprioritised further investment in bathing rivers, and Severn Trent have omitted further expenditure in this area as a result.	Throughout the research it is clear that customers have definitively stated that they care about the environment and want rivers to be clean and healthy. Similarly, customers have stated that investing in environmental improvement is a high priority for them providing clear evidence for the need for investment on this matter. Additionally, customers have displayed interest in SSSIs and believe that Severn Trent should invest to protect these areas as well as other environmentally sensitive areas.	Customers' preferences on solution and timescales earlier has been identified in the engagement. Thus, potential solutions have been tested with customers on multiple engagement sources.

Detailed insight

For this area we have gathered insight through different approaches including our BAU research, and engagement through the delivery of the Green Recovery programme, *Your water, your say* and specific PR24 research activities. Each activity is summarised in the following Table including the scope of the research, the objectives and methodology and number of customers involved. All main sources have been assured by Sia Partners as robust and meeting Ofwat's high quality research standards. For more information on our customer engagement assurance please see Section **Error! Reference source not found.** of Annex 3a.

Phase	Date	Research activity	Objectives	Methodology	Number of customers engaged	Sia Assurance
BAU	Dec-21	Storm overflow tracker boost (Ci)	1. Gauge current awareness of, and response to, publicity on storm overflows 2. Measure current knowledge of storm overflows 3. Capture reaction to the process and impact on opinion of Severn Trent	Online survey Panel: Dynata	500 HH customers	No
Understanding needs and priorities	September 2021 – April 2023	Social barometer tracker (wave 1 – 5) (Ci)	Tracking survey on a range of topics including wider customer priorities, the environment, climate change and investment priorities.	Online tracking survey Panel: Made In Surveys	Representative sample of HH customers (500 per wave)	Yes
Understanding needs and priorities	Dec-21	Strategic priorities research (Community Research)	Explore a multitude of future priorities, drought resilience and the environment.	Online community and depth interviews	30 Bill payers (HH), 10 future customers, 10 small businesses (NHH) and 5 vulnerable customer depths	Yes
Understanding needs and priorities	2022	Social Listening (Kantar)	Explore what the current water industry landscape looks like, what themes are emergent, how Severn Trent can improve the customer experience it offers, brand perception, competitor landscapes and how the climate and environment feature in water industry conversation.	Analysis of consumer expressions from Twitter, Google, Reddit, Trustpilot, YouTube, Facebook	n/a	No
Exploring opportunities for investment	Dec-21	River users and locations research (Ci)	Research with recreational river users to understand motivations, preferences and behaviours to help inform potential further development of the areas' rivers as part of PR24.	Online survey via panel Dynata and distributed through social media interest groups	473 consumers	No
Exploring opportunities for investment	Feb-22	Tap Chat - investing to protect SSSIs	1. To understand whether or not customers want Severn Trent to invest to protect SSSIs and other environmentally sensitive areas from the potential impact of its wastewater assets failing. 2. To understand whether or not customers are willing to contribute to the cost of this investment via their future bills.	Tap Chat poll and discussion	1,705 Tap Chat members	No

Phase	Date	Research activity	Objectives	Methodology	Number of customers engaged	Sia Assurance
Exploring opportunities for investment	Apr-22	River pollution and river use research (Blue Marble)	Understand and quantify customer views about river water quality, and how they want to see Severn Trent invest to improve it	Qual: Online community and reconvened focus groups Quant: Online survey on panel: Yonder Data Solutions	2,093 HH customers	Yes
Refining the plan	Nov-22	Strategic investment choices research (Explain)	Robust quantitative research to understand customer preferences when presented with strategic investments, exploring priorities with, and without, a view of the bill impact that investment will have.	Online panel Dynata and face to face survey	1,954 HH customers, 79 future customers and 436 NHH customers	Yes
Refining the plan	Dec-22	DWMP Customer consultation research (Relish)	1. Understand customer views on the long-term targets for the DWMP and planning objectives. 2. Explore customer views on 2030 plans to protect river water quality, increase flood resilience and improve wastewater treatment works capacity. 3. Feedback on the Customer Quick Guide. 4. Ascertain support for further investment to meet long term targets, including different levels of ambition of flood risk, operation of storm overflows, emphasis on nature based and partnership solutions. 5. Establish which areas of investment are a priority. 6. Explore perceptions of intergenerational fairness.	Qual phase consisting in an online community and IDIs and 2 face-to- face follow up groups. Quant phase - online survey	Qual: 24 HH, 8 NHH and 3 flooding experts Quant: 1000 HH and 200 NHHs	Yes
Is the plan acceptable and affordable?	May – Aug 23	PR24 Acceptability and Affordability testing (Thinks Insight & Strategy and Explain)	Understand whether the PR24 plan is acceptable and affordable to customers.	Deliberative workshops, IDIs and survey	Qual: 96 customers (72 HH and 24 NHH) Quant: 3969 HH and 200 NHH	Yes
Is the plan acceptable and affordable?	July -23	Long term delivery strategy research (Thinks Insight & Strategy)	1. Test the 2050 vision with customers and the PR24 plan as the first stage in achieving longer term ambitions 2. Understand whether future targets are acceptable, stretching enough or too stretching 3. Explore views on future uncertainties 4. Understand whether customers support the proposed approach to adaptive planning 5. Explore responses to potential future bill options including views on intergenerational fairness	Face- to- face deliberative workshops and IDIs	33 HH customers, 12 future customers and 12 NHH customers	Yes

We have also referenced the following third party nationwide research:

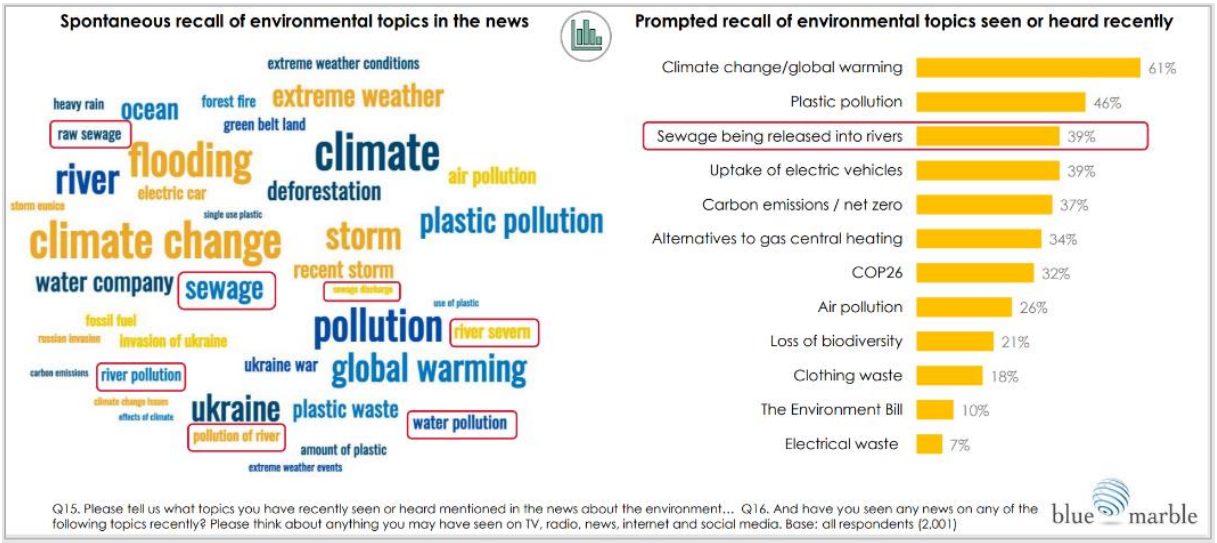
- River water quality customer research, Ofwat, July 2022

Customers care about the environment and want rivers to be clean and healthy.

The environment is raised spontaneously by customers as an area of core service and a key concern. Preventing / minimising the pollution of waterways is one of the areas customers want us to prioritise, and has consistently been the top investment priority in the Social Barometer.

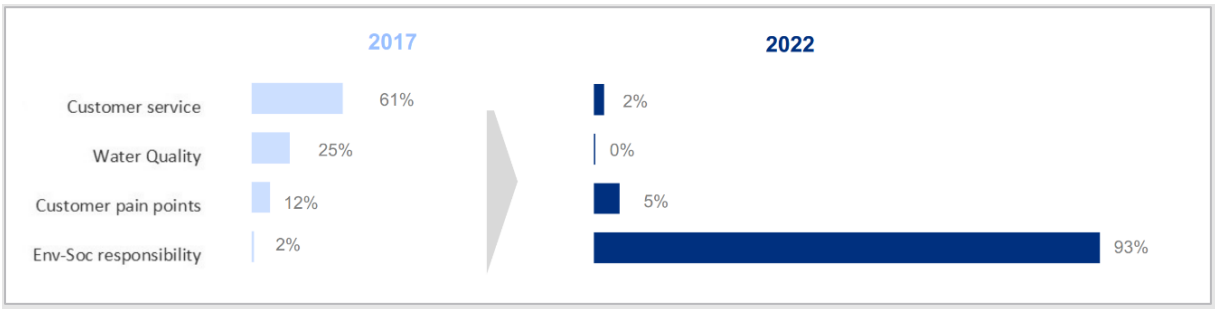
Rivers play an important part in people's lives, 81% of customers tell us they have visited their local river and people talk about the emotional connection that they have with these spaces. As result, pollution and litter get a strong negative response[40]. 95% of customers agree that river water should provide healthy habitats for plants and animals[41].

Sewage being released into rivers is high on people's agenda - it is a top 3 environmental concern for 39% of the region's population, behind climate change (61%) and plastic pollution (46%)[42].



It also emerges strongly in our 2022 Social Media Listening, which sees a major shift in water industry conversation from customer service to environmental and social responsibility.

[40] River pollution and river use research, Blue Marble, April 2022
[41] ibid
[42] ibid



Research conducted by Ofwat[43] found that three in ten respondents (29%) ranked water pollution of rivers and seas among the top three things having a negative impact on the environment. Almost six in ten (59%) wanted their water company to prioritise improving the quality and cleanliness of rivers in England and Wales, even if this were to increase the price of their water bills.

"It's nice to find an extra excuse to go and visit the river… I struggle with my mental health, so having reasons to get outdoors helps my mood greatly." River pollution and river use research, HH customer

"I wish for Severn Trent to focus on improving the environment, tackling climate change and reducing the amount of wastewater that is released into rivers, lakes and the sea." Tap Chat customer

As well as the environment in general, customers care about SSSIs and believe that Severn Trent should invest to protect them and other environmentally sensitive areas.

Customers care deeply about these sites and value them highly. 99% of Tap Chat customers polled were in favour of Severn Trent investing in protecting SSSIs from pollution. However, not many were willing to pay extra for this via their bill, seeing it as Severn Trent's responsibility.

"These sites are not only beautiful and varied locations that we can access for pleasure, exercise and wellbeing, they are also incredibly important environmental habitats for a huge range of flora and fauna" Customer, Tap Chat discussion

Investing in environmental improvements is a high priority.

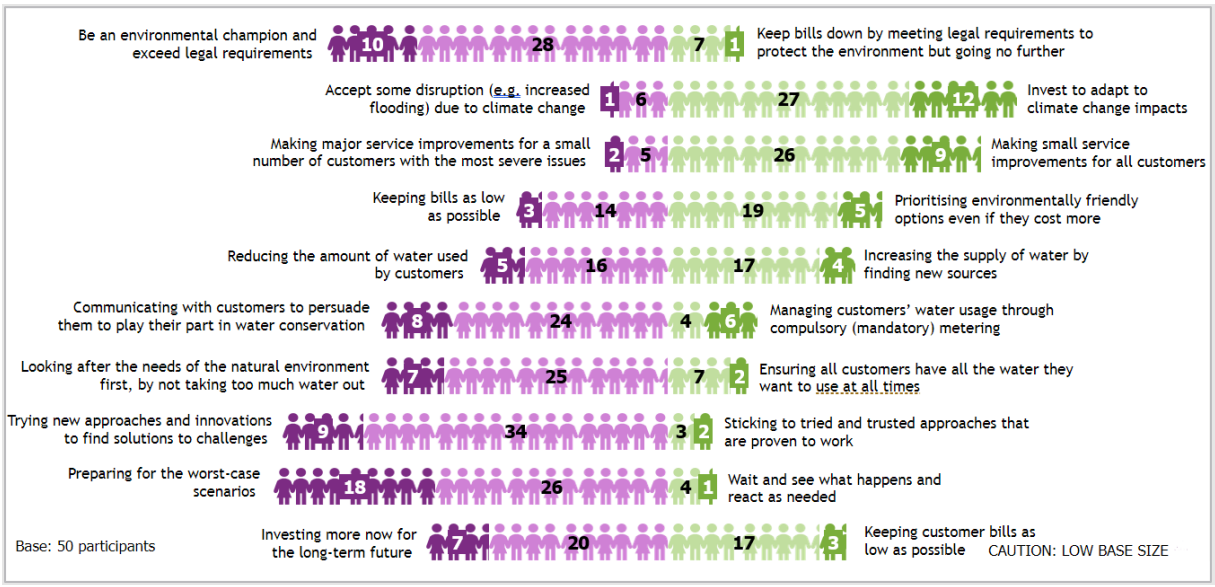
Across our overall triangulation of customer priorities, "Preventing the sewage network from causing environmental pollution" and "Doing more to ensure sewers and sewage treatment works do not cause environmental harm to rivers" are high investment priorities. Only 13% of customers agree with the statement "there are more important things for Severn Trent to invest in than reducing river pollution". This is also a key priority in the qualitative research

When thinking about our future plans, customers are increasingly aware of issues relating to climate change but also want environmental protection to be central to our long term plans. This is consistent amongst all customer groups.

Customers expect us to deliver our statutory requirements. Some customers want us to go beyond this as well, although views are mixed.

[43] River water quality research, Ofwat, July 2022

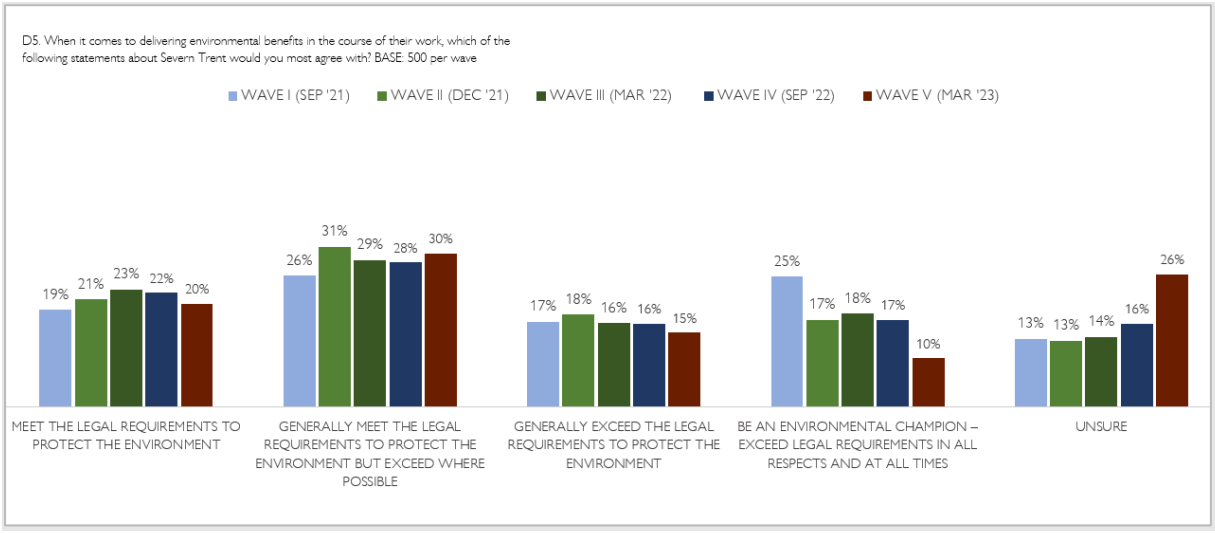
Delivering the statutory minimum is a basic expectation of the service we deliver. There are some **mixed views** on how far we should go in terms of going beyond these requirements. Our early qualitative research in 2021[44] showed an indicative preference towards "Being an environmental champion and exceeding legal requirements".



As the cost of living crisis has developed this view has weakened slightly. Quantitative (uninformed) research in 2022 on the water resource management plan shows a swing towards keeping bills low[45].

Since we have been tracking customer preferences in the Social Barometer there is increased uncertainty when it comes to delivering or exceeding level requirements. Despite this, 54% of customers still want us to either *exceed where possible / generally exceed / exceed at all times*.

[44] Strategic Priorities research, Community Research, December 2021
[45] WRMP deep dive survey, Accent, May 2022



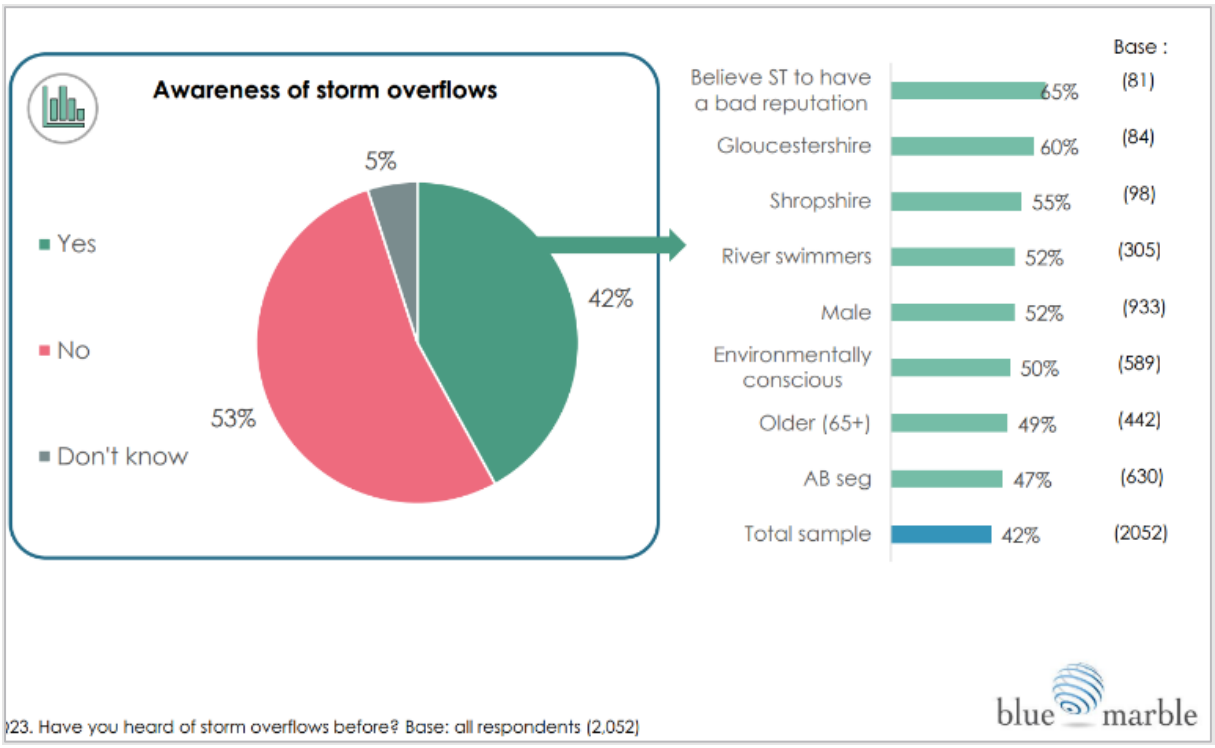
In national research conducted for Ofwat46, respondents were given a choice between improving the quality of rivers or keeping bills low. 59% wanted their water company to prioritise improving the quality and cleanliness of rivers even if this were to increase the price of their water bills. Younger people were more likely than older people to want companies to keep the water bills low (40%), as well as those behind of the payment of any bills.

Customers are concerned about overflows and the impact on rivers, and want us to invest to reduce spills. Longer term they ideally want to see spills reduced to zero, and question why the Government isn't more ambitious.

Storm overflow spills have become a prominent customer concern, driven at least in part by media attention. 75% of customers in national research are aware that sewage is sometimes released into rivers and seas, but very few report a good understanding of storm overflows. Many respondents report concern about this, with the most common emotions relating to this being anger and upset[47].

In our research[48] over half of customers were unaware of storm overflows, and awareness correlates with older, higher socio-economic groups. River swimmers and environmentally conscious customers are also more likely to claim awareness, as well as those who believe Severn Trent has a bad reputation.

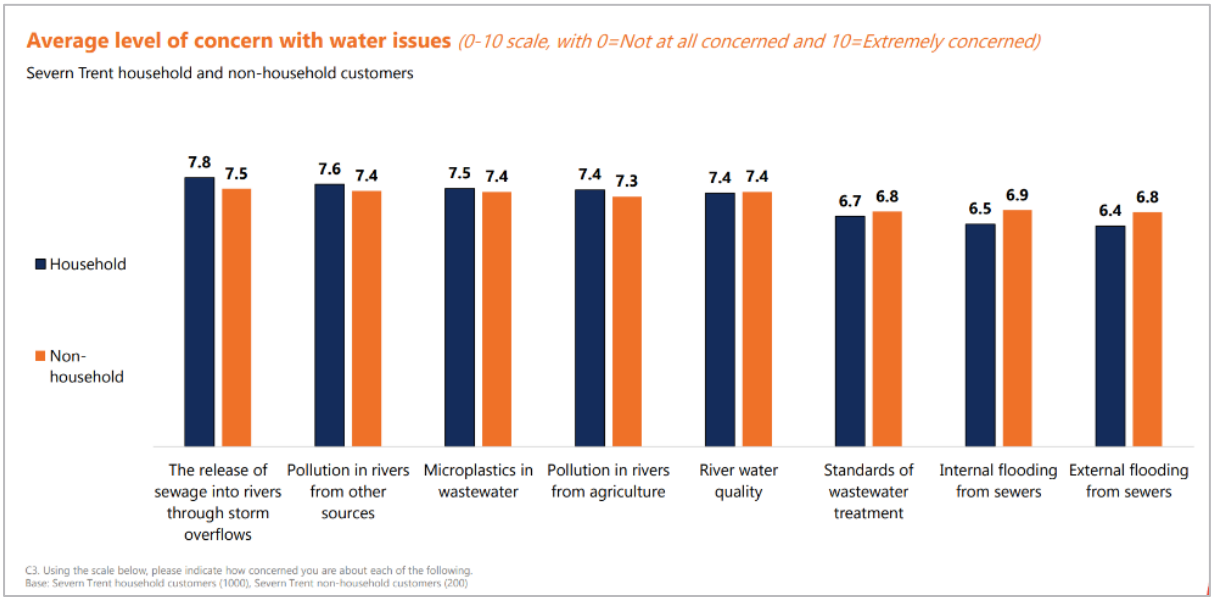
[46] River water quality customer research, Ofwat, July 2022
[47] Trust and perceptions: people's views on the water sector, Ofwat, February 2023
[48] River pollution and river use research, Blue Marble, April 2022



Despite the media reports, in our qualitative research we also find that understanding of overflows is very limited, with river users being the more informed group.

"Yes, as a nature lover…I take a keen interest to ensure that we all play our part in minimising pollution. The understanding of drainage and storm overflows play a large part of minimising the damage to our local environment" River user, River pollution and river use research

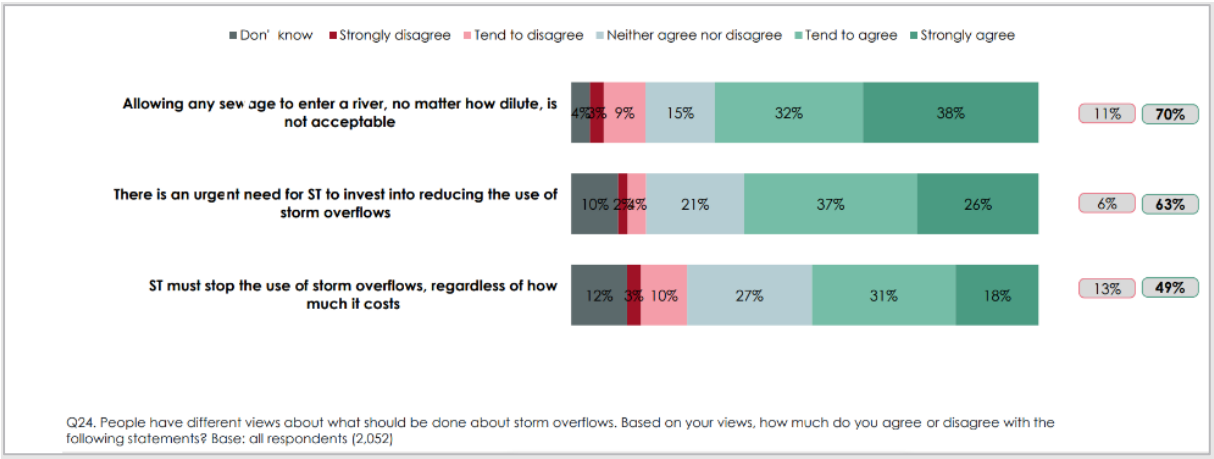
In our DWMP Customer consultation we find that the release of sewage into rivers through storm overflows is the top thing that customers are concerned about (compared to other wastewater issues).



When it comes to tackling the problem, in our quantitative research, 70% of respondents agree that no sewage should enter rivers, no matter how dilute[49].

Agreement that no sewage should enter rivers is higher for those who swim in rivers (77%) and more environmentally conscious customers (79%).

63% of customers agree that investment is urgently needed to reduce the use of storm overflows and 49% agree they should stop being used regardless of cost[50]. Those who were aware of storm overflows before taking part in our research feel even more strongly than those who were unaware.



"Why is it that the treatment facilities can't deal with it. If it's from Victorian times they should be prepared" Customer, River pollution and river use research

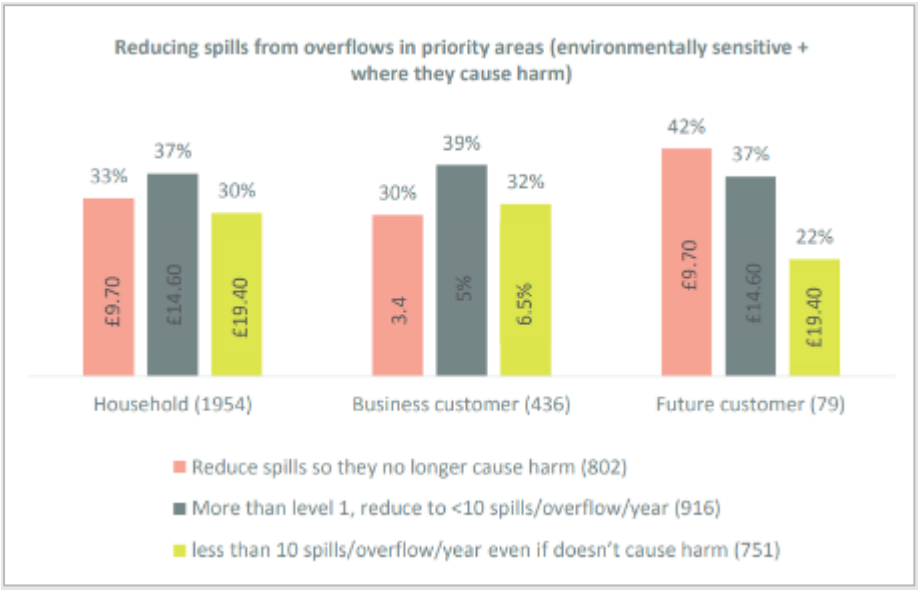
When it comes to the impact of overflow spills, there is some scepticism from customers that storm overflows can cause minimal ecological damage / not cause harm. Only 36% agree it is acceptable for very dilute sewage to enter a river, provided the Environment Agency is satisfied no plants or animals are harmed as a result[51].

"You have to take what they say with a pinch of salt about ecological damage" Future customer, River health and river use research

"Stop the sewage overflows that go into the river. It's not nice after heavy rains then having to dodge unmentionable stuff and raw sewage." River user, River users survey

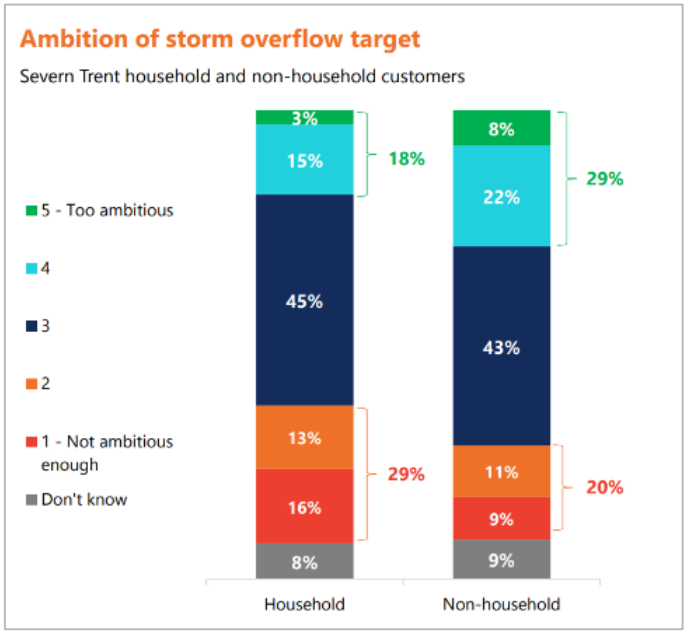
While 81% of customers associate "no environmental harm" with no fish, wildlife or plants being killed or damaged as a result of sewage, 31% think it means eliminating all overflow spills.
There are mixed views in the Strategic investment choices research about how far we should go in AMP8 in reducing overflows, with slightly more option for the mid-level investment.

[49] River pollution and river use research, Blue Marble, April 2022
[50] ibid
[51] River pollution and river use research, Blue Marble, April 2022



Future customers are more likely to opt for a lower level of investment, whilst older customer groups chose the highest level significantly more than younger groups. Those on a higher income, and those who say they make a great deal of effort toward environmental sustainability were more likely to select level 3.

When it comes to the long term targets to reduce storm overflow spills, with informed customers in the DWMP Customer consultation more customers tend to accept 10 spills per year than aiming for zero. However, there is no universal consensus on this. For less informed customers there are also split views on the level of ambition.



"I think 10 times is quite a low number and we're increasing the amount of rainfall we have due to climate change. We've already had a lot of rain this year and floods etc so it doesn't seem possible"
NHH customer, DWMP Customer consultation

"10 a year doesn't sound too bad to be honest, for the billions that would be saved – I would be open to the 10 spills" NHH customer, DWMP Customer consultation

"I think they should be aiming for the best possible resolution and that would be for there not to be any overflows in a year. Reducing it to 10 shouldn't be the end goal but just a gate on the project" HH customer, DWMP Customer consultation

In the LTDS research customers told us they ideally wanted to see storm overflows reduced to zero, and there are questions about why the government targets are not more ambitious.

"I don't know that the government targets look that difficult, it's a really long time. You'd hope they could do this sooner than that" HH customer, LTDS research

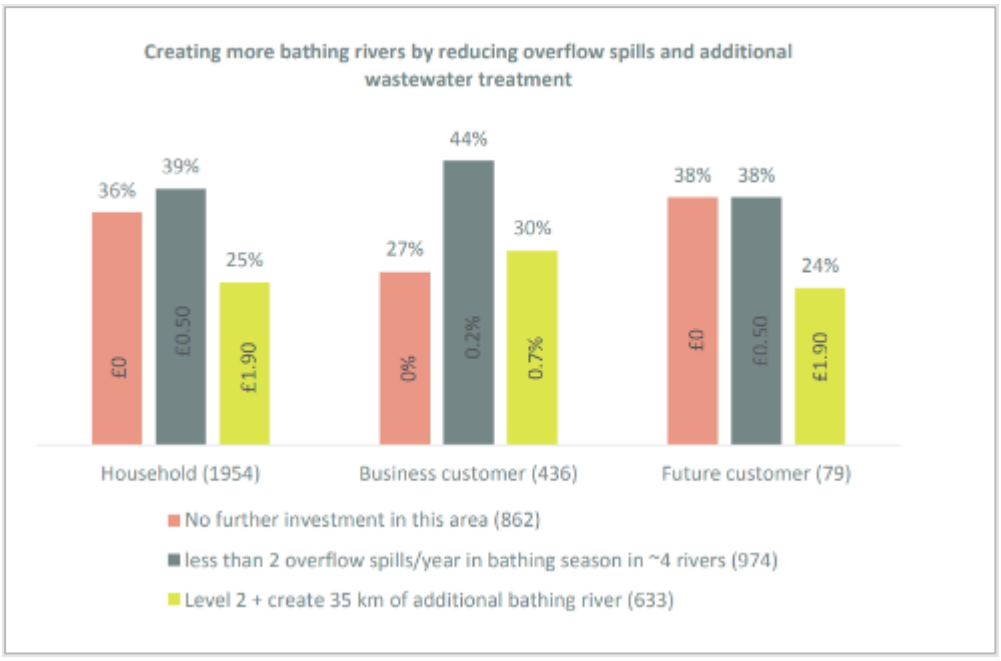
While customers support investment improving river water quality, delivering further bathing standard rivers isn't such a priority right now.

75% of customers think it should be safe to go swimming in a river without the risk of becoming ill, however ecological health takes priority for customers over aesthetics and achieving bathing quality[52].

Compared to other investment areas, investing in bathing rivers is not a high priority investment, with less than 50% of customers ranking it as a high priority (in the Social Barometer). It also emerges as a low priority in our other research.

In the Strategic Investment choices, it is the lowest priority out of the 8 investment areas with only 31% of HHs and 38% of NHHs ranking it as high importance. It is also lowest for future customers. Only 25% of HH customers and 30% of NHHs selected the investment option to create additional bathing rivers (going beyond just reducing overflows).

[52] River pollution and river use research, Blue Marble, April 2022



This is echoed in our DWMP Customer consultation research – it feels less urgent and something that should be going on in the background rather than a priority right now.

"Bathing water quality is a lovely idea, but not something I believe to be a priority at present having learned the full extent of what is going on" Future customer, DWMP Customer consultation

River users tell us they are concerned about river water quality and their health, with concern over storm overflows (89%) outweighing concern over the levels of sewage treatment (70%) and the impact of agriculture (61%)[53].

"The river's not a swimming pool, the river's a natural thing and we should be looking after it - we should prioritise its health over it being ok to bathe in" Customer, River pollution and river use research

Our proposed plan is considered acceptable to customers, but if we were going further investment in reducing overflows is a priority.

In our Acceptability and Affordability research we find that *Improving river water quality and reducing storm overflow spills* is an area of great importance for customers. When discussing performance commitment targets, customers tell us they want to see the specific targets on storm overflow spills to deal with what they see as a major issue for the environment (the research guidance did not include these amongst the common performance commitments discussed).

Customers tell us they are aware of media reports on sewage pollution in rivers, and want to see the issue tackled quickly.

"This is important because it doesn't just affect us, it's wildlife too. We need a sustainable environment" HH customer, Acceptability and Affordability research

Reducing phosphate through the sewage treatment process is also seen as important, but this is less tangible to customers than storm overflows.

[53] River users survey, Consumer Insight, December 2021

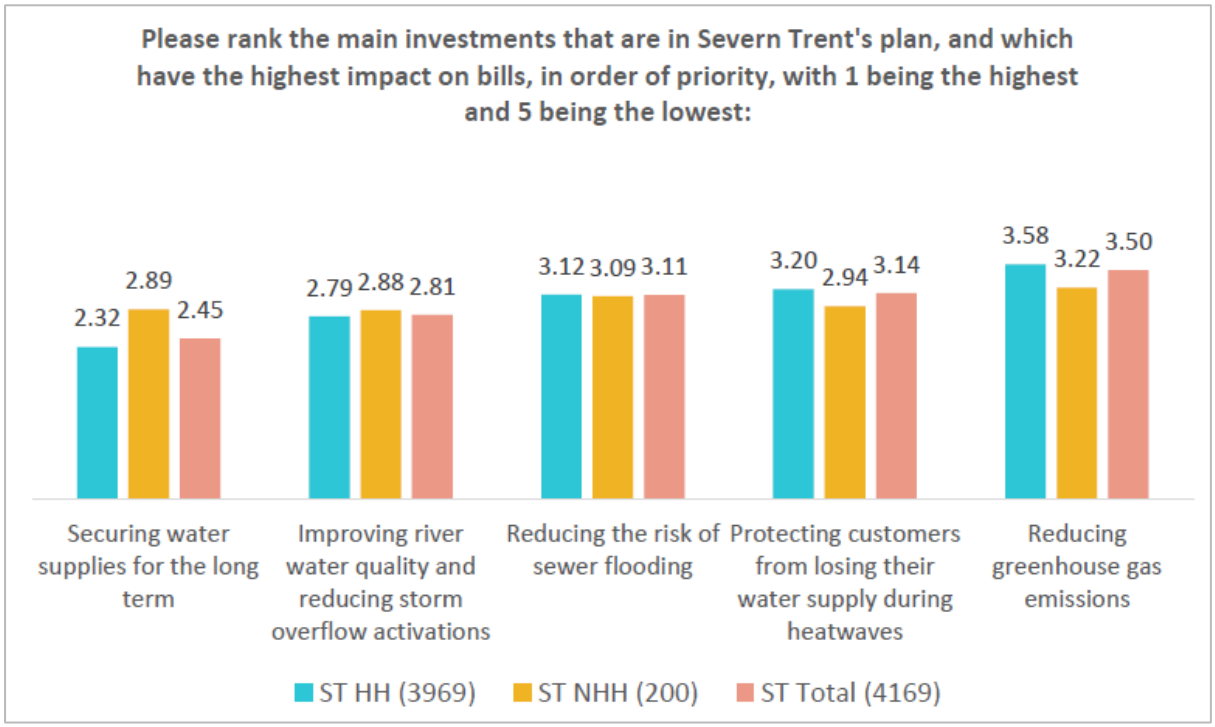
"£5 more per year to address [more] phosphate – I don't know enough about this to know how bad they are" HH customer, Acceptability and Affordability research

Customers felt positive towards our proposed plan, although some wanted more action on storm overflows, and they are often surprised about how expensive this investment areas is compared to other priorities. Customers were also pleased to hear we would be working with farmers to reduce their impact too.

For some customers, the long-term target feels unambitious and still constitutes more spills than they would like. Others feel that going further would require even more investment (on an already large amount).

While it doesn't feel as affordable, the proposed plan is seen as acceptable in this area. Overall, customers believe it is essential to protect the nation's rivers and that while expensive, it is worth the cost. If more money was to be invested, customers often say they would like to this go toward reducing storm overflow spills, which is seen as more of a priority than reducing phosphates.

In our quantitative research, this investment area was ranked the second most important, following *Securing water for the long term*. Older age groups tend to rank it higher than those who are younger, and those who have seen / heard about water companies and about Severn Trent in the media in the last 3 months are more likely to rank it more highly than those who are not aware. Overall, the plan is acceptable to 76% of customers.



Appendix H: Proportional Allocation

We have been careful to protect customers from paying twice, and have applied proportional allocation rules to all of our WINEP solutions to ensure that any elements of scope that entail provision of new capacity for growth and/or replacement of existing capacity are removed from our enhancement costs and allocated to base expenditure.

As an example, we have a project at Harworth STW that is delivering two separate WINEP enhancement obligations (tighter ammonia and phosphate permit limits) and a significant capacity increase to cater for population growth. The overall project cost to cover all of these investment drivers is £36.9m. To ensure that correct allocations are made, the project scope was reviewed on an item-by-item basis to assign each new asset to the correct driver. For simplicity we have summarised the outcome of this exercise at process stage level in the table below. The outcome of this exercise is that 56% of the total project cost has been assigned to growth.

Process stage	Allocation
Intake Screening	Growth
Grit Removal	Growth
Storm Water Tank	Growth
Primary Tanks	Growth
Tertiary Solids Removal	Phosphorus Enhancement
Chemical Dosing	Phosphorus Enhancement
Sludge Holding Tank	Shared
Biological Filters	Growth
Nitrifying SAF Plant	Ammonia Enhancement
Humus Tank	Growth