TMS26 Enhancement Case: WINEP

Contents

1. Summary

Reference	PR24_TMS_Enhancement Case - WINEP
Description	The Water Industry National Environment Programme (WINEP) is designed to enable companies to meet new legal obligations and regulatory expectations in relation to the environment. Actions required under the WINEP, as cascaded from priorities and expectations in the Water Industry Strategic Environmental Requirements (WISER) are designed to ensure compliance with UK environmental legislation. In most cases the actions are statutory, and companies and their stakeholders have limited influence over associated investment. In some cases, the need for a scheme is dependent on a favourable cost-benefit assessment and / or evidence of customer support. Our customers have long supported the achievement of positive environmental outcomes, and our latest customer research confirms this remains the case. Addressing the more contemporary issue of storm overflows is a high priority for customers, with strong preferences shown for addressing the issue quicker than the legislation dictates. We have assessed that the full statutory WINEP, as anticipated in AMP8, is significantly beyond our capacity to finance and deliver the necessary improvements within a single AMP, even after doubling the capacity of our Capital Delivery function. This is also in the context of other significant legislative and regulatory programmes that are being requested in AMP8. We have therefore needed to make a number of difficult 'trade-off' decisions across our entire AMP8 programme and this is also the case for the AMP8 WINEP. Our current proposal (and the basis for this Enhancement Case) is to meet the statutory requirements associated with storm overflows, bathing waters and low flow alleviation, with all other elements phased for delivery beyond 2030. We recognise this does not meet all current statutory requirements and are therefore open to further discussions with the government and regulators to explore alternative options.
Outputs	In AMP8 our deliverable plan comprises actions to improve or protect the environment for: • Storm overflows (actions in 107 locations and 454 investigations) • Inland bathing waters (1 action and 1 investigation)

	• Low flow alleviation (6 WTW improvements, 22 investigations) This work will drive improvements under the bathing water quality common Performance Commitment (a forecast improvement of 16.5%) and under the storm overflow Performance Commitment (a forecast reduction in discharges by an average of 6.63 discharges per asset per year over AMP8). Rethinking Rivers (27 catchments). Our long-term strategy is focused on resolving environmental challenges through nature-based solutions and in particular the collaborative work we undertake with partnerships to manage river basins in a long-term, sustainable manner. This is delivering results; however, it does not form part of the statutory programme within WINEP. This has resulted in us removing our 'Rethinking Rivers' investment ('Advanced WINEP') from our PR24 submission. However, subject to Defra's agreement, we would welcome the opportunity to revisit this decision, given the support from our environmental partners and the long term benefits this programme could deliver. In AMP9 and AMP10, we will deliver interventions to address all deferred environmental requirements, continue to improve storm overflows and implement the outcomes of investigations undertaken in AMP8. This has resulted in the following programmes, originally identified for delivery in AMP8, being deferred beyond 2030: • Phosphorus (160 actions including 4 catchment solutions) • Chemicals (105 actions) • Drinking water protected areas (10 actions) • Water resources (river restoration and fish passage) (40 actions, 21 investigations) • INNS / Biodiversity / SSSI / Habitats / Eels (7 actions) • Flow, event duration and river water quality monitoring (475 actions[1]) • Sanitary determinants (BOD, Ammonia, SS) (13 actions) • Groundwater (11 actions) • Investigations / CIP / N-TAL / Microplastics trials (68 actions for wastewater) • Low flow alleviation (1 licence growth investigation)

[1] *River water quality and emergency overflow monitoring actions and costs to be confirmed by 27 October 2023, as per the latest Environment Agency guidance, released to water companies on 18 August 2023.*

<table>
<tr><td>Proposed AMP8 Cost</td><td>£950.4m</td></tr>
<tr><td>Spend apportionment</td><td>The AMP8 investment is split between the water resources price control (2.3%), water network+ price control (3.8%) and the wastewater network+ price control (93.9%)</td></tr>
<tr><td>Long term anticipated spend profile</td><td>The expected investment to deliver WINEP requirements up to 2050 is as follows:
<table>
<tr><th>AMP</th><th>Cost £m (waste WINEP)</th><th>Cost £m (water WINEP)</th><th>Cost £m (water and waste WINEP)</th><th>%</th></tr>
<tr><td>8</td><td>892.00</td><td>58.423</td><td>950.42</td><td>4%</td></tr>
<tr><td>9</td><td>5,387.87</td><td>191.620</td><td>5,579.49</td><td>25%</td></tr>
<tr><td>10</td><td>5,729.01</td><td>346.688</td><td>6,075.70</td><td>27%</td></tr>
<tr><td>11</td><td>4,383.86</td><td>1140.280</td><td>5,524.14</td><td>25%</td></tr>
<tr><td>12</td><td>2,874.49</td><td>1166.287</td><td>4,040.78</td><td>18%</td></tr>
<tr><td>Total</td><td>19,267.22</td><td>2903.298</td><td>22,170.52</td><td>100%</td></tr>
</table></td></tr>
<tr><td>DPC</td><td>Several projects within the WINEP portfolio have been assessed for DPC. None were deemed suitable, either due to failing the scalability test or having construction and/or operations and maintenance risks that could not be passed on to a Competitively Appointed Provider (CAP). For more information, please refer to Technical Appendix TMS38 – Direct Procurement for Customers (DPC).</td></tr>
</table>

2. Description of the proposed enhancement

2.1 This section presents the total investment programme needed through WINEP to deliver all new and existing environmental legislative requirements as they apply to Thames Water under the WINEP, alongside our proposed programme taking into account challenges associated with deliverability, financeability and affordability across our entire AMP8 programme.

2.2 The WINEP proposals have been developed in line with guidance published by the Environment Agency (EA) and cover a wide range of activities across our catchments for both water and wastewater.

2.3 WINEP actions cascade from the government's priorities and expectations as set out in the Water Industry Strategic Environmental Requirements (WISER) and are designed to ensure compliance with UK environmental legislation, including any target delivery dates.

AMP8 Water Industry National Environment Programme

2.4 The formal issue of the WINEP to companies in July 2023 (Table 2-1), with costs updated to reflect the very latest position, represents the output of work undertaken to meet WISER expectations. This programme is aligned with statutory requirements, whilst also including smaller, non-statutory elements for accelerated delivery against some targets such as a 'Rethinking Rivers' programme to develop innovative approaches not currently available within the standard WINEP framework.

Table 2-1 - July 2023 WINEP updated with latest costs

		July 2023 WINEP
Statutory and Policy Framework	Investment category	AMP8
Water Framework Regulations (WFD) Urban Waste Water Treatment (England and Wales) Regulations (UWWTR) (1994)	Sanitary	103
Water Framework Regulations (WFD)	Investigations / CIP / N-TAL / Microplastics trials	145
National Framework for Water Resources (2020); Water Resources Planning Guidelines (2021); Water Framework Regulations (WFD)	Water resources (inc. low flow alleviation, river restoration and fish passage)	160
Environment Act (2021); Water Framework Regulations (WFD)	River quality, STW and overflow monitoring	168
Environment Act (2021) Urban Waste Water Treatment (England and Wales) Regulations (UWWTR) (1994) Water Framework Regulations (WFD) Conservation of Habitats and Species Regulations 2017 Wildlife and Countryside Act 1981	Phosphorus reduction in rivers (Environment Act P & Other P drivers))	1786
Environment Act (2021)	Storm overflows	810
Invasive Alien Species Regulations (IAS Regulations); The Wildlife and Countryside Act (1981); Alien Species (Enforcement and Permitting) Order (2019); Wildlife and Countryside Act (1981); Water Industry Act (1991); Natural Environment and Rural Communities Act (2006); Conservation of Habitats and Species Regulations 2017; The Eels (England and Wales) Regulations (2009)	INNS / Biodiversity / SSSI / Habitats / Eels	50
Water Supply (Water Quality) Regulations (2016)	Drinking water protection	14
Bathing Water Directive and Regulations (2018)	Bathing waters	166
25-Year Environment Plan	Rethinking rivers	53
Water Framework Directive	Chemicals	545
	Total £m (2022/23)	4000

2.5 This complete AMP8 WINEP programme, which contained investment to meet all WINEP drivers and was fully aligned with WISER, was almost five times larger than our AMP7 WINEP programme. As such, deliverability posed a significant challenge for us, with this scale of programme exceeding our ambitious target of doubling our capital delivery capability.

2.6 Having raised this concern, we have been advised via the Environment Agency where the Secretary of State for the Environment has offered guidance on which investment can be phased to later periods. This was anticipated to enable plans to be deliverable, financeable, and affordable.

2.7 However, this guidance only permits non-statutory drivers to be phased, and as around 90% of our plan is statutory, this steer on phasing, whilst very welcome, still results in a plan that is undeliverable.

Our deliverable and financeable AMP8 programme

2.8 Funding and delivery constraints mean we will not be able to deliver the full extent of the asset investment programmes or environmental obligations and outcomes that we had originally aspired to. We have considered how best to allocate the capital available to us, taking into account the funding and deliverability constraints. We have sought to do so in a way that provides the highest possible protection of the health and safety of our colleagues and customers.

2.9 Additionally, we want to maximise performance in areas that matter to our customers and communities and aligns with the expectation of regulators. In essence, our aim has been to secure maximum value from every pound spent, for our customers and the environment and to run our business in a way that supports the achievement of broader environmental outcomes and policy commitments.

2.10 Our delivery constraints are also limited by the external supply chain – this includes contractor, consultant, and manufacturing sectors where capacity and resources are either diminishing or unable to expand quickly enough.

2.11 This has resulted in phasing the anticipated AMP8 programme over the period AMP8-AMP10 as outlined in Table 2-2 below:

Table 2-2 - WINEP categories and proposed phasing

	AMP8		AMP9		AMP10	
	Act.	Inv.	Act.	Inv.	Act.	Inv.
Phosphorus reduction in rivers						
WFD No deterioration (Ammonia / BOD reduction)						
Storm overflows						
New monitoring equipment						
Reducing chemicals in discharges						
Investigations / CIP / N-TAL / Microplastics trials						
Bathing waters						
Drinking water protected areas						
Water resources (inc. low flow alleviation, river restoration and fish passage)						
INNS / Biodiversity / SSSI / Habitats / Eels						
Rethinking Rivers						
Other WFD river and groundwater quality improvements						

Key:
Actions
Investigations

2.12 Our long-term ambitions have not changed. We are still committed to playing an active part in improving river quality throughout the River Thames catchment, however due to the constraints stated above, we have had to make some difficult choices, which have resulted in a change in the delivery profile for large parts of our WINEP programme.

2.13 Recognising that this profile is not aligned to the steer from the Secretary of State and the WISER expectations, we anticipate that further joint consideration of the balance of investment in our Plan with all our regulators will be necessary.

During AMP8, we will focus on what matters most to our customers and the environment

2.14 Our plan for WINEP categories, included in our AMP8 plan, comprises statutory actions to improve or protect the environment for:

- Storm overflows (statutory only)
- Bathing Waters
- Addressing low river flows (Water Resources)

2.15 Our proposed investment across AMP8 is outlined in Table 2-3 below:

Table 2-3 - Our proposed AMP8 investment (£m)

	2025/26	2026/27	2027/28	2028/29	2029-30	AMP8
Totex	117.618	125.256	185.373	227.134	295.042	950.424

Storm overflows. 107 actions in AMP8, £885.0m

	AMP8	AMP9	AMP10	Total
Actions (No.)	107	150	201	458
Investigations (No.)	454			454
Cost (£m 2022-23)	885.0	2529.2	4099.2	7,513.4

2.16 Our storm overflow programme is a combination of investigations and improvements to meet the targets set out in Defra's Storm Overflow Reduction Plan. For AMP8 this is for 38% (indicative target) of high priority sites and 14% (indicative target) of all sites that need improving meeting the target performance requirements by 2030. Improvement actions include increased treatment capacity at sewage works, providing storage for high flows, reducing flows entering the system and provision of treatment for storm overflows separate from the main treatment route. This programme also improves a storm overflow upstream of the two designated bathing waters impacted by our operations.

2.17 The programme aligns with our Storm Overflows Discharge Reduction Plan (SODRP), frontloading action in high priority areas, including Sites of Special Scientific Interest (SSSIs), Special Areas of Conservation (SAC) and chalk streams.

2.18 AMP8 proposals are for delivery in line with statutory targets for:

- 107 actions under EnvAct_IMP2 and EnvAct_IMP3 primary drivers
- 454 investigations under EnvAct_INV4

Bathing waters. 1 action in AMP8, £7.0m

	AMP8	AMP9	AMP10	Total
Actions (No.)	1	8	3	12
Investigations (No.)	1	8	3	12
Cost (£m 2022-23)	7.0	159.3	53.0[2]	219.3

2.19 As new bathing water designations are created in our area, we have a statutory duty to help it achieve a 'sufficient' level of quality. At present Wolvercote Mill Stream, Oxford is recorded as being at 'poor' status from its first designated year (2022).

2.20 Further to the designated site in Oxford, we are aware of eight other locations where applications for bathing water status are being pursued. These will be actioned, pending future investigations. Investment is not currently allocated under the AMP8 WINEP programme.

2.21 Investment in future AMPs will support the achievement of sufficient status for each of these locations, should they be designated.

2.22 AMP8 proposals are for delivery in line with statutory targets for:

- One investigation under the BW_INV1 driver to confirm pathogen pathways

[2] *Indicative investment added to account for any potential bathing waters. A pre-FSE adjustment has been applied to all numbers.*

- Subsequent action at Oxford Port Meadow Actions under BW_IMP1

2.23 Further investigations and potential actions are proposed for future AMPs for other candidate bathing locations, including understanding sources of pathogens and their pathways.

Addressing low river flows (Water Resources). 6 actions in AMP8. £58.4m

	AMP8	AMP9	AMP10	Total
Actions (No.)	6	1	0	7
Investigations (No.)	22	1	0	23
Cost (£m 2022-23)	58.4	109.8	0	168.2

2.24 Ensuring that we do not continue making abstractions where they cause environmental harm to vulnerable catchments is a key company priority, highlighted in our Vision 2050. Licence reductions will be made at sources either where abstraction at our existing licensed volume poses a risk of causing deterioration (to ensure that we comply with 'No Deterioration' requirements of the Water Framework Directive), or where making a licence reduction is considered very likely to result in the improvement of water body status (subject to cost-benefit analysis). Investment is required to ensure that our supplies for customers continue to be resilient when licence reductions are made.

2.25 In addition to enacting licence reductions, we will also carry out a wide-ranging programme of low-flow investigations to determine licence reductions that may need to be made in the future, to help us determine our pathway to an environmental destination, including contributing towards a regional study.

2.26 AMP8 proposals are in line with our Water Resources Management Plan (WRMP), which supports the development of a pathway to the regional long-term environmental destination, within the Government's 25-Year Environment Plan.

- 6 actions under WFD_IMP_WRFlow and WFD_ND_WRFlow drivers
- 22 investigations under EDWRMP_INV, WFD_INV_WRFlow, WFD_INV_WRHMWB and WFD_NDINV_WRFlow drivers

2.27 The above programmes will be supplemented with other significant environmental improvements during AMP8 including the completion of the AMP7 WINEP and upgrades to over 100 STW's reducing the risk of non-compliance with flow conditions with the permits.

AMP8 outcomes and impact on Performance Commitments

2.28 The proposed investment will benefit two Performance Commitments – Bathing Water Quality and Storm Overflows. AMP9 and AMP10 investment will also benefit River Water Quality (Phosphorus) and Biodiversity.

2.29 The improvement for the bathing water in Oxford is expected to increase our Bathing Water score by 16.5% as the bathing water is currently at Poor status and is forecast to improve to 'sufficient'. We only have one other bathing water which we can impact – Frensham Ponds near Farnham in Surrey, currently at Excellent Status.

2.30 Our storm overflow improvements are forecast to improve our average discharges per asset per year from 23.84 to 17.21, an improvement of 6.63.

2.31 For further details refer to Technical Appendix TMS09 Our AMP8 Wastewater Outcomes Delivery Strategy.

Phased investment proposed for AMP9 and beyond

2.32 The remainder of the July 2023 WINEP submission from the EA has been phased for delivery in AMP9 and AMP10.

2.33 This includes the continuation to improve storm overflows and implement the outcome of investigations undertaken in AMP8. We will also deliver against the wider WINEP drivers, not currently deliverable.

2.34 These WINEP investment categories have been re-profiled to show expected future delivery timescales.

Phosphorus reduction in rivers

	AMP8	AMP9	AMP10	Total
Actions (No.)		127	33	160
Investigations (No.)		3		3
Cost (£m 2022-23)		1,790.3	704.9	2495.2

2.35 This investment comprises a combination of investigations and interventions such as end-of-pipe sewage treatment works upgrades, nature-based solutions and catchment management measures.

2.36 Improvements are needed to reduce the risk of eutrophication in rivers, lakes and canals, which in turn impacts on the quality of rivers for wildlife and recreation. It can also increase flood risk and increase water treatment costs. In some cases, investment is needed to counteract impacts of growth (within permit), preventing waterbodies from deteriorating.

2.37 The requirements are driven by multiple regulatory drivers, including Water Framework Regulations, Environment Act, Habitats Regulations and Urban Wastewater Treatment Regulations. Two requirements are to achieve 'nutrient neutrality', a legal requirement anticipated to be included in the forthcoming Levelling Up and Regeneration Act.

Sanitary requirements – Ammonia, BOD and Suspended solids reduction in rivers

	AMP8	AMP9	AMP10	Total
Actions (No.)		14	10[3]	14
Investigations (No.)		14	0	14
Cost (£m 2022-23)	-	103.4	74.2	177.6

2.38 This investment comprises a combination of investigations and interventions at STWs.

2.39 Improvements are needed to reduce the risk of the load of ammonia, BOD and suspended solids. In some cases, investment is designed to prevent river deterioration as a result of population growth using up permit dry-weather flow headroom and increasing the discharge load of sanitary parameters. Ammonia and the impacts of Biochemical Oxygen Demand on dissolved oxygen levels in rivers can have harmful impacts on biota, particularly fish. Future investment will involve STW upgrades to counter the increased load.

2.40 Requirements are driven under Water Framework Regulations, Habitats Regulations and Urban Wastewater Treatment Regulations.

Flow, event duration and river water quality monitoring

	AMP8	AMP9	AMP10	Total
Actions (No.)		471+	TBC	471+
Investigations (No.)				
Cost (£m 2022-23)	-	168.4	453.8+	622.2+

2.41 Installation of continuous river quality monitors to provide detailed river monitoring around our discharges; new pass-forward flow monitors to detect if overflows are being operated too soon; new continuous flow monitors where previously, the STW's discharge was too small, need measuring; and new event-duration monitors at newly identified storm overflow locations.

2.42 Regulatory drivers fall under the Environment Act and Urban Wastewater Treatment Regulations.

2.43 Numbers in the table above reflect the EDM, emergency overflow and pass-forward flow monitoring.

2.44 Investment and number of actions will be confirmed, following further discussion with the Environment Agency over the autumn of 2023.

[3] Estimated number only based on AMP9 investigations confirming need for some upgrades.

Reducing chemicals in discharges

	AMP8	AMP9	AMP10	Total
Actions (No.)		105		105
Investigations (No.)		32[4]		32
Cost (£m 2022-23)		570.2		570.2

2.45 Driven by Water Framework Regulations, this investment comprises upgrades to treatment processes at sewage treatment works to reduce the concentration of specific chemicals (nonylphenol, cypermethrin, PFOS, copper and zinc). It will help achieve chemical standards in rivers. We will also trial new technologies, explore trader control and catchment tracing, however not as part of the WINEP programme.

2.46 Investigations are also proposed, continuing the Chemicals Investigation Programme. These include 26 Chemical Investigations, 2 Microplastics Investigations, and 4 N-Tal Investigations (of which up to 3 technology trials).

Drinking water protected areas

	AMP8	AMP9	AMP10	Total
Actions (No.)		10	10	20
Investigations (No.)		1	2	3
Cost (£m 2022-23)		14.3	14.8[5]	29.1

2.47 Catchment investigations to understand the sources of nitrate in one groundwater catchment, and catchment protection actions to prevent deterioration of water quality as a result of pesticides and nitrate entering waterbodies designated as Drinking Water Protected Areas for both groundwater and surface water catchments. Actions under this driver relate to either new substances to be controlled, or new areas for substances previously controlled through catchment management. It is assumed that the Botex allowance will include funding to continue ongoing drinking water protection activities from AMP7.

2.48 Requirements are driven by Water Supply Regulations.

River restoration and fish passage (Water resources)

	AMP8	AMP9	AMP10	Total
Actions (No.)		19	21	40
Investigations (No.)		18	3	21
Cost (£m 2022-23)		21.9	22.6	44.5

[4] This includes 26 Chemical Investigations, 2 Microplastics Investigations, and 4 N-Tal Investigations.

[5] This is based on a high-level estimate.

2.49 Driven by Water Framework Regulations, a series of actions to enhance physical habitats within and around rivers by undertaking restoration activity, e.g., making morphological changes to enhance in-river and riparian habitats. This includes investigations to determine the need for and feasibility of other restoration activities that could be undertaken in the future. Our ambitious plan for river restoration involves schemes to either mitigate or complement abstraction reduction.

2.50 Water Framework Regulations also require a series of actions to implement schemes to improve fish passage where water resources infrastructure (such as weirs) can impede their movement, alongside investigations into fish passage schemes which could be implemented in the future. We have identified fish passage schemes in recognition of their value and benefit in establishing improved fish populations in chalk and other streams.

2.51 River restoration and fish passage schemes represent good value for money in improving river habitat, especially in relation to abstraction reductions which are significantly higher in cost.

2.52 Feasibility assessments and design of further schemes are also proposed for later AMPs.

Invasive and non-native species (INNS) / Biodiversity / SSSI / Habitats / Eels

	AMP8	AMP9	AMP10	Total
Actions (No.)		7		7
Investigations (No.)		3		3
Cost (£m 2022-23)		41.3		41.3

INNS

2.53 Complying with the Invasive Non-Native Species (Enforcement and Permitting) Order 2019 requires us to implement our company-wide plan for mitigating the risk that INNS pose. In addition, we will undertake monitoring, investigation, and pilot transfers to improve our understanding of the actions that we should take.

Biodiversity

2.54 Under the Natural Environment and Rural Communities (NERC) Act, a series of actions are required to enhance the biodiversity on landholdings we own or impact upon. This will include changes to permits or licences, and / or other actions that contributes towards biodiversity duties, requirements and priorities.

SSSI

2.55 The Wildlife and Countryside Act 1981, Water Industry Act 1991 and Biodiversity 2020 require action to contribute to restoration of a SSSI to favourable condition. Investigation and / or options appraisal is also necessary to determine the impacts of water company activities or permit or licence conditions / standards on a SSSI; or to determine the costs and technical feasibility of meeting targets.

Habitats

2.56 Two nutrient neutrality schemes under Conservation of Habitats and Species Regulations 2017 and supporting the Government's Levelling Up agenda, to reduce

phosphorus loadings at the point of discharge. There is a statutory duty on us to upgrade wastewater treatment works to the highest technically achievable limits by 2030 in nutrient neutrality areas. The outcome is our contribution to achieving improved water quality in the River Lambourn.

Eels

2.57 Actions to remove eels from 12 of our reservoirs and investigations into the impacts of our outfalls on eels, as well as considering new solutions preventing risk to eels. This is needed to comply with The Eels (England and Wales) Regulations 2009.

Rethinking Rivers. 50% of our catchment

	AMP8	AMP9	AMP10	Total
Actions (No.)		14	13	27
Investigations (No.)		27	0	27
Cost (£m 2022-23)	-	53.3	53.0	106.3

2.58 Working together with stakeholders, co-funders and co-deliverers to implement a broad mix of solutions to achieve better value environmental outcomes under the 25-year environment plan, including deployment of catchment and nature-based solutions.

2.59 Our long-term strategy is focused on resolving environmental challenges through nature-based solutions and in particular the collaborative work we undertake with partnerships to manage river basins in a long-term, sustainable manner. This is delivering results; however, it does not form part of the statutory programme within WINEP. This has resulted in us removing our 'Rethinking Rivers' investment ('Advanced WINEP') from our PR24 submission. However, subject to Defra's agreement, we would welcome the opportunity to revisit this decision, given the support from our environmental partners and the long term benefits this programme could deliver.

Other WFD river and groundwater quality improvements

	AMP8	AMP9	AMP10	Total
Actions (No.)		11		11
Investigations (No.)		8		8
Cost (£m 2022-23)		35.7		35.7

2.60 Actions to improve water quality in terms of relevant Water Framework Regulations (WFD) status objectives; to ensure no river, lake or estuary is in poor or bad ecological status due to the water industry.

2.61 Actions are also required to prevent deterioration in areas where groundwater does not have WFD 'good' status. Groundwater investigations will also determine potential impacts and action requirements in relation to water resource or water quality.

3. Need for enhancement

3.1 The Water Industry National Environment Programme (WINEP) is a wide-ranging collection of actions to meet new and existing environmental legislation, including the new Environment Act (2021). This programme has been jointly developed between ourselves, the Environment Agency and Natural England. Actions span our water and wastewater services, with particularly large programmes to reduce storm overflow discharges, reduce phosphorus concentrations in rivers and to limit trace chemicals such as cypermethrin and nonylphenol from entering the environment.

3.2 In nearly all cases the actions are statutory, however we initially proposed an expansion of our successful co-funded, co-delivered catchment management programme under the Advanced WINEP heading with our 'Rethinking Rivers' plans. Due to aforementioned programme constraints, this element has been postponed beyond AMP8.

3.3 Our customers support environmental improvements, with many asking for faster progress on storm overflows.

Our ambition

3.4 As the world around us changes, we can only deliver our purpose if we change too. Our ambitious vision imagines a world where we've learnt from the past and adapted to the future so our customers, communities and the environment can thrive. It starts with tackling the issues that matter most to our customers right now: providing better customer service, finding and fixing leaks more quickly and reducing pollution. And it goes beyond our core services to help us become a force for good: equipping local communities with new skills, restoring rivers and producing more green energy than ever before.

3.5 The environment, and the natural capital within it, is at the core of our business – principally through the provision of water suitable for abstraction to treat and put into supply and the dilution and drainage of wastewater discharges. We want to ensure that our rivers are healthy today and into the future; an ambition our customers share with us. We will work to improve biodiversity, increase wildlife, and enhance the amenity value of the water environment for recreational and social use. Our ambition is to lead the improvement of the environment and clean-up of rivers in our region to become among the healthiest in the UK.

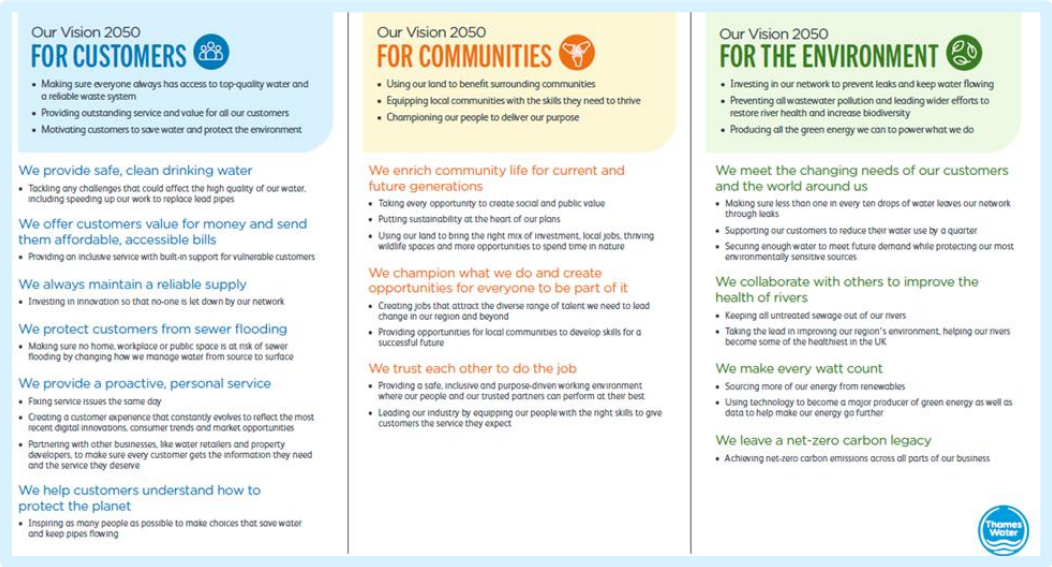
3.6 The activities we routinely undertake aim to protect this scarce natural resource. We use a systems-based approach with our water and wastewater assets and the aquatic environment in which they reside. One of the vehicles supporting the delivery of our ambition is the Water Industry National Environment Programme (WINEP).

3.7 Our Vision 2050 covers three themes, under which we state the outcomes we want to achieve and the goals that will see us achieve them. This Enhancement Case supports the 'for the environment' theme, and is essential to achieve our 2050 Vision, as highlighted in Figure 3.1.

3.8 This is underpinned by the following goals that fall under the WINEP:

- Keeping untreated sewage out of rivers
- Taking the lead in improving our region's environment, helping our rivers become some of the healthiest in the UK
- Securing enough water to meet future demand while protecting environmentally sensitive sources

Figure 3-1 - Our Vision for 2050



Why is this important?

3.9 Actions in the WINEP reduce pollutants entering the environment, reduce abstractions where they pose risk, enhance biodiversity and wildlife, or enable better understanding of the environment and risks to its health. As well as direct benefits to the environment itself, this also provides benefits to users of rivers and to society more widely.

3.10 While most waterbody classification parameters within the Thames River Basin are at 'good' or better status, the overall river classification highlights there is still much to do, with only 9% of waterbodies at 'good' status, 59% at 'moderate', 27% at 'poor' and 5% at 'bad'.

3.11 Stakeholder environmental expectations have also markedly increased from previous investment cycles, with particular aversion to the operation of storm overflows – a sentiment we share. This emotive topic is causing significant reputational damage to the industry, particularly when storm discharges affect water people wish to swim in; either designated or not.

3.12 As more data is being collected, new environmental problems are being discovered – including new data on the presence of potentially harmful micro-pollutants in sewage that have not previously been subject to regulatory scrutiny.

3.13 At the same time, climate change and population growth continue to exert pressure on the environment. We have to do more to prevent deterioration than ever before.

3.14 Impacts on the environment and our customers could materialise in many ways.

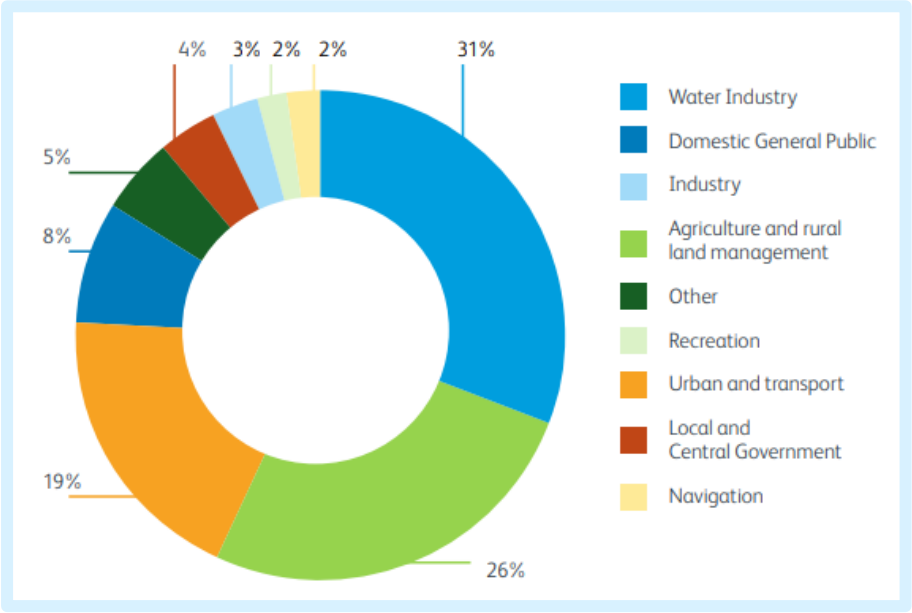
- Wastewater discharges contain pollutants that can impact wildlife, plant life and the overall health of rivers, lakes, and estuaries

- Escapes of untreated sewage can cause both chronic and acute damage depending on location, frequency, and duration
- Poor quality water, both in surface and ground waters, can impact on water abstractions for potable water supply
- Abstracting too much water from catchments can cause direct and indirect damage to rivers and dependent ecosystems
- Assets and structures we operate or rely on, such as weirs and impoundments, can impair fish passage or entrain certain species
- Invasive non-native species can out-compete native species and can be spread through our networks and at sites where we operate recreational facilities such as sailing or fishing

3.15 We agree with WINEP guidance that water companies have a primary role in protecting and enhancing the environment and in so doing improving the lives of those in the communities we serve.

3.16 As the single biggest contributor to poor river water quality in the Thames basin, we must take a leading role in addressing the problems, and not just those for which we are directly responsible.

Figure 3-2 - Reasons for less than good river water quality status in the Thames river basin[6]



Alignment with Long Term Delivery Strategy

3.17 This Enhancement Case is aligned with our long-term delivery strategy. The proposed investment will primarily be delivered in AMP8, AMP9 and AMP10, however, the benefits will ensure a strong foundation for the future and contribute to our 25-year plan to 2050.

[6] Improving water quality in the River Thames catchment, *April 2023, based on our analysis of EA data.*

3.18 To meet customer expectations, we set our Vision 2050 to help our rivers become some of the healthiest in the UK. Our Vision 2050 Customer Research shows that 94% of customers support this goal.

3.19 Our Drainage and Wastewater Management Plan (DWMP), together with the subsequent Long Term Delivery Strategy (LTDS), maps out what we need to do over the next five AMPs to achieve this vision. Our AMP8 Enhancement Case is the first phase of this long-term delivery strategy and is shown within this context in Table 3-1.

Table 3-1 - Summary of WINEP in the context of a 25-year plan

WINEP	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050	Total
Totex(£m)	950.4	5,579.5	6,075.7	5,524.1	4,040.8	22,170.5

3.20 Regulatory and investment requirements from 2040 onwards are harder to predict and will evolve over time. However, we anticipate that future investment programmes are likely to significantly exceed those of AMPs 7 and 8, driven principally by investment needed to meet storm overflow targets and completing the investment needed to meet Environment Act phosphorus targets.

How have we built our WINEP plan?

3.21 We have developed our plan following the methodology[7] set out by our regulators.

3.22 The development process for WINEP has significantly changed since PR19. The WINEP for AMP7 was driven mainly by the EA, who issued a list of projects and actions that companies supplying water and / or sewerage services, should undertake following EA-led assessment of environmental risks and solutions, with collaboration and negotiation between ourselves and the EA.

3.23 The AMP8 development process featured water and sewerage companies collaboratively identifying environmental risks and issues, leading the development, assessment and proposal of solutions before the EA and Natural England assess these proposals and agree actions that we should undertake.

3.24 For each regulatory expectation, the EA published a driver guidance document as well as overall guidance documents on developing the WINEP, developing options and assessing options.

3.25 We have assessed environmental risks that are associated with our operations in several ways. We have:

- Taken findings from studies undertaken in AMP7 and earlier, including studies into impacts of our assets on SSSIs, storm overflow assessments, UPM (Urban Pollution Management) studies, river dissolved oxygen studies, low flow investigations and the Chemical Investigation Programme.
- Reviewed data held by Environment Agency for water quality planning, including the 'Reasons for not achieving good status' (RNAG) data and evidence of

[7] *Water industry national environment programme (WINEP) methodology - GOV.UK (www.gov.uk)*

eutrophication data. We have also reviewed Natural England's list of our assets where they have concerns about environmental impact or risk.

- Used the SIMCAT-SAGIS[32] model to quantify the pollutant loads entering the environment.
- Reviewed stakeholder evidence.

3.26 For each requirement identified, options were developed, following the Environment Agency option development guidance. Wherever appropriate and possible, multiple options were considered to enable comparison.

3.27 As part of the option development process, we employed a natural capital approach to help us identify a wide range of interventions and not be constrained to traditional end-of-pipe actions.

3.28 Wherever compliant with guidance and suitable, we considered the viability of catchment and nature-based solutions as part of this process, either as a complete solution or as part of a solution in conjunction with more conventional asset-based actions.

3.29 Each option was then assessed following option assessment guidance, identifying the best-value and least-cost solutions. In nearly all cases, the best-value options were the same as the least cost options, however in cases where there was divergence, we typically put the best-value option forward for inclusion on the full WINEP.

3.30 We submitted our WINEP proposals to the Environment Agency for review in November 2022 and in January 2023, where deadline extensions were granted due to late provision of guidance and / or models. As part of the development process, we commissioned external assurance on how well we have followed the guidance – this confirmed that we had met the guidance expectations.

3.31 The Environment Agency and Natural England reviewed these proposals. In some instances, further information was sought, or new approaches were requested. We amended our plans in light of these requests. In July 2023, the Environment Agency provided their final view of whether each action in the plan should proceed, be phased into later AMPs or be removed.

3.32 For storm overflow, bathing water and addressing low river flows drivers, our proposals in our Business Plan are aligned to this final, agreed version of the WINEP. In relation to the storm overflow programme, some changes to scheme locations are expected mid-period, once investigations into environmental harm conclude. We will ensure that assets that are not causing environmental harm are deprioritised in favour of assets that are more problematic.

3.33 We have phased all other investment needed to meet the full WINEP plan issued in July 2023 to be delivered as early as possible after AMP8 – in most cases this will be AMP9.

Scale and timing of our proposed investment

3.34 The scale of our full WINEP programme was predominantly dictated by the WINEP methodology and the individual driver guidance documents, including a specific guidance document on investment profiling. All requirements have a specific date

that the outcome needs to be achieved by, and most of these are within AMP8. In two areas, WINEP requirements extend beyond 2030 – this relates to improvement to achieve the Environment Act phosphorus and storm overflow outcomes where full delivery is expected by 2037 and 2050 respectively.

3.35 Our proposed programme no longer aligns with regulatory deadline requirements for several drivers (Table 3-2), and their enhancement has been re-profiled to AMP9 and beyond.

Table 3-2 - AMP8 delivery against regulatory deadlines

Key – Green: Our PR24 plan meets regulatory expectations. Amber: Our plan partially meets expectations. Red: The plan does not meet regulatory expectations. Grey: non-statutory driver.

Statutory and Policy Framework	Driver	Legal obligation[8]	Regulatory Deadline	Planned delivery	AMP8 RAG
25 Year Environment Plan	25YEP_IMP	NS	2030	2035	
	25YEP_INV	NS	2027	2035	
Bathing Water Directive and Regulations 2018	BW_IMP1	S	2026	2026	
	BW_IMP4	NS	2030	2035	
	BW_INV1	S	2027		
	BW_INV5	NS	2027		
Water Supply (Water Quality) Regulations 2016	DrWPA_INV	S	2027	2035	
	DrWPA_ND	S	2030	2035	
National Framework for Water Resources 2020; Water Resources Planning Guidelines 2021	EDWRMP_INV	S	2026	2026	
The Eels (England and Wales) Regulations 2009	EE_IMP	S+	2030	2035	
	EE_INV	S	2027	2035	
Environment Act 2021	EnvAct_IMP1	S	2037	2037	
	ENVAct_IMP2	S	2030	2030	
	ENVAct_IMP3	S	2030	2030	
	ENVAct_IMP4	S	2030	2030	
	ENVAct_IMP5	S	2030	2030	
	EnvAct_INV4	S	2027	2027	
	EnvAct_MON4	S	2030	2035	
Conservation of Habitats and Species Regulations 2017	HD_IMP_NN	S	2030	2035	
Invasive Alien Species Regulations (IAS Regulations); The Wildlife and Countryside Act 1981; Alien Species (Enforcement and Permitting) Order 2019	INNS_INV	S	2027	2035	
	INNS_MON	S+	2026	2035	
	INNS_ND	S	2030	2035	

[8] *statutory (S), statutory plus (S+) or non-statutory (NS); PR24 WISER Response*

Statutory and Policy Framework	Driver	Legal obligation[8]	Regulatory Deadline	Planned delivery	AMP8 RAG
Natural Environment and Rural Communities Act 2006	NERC_IMP	S+	2030	2035	
Wildlife and Countryside Act 1981; Water Industry Act 1991; Biodiversity 2020	SSSI_IMP	S	2030	2035	
	SSSI_INV	S		2035	
Urban Waste Water Treatment (England and Wales) Regulations (UWWTR) 1994	U_IMP1	S	2026*	2035	
	U_IMP2	S	2030	2035	
	U_MON3	S	2026*	2035	
	U_MON4	S	2026*	2035	
	U_MON6	S	2030	2035	
Water Framework Regulations (WFD)	WFD_IMP_CHEM	S	2030	2035	
	WFD_IMP_MOD	S+	2030	2035	
	WFD_IMP_PHYSHAB	S+	2030	2035	
	WFD_IMP_WRFlow	S+	2030	2035	
	WFD_IMP_WRHMWB	S+	2030	2035	
	WFD_IMP	S+	2030	2035	
	WFD_INV	S	2027	2035	
	WFD_INV_CHEM	S/S+	2027	2035	
	WFD_INV_MOD	S+	2027	2035	
	WFD_INV_MP	NS	2027	2035	
	WFD_INV_N-Tal	NS	2027	2035	
	WFD_INV_PHYSHAB	S	2027	2027	
	WFD_INV_WRFlow	S	2027	2027	
	WFD_INV_WRHMWB	S	2027	2027	
	WFD_ND	S	2030	2035	
	WFD_ND_CHEM3	S	2030	2035	
	WFD_ND_WRFlow	S	2030	2035	
	WFD_NDINV_WRFlow	S	2027	2027	
	WFD_NDLS_Chem1	S	2027	2035	
	WFD_NDLS_Chem2	S	2027	2035	
	WFDGW_ND	S+	2026	2035	
	WFDGW_INV	S	2027	2035	

3.36 Alongside our storm overflow reduction programme, phosphorus reduction accounted for a large proportion of the WINEP submission (circa one-third). Despite very significant investment in phosphorus reduction over past AMPs yielding a high percentage of phosphorus reduction, the level of nutrients in our rivers typically remain above target levels, risking eutrophication and its associated ecological impacts. Common with most other river basins, excess phosphorus levels in the Thames River Basin District is the number one cause of environmental harm or risk. Wastewater is a very significant source of phosphorus in the environment, even when treated.

3.37 The need for continued investment in phosphorus reduction is very much still present, however we have made the difficult decision that large scale investment originally programmed for AMP8 will now be delivered in AMP9, with the aim of still meeting the Environment Act regulatory deadline of 2037 for the industry to achieve an 80% reduction in phosphorus discharged compared to 2020 levels.

3.38 As outlined in Section 2, our proposed AMP8 WINEP will focus on storm overflow, bathing waters and low flow alleviation.

Storm overflows

3.39 Five regulatory drivers have been developed to meet Environment Act 2021[9] requirements relating to reducing discharges from storm overflows and their impacts. They underpin improvement actions to be delivered up to 2050 as part of the UK Government's Storm Overflows Discharge Reduction Plan[10].

3.40 The storm overflow reduction drivers require action to reduce discharges and adverse impacts from storm overflows. They apply to all storm overflows including:

- Combined Sewer Overflows (CSOs) within a sewer network.
- Storm and emergency discharges at pumping stations.
- Inlet CSOs at sewage treatment works (STW).
- Storm tanks at STWs and in the sewer network.

3.41 Our position is that no discharge of untreated sewage is acceptable, and we wish to address the legacy of storm overflows as quickly as possible. We previously set ourselves an ambitious target to go above and beyond the minimum regulatory requirements set out in the storm overflow driver guidance. We publicly stated we would halve the duration of all our storm overflow discharges from a 2020 baseline by 2030, with an 80% reduction in the most sensitive locations.

3.42 Due to the constraints previously mentioned in this document we are no longer planning to accelerate delivery and have aligned our plan with statutory (indicative) targets of 38% of high priority assets and 14% of all assets addressed by 2030.

3.43 Our final DWMP was aligned with our proposed storm overflow improvement plan proposed in January 2023. We have subsequently concluded studies into many of the overflows and improved our plans, including site and solution selection. We now have a better plan with reduced uncertainty; however we note that this is now divergent from the final DWMP for AMP8. We anticipate further updates will be needed to our full long-term storm overflow plan as further investigations complete and new data is available. Future DWMPs will realign to our latest Storm Overflow Reduction Plan.

Bathing waters

3.44 Until 2022, there were no designated bathing waters in our operational area, that we discharge into (directly or indirectly) and were deemed as 'poor' bathing water

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[9] *Environment Act 2021 (legislation.gov.uk)*

[10] *https://www.gov.uk/government/publications/storm-overflows-discharge-reduction-plan*

quality. We have long operated a sewage pumping station at Churt upstream of the Frensham Pond bathing water in Surrey, however this asset is small and rarely releases any wastewater. Frensham Pond has long been at 'excellent' status for bathing.

3.45 In 2022, a section of the Wolvercote Mill Stream in Oxford was newly designated as a bathing water. Being a bifurcation of the main River Thames, there are a very large number of wastewater discharge locations upstream of this location, with Cassington STW within 5 km.

3.46 Research (we supported) has found that the pathogen levels in the Wolvercote Mill Stream do not always support a sufficient bathing water quality and this has subsequently been confirmed by official bathing water sampling and analysis, with the water being given a 'poor' bathing water status in 2022.

3.47 Further investigations are being carried out and are being planned to better understand the sources of the pathogens, although modelling indicates that both treated wastewater effluent and storm overflows are major sources of pathogens.

3.48 It is a legal requirement under the Bathing Water Regulations 2013 to ensure that bathing waters meet 'sufficient' status as a minimum. This is reflected in driver BW_IMP1.

Addressing low river flows

3.49 The UK Government's 25-Year Environment Plan sets out their long-term approach and goals for protecting and enhancing our natural landscapes and habitats[11].

3.50 The National Framework for Water Resources (March 2020), explores how much water England needs over the long-term, and how to ensure resilient water supplies, including by addressing unsustainable abstraction.

3.51 Both the plan and framework include the requirement for regional groups - our region is Water Resources South East (WRSE) - to work together to develop holistic, regional plans. These plans include a long-term environmental destination for water resources in the region and the pathway required to achieve this, including short, medium and long-term actions. Our WRMP reflects and supports the achievement of this environmental destination.

3.52 We haven't fully determined the regional environmental destination / pathway yet, but short-term abstraction changes have been requested by the Environment Agency and form part of our WINEP. Our plan follows the high scenario for environmental ambition, as required in the guidance for the Regional Plan. We must implement these actions to support the WRMP and our commitment to reaching the environmental destination.

3.53 One of our key priorities is making sure that we stop making abstractions where they cause environmental harm to vulnerable waterbodies. This includes abstraction licence reductions where this is very likely to result in the improvement of the water body status, or where existing licence volumes pose a risk of causing deterioration

[11] *A Green Future: Our 25 Year Plan to Improve the Environment, gov.uk*

(under Water Framework Regulations (WFD)). Investment ensures customer water supplies continue to be resilient when licence reductions are made.

3.54 Low-flow investigations to determine potential future licence reduction requirements are also necessary, supporting the WRSE studies and helping us determine our pathway to a regional environmental destination.

Collaboration with regulators and stakeholders

3.55 The PR24 WINEP guidance has a fundamental principle that water companies should take a collaborative approach with regulators and other stakeholders to gain a shared understanding of the environmental risks and issues to be addressed through WINEP. Where appropriate, options should be co-designed to maximise wider environmental outcomes.

3.56 The steps we have taken to meet this requirement are as follows:

- Regular meetings with the Environment Agency and Natural England to discuss the PR24 WINEP development, in dedicated sessions for water quality and water resources.
- Bespoke meetings with the Environment Agency Technical Leads to discuss specific PR24 WINEP guidance, how this should be interpreted in defining the need and building the business plan, looking for their consent / comments of the options to be submitted.
- Proactive engagement with other water companies where our assets interact with their activities.
- Proactive engagement with other water companies to discuss and agree co-funding opportunities. The proportion of co-funding is currently under discussion; however, the aim is to be at least equal to the proportion of benefits each partner expects to receive.
- Ability to use our Smarter Water Catchment existing stakeholder engagement with the Evenlode catchment to trial co-creation, by collaboratively identify risks and issues and co-design of options. Workshops were held on a bi-weekly basis.
- Development of a GIS platform to map all co-creation and co-funding opportunities identified during the DWMP (Drainage and Wastewater Management Plan) and WRSE workshops.

Limiting the scale of the WINEP programme

3.57 The scale of this WINEP is significantly larger than any preceding WINEP programmes. To limit the financial impact of this programme and to allow for money to be directly put towards areas our customers feel most strongly about, such as storm overflows, we have not sought to go beyond the regulatory minimum expectations, in most cases. We have also challenged actions proposed to the Environment Agency where we believe they offer poor value for money. This includes a saving of £100m for a water resource scheme which only benefitted a short stretch of river.

3.58 Additionally, we have challenged policies where we believe they are over-protective and are not in customers' interests. For example, we have challenged the ban on

the use of single stretch targets for STW permits when fulfilling the requirements of the Environment Act for nutrient reduction. This approach drives an additional £200m of schemes but would not achieve any further environmental improvement and would purely mitigate against a remote possibility that company-wide load reductions could not be achieved. The EA have agreed to review performance as the Environment Act programme is delivered to determine if these additional sites will be required.

3.59 One of the largest investment areas in the full plan is to meet chemical concentration targets for cypermethrin and nonylphenol. We have worked with the EA to identify innovative options to limit costs while still adequately addressing the environmental risk. In combination with economic appraisal outcomes, this almost halved the size of the programme.

3.60 We have also reduced the full scale of the full WINEP by working with the EA to identify actions that are in-line with the steer from the Secretary of State that enables non-statutory investment to be deferred to AMP9.

Management control

3.61 Actions included in the full WINEP fulfil environmental legislative requirements and relevant expectations set out in WISER - the principal element of management control is during the development of the programme of measures that respond to these legislative requirements.

3.62 We developed the programme, with input from other stakeholders, such as the Environment Agency, Natural England and other companies, as well as considering our customers' preferences. This sought to identify the best value programme that would fulfil environmental requirements and the WINEP guidance documents.

3.63 We commissioned external assurance from Jacobs to review how well we fulfilled WINEP guidance expectations for developing options. This scored every area as either 'No issues identified' or 'No material issues identified', confirming we had followed the guidance correctly.

3.64 There are four investment areas within the WINEP where we have more than one AMP period to deliver improvements, namely:

- Storm overflows
- Environment Act nutrient reduction targets
- River quality monitoring
- Emergency Overflow monitoring

3.65 For these there is a small degree of flexibility in terms of pace of delivery, but with minimum regulatory expectations set out in the drivers' guidance. However, in some cases, even the minimum expectations will present multiple challenges in their delivery stage.

3.66 We have also assessed multiple options for much of the WINEP (by value). We have identified a 'least cost' and 'best value' solution in these cases, considering whole-life net-present value. Where possible, catchment and nature-based solutions have been developed for consideration.

3.67 In some areas where there is uncertainty regarding technology effectiveness for unprecedented permit limits, we have proposed to undertake investigations in advance of solution implementation. This approach may limit expenditure requirements. While this is no longer in our AMP8 plan, this approach will be adopted in AMP9 if uncertainty has not been resolved.

3.68 We also have ambitions to expand our current Smarter Water Catchments programme approach to half of all catchments in our area under our Rethinking Rivers proposal. While this is also delayed, this project plans to maximise opportunities for co-development, co-funding and co-delivery of environmental outcomes with stakeholders. This is forecast to yield financial savings and/or improved benefits compared to conventional solutions alone.

3.69 After we submitted our proposals, the EA assessed our programme to determine if the regulatory requirements will be adequately met. Where concerns or challenges arose, we worked with the EA to find resolution, including the creation of new actions and modifications to proposed actions.

3.70 In parallel, we raised our concern about the scale of the programme's size with our regulators. In combination with other companies with similar concerns, Defra considered these concerns and responded with guidance on where phasing of investment could be considered.

3.71 The outcome was the final WINEP that the EA expect us to put into our PR24 Business Plan. From this point there is limited management control relating to defining the required outputs for delivery, with only exceptional changes typically accepted where new information has come to light.

3.72 When in the delivery phase, delivery of deadlines is under management control. This requires strong programme management. Even with our heavily constrained programme we will need to work effectively with the supply chain to enable sufficient resources, equipment and operational supplies to be available to deliver these actions.

3.73 Where unmitigable delivery issues arise, acceleration of delivery of alternative and equivalent schemes can ensure outcomes can still be met.

Our proposed enhancement funding does not overlap with base or previously funded projects

3.74 In almost all circumstances, the requirements for WINEP are new obligations that we have not been required to deliver in the past and are therefore not reflected in Botex allowances. The exception to this is storm overflows, where the programme to address storm overflows is a combination of base expenditure / capital maintenance of existing assets, new enhancements under the WINEP, and an enhanced level of service relating to addressing infiltration in sewers.

3.75 We recognise that enhancement investment, for example via sealing the network, will also remedy structural defects (Grade 4 and 5 structural defects) that should be rehabilitated via base expenditure. To avoid double counting, we will undertake Industry standard inspections (CCTV) to identify any pre-existing structural defects

and will fund the cost of remedying these defects through Botex and not as part of this Enhancement Case.

3.76 There is no duplication with activities already funded at previous price reviews.

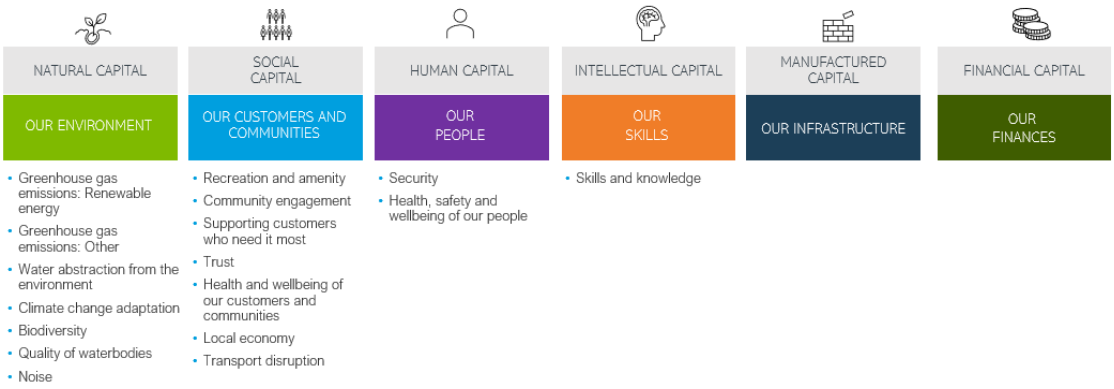
Delivering public value

3.77 Delivering public value is about maximising the positive impact we have on customers, colleagues, communities, and the environment, as we provide water and wastewater services, and through our wider impact. It's about being a force for good and making the biggest positive difference.

3.78 We're starting to implement a new approach to guide and measure both the public value we create and the delivery of our purpose. The public value framework helps us identify, evaluate and deliver public value which balances cost and value to customers, community and the environment over the long-term.

3.79 Our framework uses a capitals approach to understand how our success is directly or indirectly underpinned by natural, social, human and intellectual capital, as well as the traditional consideration of manufactured and financial capital. The capitals, along with Thames Water's customer-facing language for them and what is considered under each capital is set out in Figure 3-3.

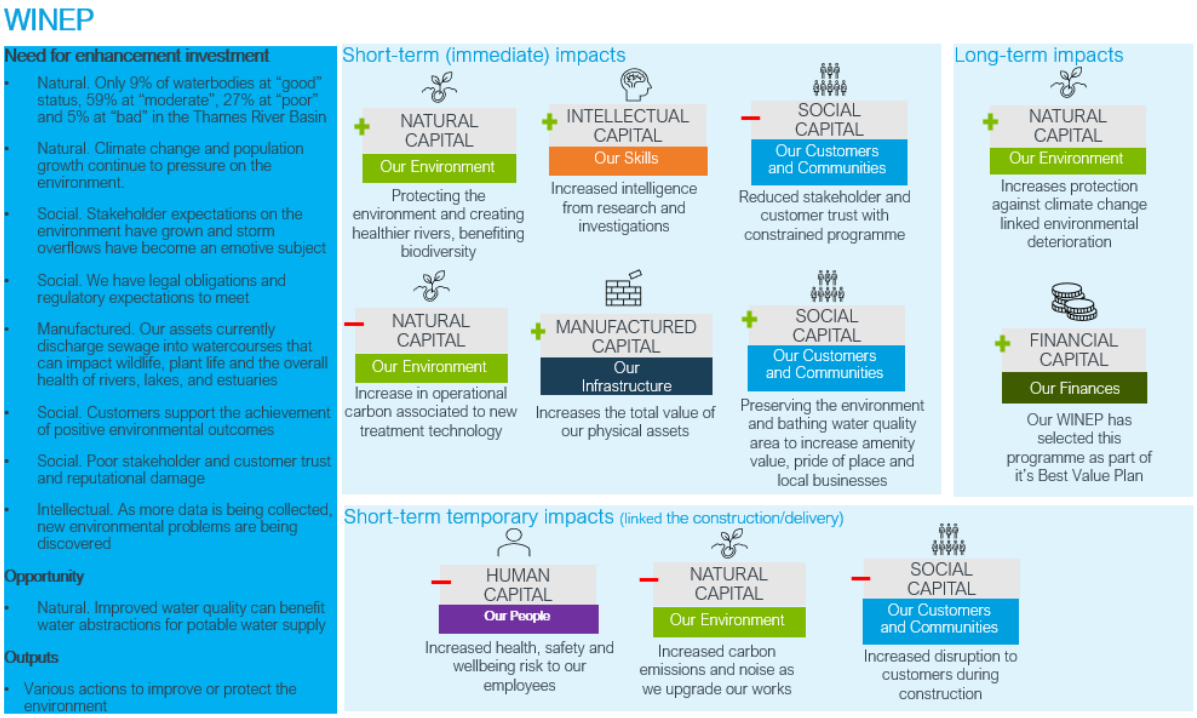
Figure 3-3 - The capitals



3.80 We applied the public value framework here to fully understand how the investment leads to impact on the six capitals.

3.81 This investment grows value in social, natural, intellectual, and manufactured capital. We discovered a range of short-term temporary, short-term immediate and long-term impacts. The theory of change infographic in Figure 3-4 shows how this investment leads to impact on the six capitals and delivers public value.

Figure 3-4 - The impacts on the six capitals associated with the WINEP Enhancement Case



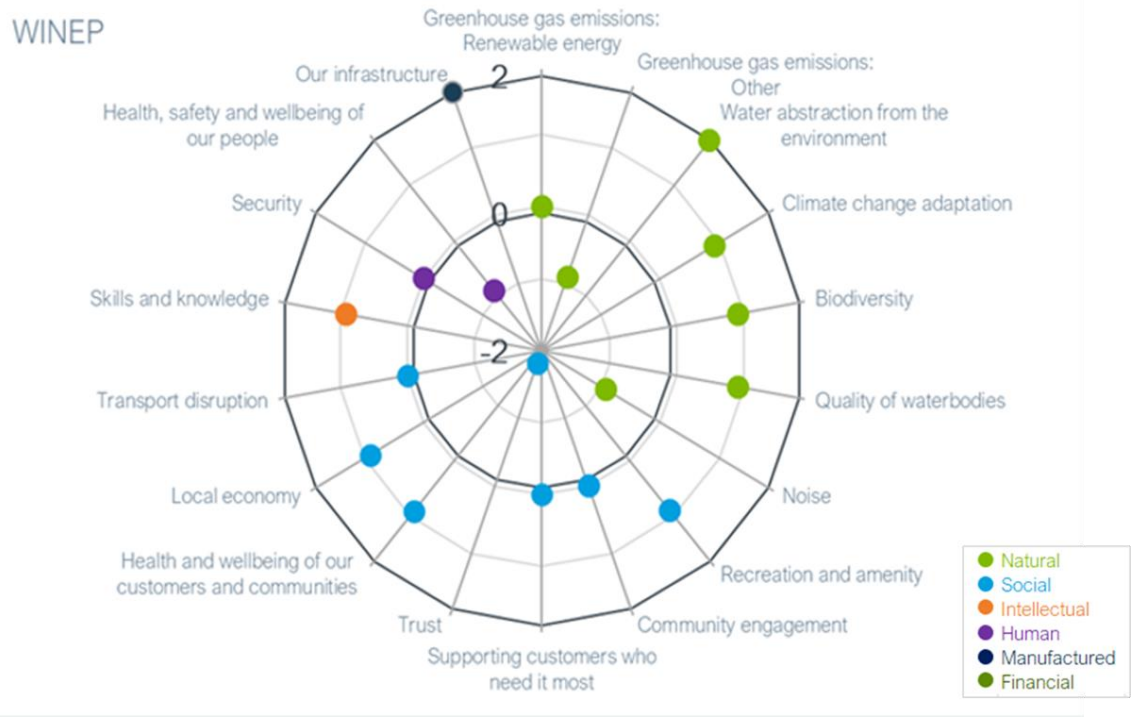
3.82 Our public value framework uses a semi-quantitative, multi-criteria analysis approach, where values are weighted using customer preferences12. There are nineteen measures in our public value framework which are used to assess an option.

3.83 The public value framework assessment includes a wide range of measures such as biodiversity, waterbody quality, recreation, amenity and local economies, while the financial capital measure continues to be captured in other parts of our investment planning processes. The framework considers both short and long-term impacts, looking approximately 30 years ahead.

3.84 The degree of impact between the capitals varied. These are outlined in Figure 3-5.

[12] *Public value research, May 2022* Verve

Figure 3-5 - The results of the public value scoring for WINEP



3.85 The investment strongly benefits natural capital in one or more measures. Improvement and protection of the environment is our key driver, and our actions act to protect and improve the overall health of rivers, lakes and estuaries and biodiversity.

3.86 Habitat health will improve more broadly with the wider WINEP programme. Actions improve environmental resistance to climatic variations and support operational climate change adaption by, for example, generating headroom. While actions to reduce licence abstraction in sensitive environments increase the quantity of water to rivers, helping us secure water resources for the future and protect our rivers.

3.87 Embodied carbon is expected to increase with the new technology installation, representing a dis-benefit to natural capital.

3.88 There is a strong benefit to manufactured capital. In addition to increasing the value of our assets, the programme will also create digital systems to store and analyse data collected. The investment is expected to improve asset efficiency and resilience while providing additional headroom, which avoids stressing our assets as frequently.

3.89 The investment benefits social capital in one or more measures. We have overwhelming customer and stakeholder support to protect our rivers and prevent pollution to watercourses. Improvements to our environment influences amenity, recreation, and the economy. The investment acts protect the amenity value in our local communities, where people's pride of place can be intrinsically linked to customer health and wellbeing. Amenity value will also be generated through bathing water quality preservation.

3.90 Protecting the environment by reducing discharges and pollutions protects local business' economic productivity, by causing less necessary remediation efforts.

Decreased disruption to recreation and economic activities will improve community wellbeing.

3.91 Delivery of our services introduces a short-term dis-benefit against transport disruption, as we expect increased road loading with construction deliveries. A decrease in customer and stakeholder trust is also expected in the short-term due to the inability to deliver the complete regulatory WINEP programme and meet our customer expectations in full.

3.92 There is a benefit to intellectual capital. Research, investigations and monitoring will provide insight and intelligence to better understand impact to improve both the environment and the delivery of our service.

3.93 The WINEP programme increases spend in storm overflows to a scale which has not been delivered previously, while we recognise that other areas of the WINEP programme have been phased to AMP9 and beyond. Accordingly, we expect advances to our engineering, operation and asset management skill sets.

3.94 There is a somewhat negative impact to human capital as we expect the inability to deliver the complete regulatory WINEP programme to negatively impact employee wellbeing.

3.95 An overview on financial capital is included in Section 6 – Cost efficiency.

3.96 We will continue to seek public value opportunities through detailed design and delivery, for example through stakeholder engagement.

4. Our customers and stakeholders support the need for the WINEP

4.1 Where choices are available and preferences can be considered regarding environmental enhancement outcomes, we have researched our customer, community and stakeholder views. We have also researched their views on types of solution to be employed, particularly where the best-value option is not the least cost option (see Section 5).

4.2 Our engagement approach combined an ongoing, iterative triangulation of insights over the course AMP7, as well as targeted research on specific Enhancement Cases for our PR24 plan. A full list of sources used is available in our What Customers, Communities and Stakeholders Want (WCCSW) document[13], which is our single unifying customer insight framework, underpinned by detailed insight.

4.3 Across our package of proposed enhancements, customers were generally supportive of the potential enhancements to service in 2025-2030, with greater support given to initiatives impacting core service delivery such as reducing sewage flooding or improving water treatment.

4.4 'Reducing Storm Overflow Discharges', 'Improving River Health', and 'Bathing Waters' were tested across several sources including Vision 2050 Customer Research in May 2022[14], PR24 Enhancement Case deep dives in February 2022[15], PR24 Enhancement Options Package Research in September 2022[16], Enhancement Case Deep Dive research in May 2023[17], and Acceptability and Affordability research in May 2023[18].

4.5 This research found that our customers continue to support the achievement of positive environmental outcomes, with investment to address storm overflows a high priority. Strong preferences were shown to address overflows quicker than Defra's Storm Overflow Reduction Plan.

4.6 Customers and stakeholders want us to protect and improve the quality of rivers and the environment. They want to see clean, well flowing rivers and want us to ensure healthy rivers that support wildlife and a wide variety of activities such as fishing and swimming.

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[13] *What Customers, Communities and Stakeholders Want v18. March 2023*

[14] *SP12 Vision 2050 Research. May 2022*

[15] *PR24-13 PR24 Enhancement case Deep Dive Summary*

[16] *PR24-12 PR24 Options Research. September 2022*

[17] *PR24-15 Enhancement Case Deep Dive research. May 2023*

[18] *PR24-16 Acceptability and Affordability Testing. May 2023*

Customers and stakeholders consider reducing storm overflow discharges as a priority

Insights: Reducing storm overflow discharges	
Support the need	• All customer groups are concerned about raw sewage entering rivers as a result of storm overflows, due to the potential harm to health from low quality water. Many are also concerned about harm to wildlife and the environment. (PR24-15) • Customer concern around this issue increases further when informed about future risks to the system, such as climate change and population growth – many are aware of negative media coverage affecting Thames Water. (PR24-15) • Reducing pollution of rivers feels important to the vast majority of customers, negative responses largely driven by media coverage. They view this practice as unacceptable and that it needs to be stopped, therefore, more ambition is desired from Thames Water on this. (PR24-16) • Customers perceive Thames Water's performance in this area poor but not as bad as other water companies (PR24-16) • There is a sense that quality of rivers is a shared responsibility – not just Thames Water issue and shouldn't just fall to Thames Water's customers. (PR24-16) • From PR24 Enhancement Case deep dive research on reducing storm overflow discharges, customers told us they felt discharges occur too frequently and want faster progress on their reduction. However, when customers are educated on the relatively low environmental damage caused by storm overflow discharges, and the occasional necessity of allowing them in order to protect homes and property, customers become much more accepting. (PR24-6) • From the PR24 Options research, customers informed that while less personally damaging compared with sewage flooding, there is general agreement that Thames Water should be reducing pollution in rivers sooner, rather than later. For some customers, this comes from seeing news stories about sewage being 'dumped' in rivers, while for others, it is about a wider negative impact on wildlife and the surrounding environment. (PR24-12) • The majority of customers recall recent controversies and media coverage surrounding storm overflow discharges into rivers and water quality. Although they generally have a low understanding of the issue, they are angry it continues to take place. (SP10) • Customers do not like that in some circumstances storm overflow discharges are legal. (PR24-6) • The majority of customers see preventing storm overflow discharges into rivers as an important issue due to potential health risks. Those who live near rivers and with personal experiences feel particularly frustrated with this area. However, customers recognise other issues as more of a priority, if not directly impacted. (SP12)

Customers and stakeholders consider improving river health as a priority

Insights: Improving River Health	
Support the need	• All different customer groups are surprised and concerned about river health in the Thames Water basin. The prevalent concern across all different customer groups is that if river health is not improved this could damage public health in the form of lower quality drinking water. There is also a concern that wildlife may be harmed. (PR24-15) • This is an emotive topic that conjures imagery of polluted water, and so all different customer groups' stance is generally: 'fix this as quickly as possible' (PR24-15) • Most customers use and enjoy their local waterways and are emotionally invested in their environmental wellbeing. Even those customers that do not regularly visit their local waterways care about their environmental condition and reducing pollution. (PR24-6) • While learning that no UK river is officially safe to swim in is shocking and concerning, this is felt to be of lower importance in comparison to others where customers felt there were health risks (i.e., sewage flooding) and severe environmental risks (i.e., river pollution). However, a few are passionate about the need to improve river health further and recognise the importance of clean rivers in terms of the entire water cycle. Some feel this improvement would be an indirect consequence of other improvements, such as reducing storm overflow discharges, and therefore place this lower in importance than reducing storm overflow discharges. (PR24-12) • Customers have a very strong preference for water companies to go beyond minimum requirements for protecting the environment. (PR24-2, CX24) • In unprompted customer feedback, a number of customers mentioned that we should do more to ensure waterways are clean and to ensure the wellbeing of wildlife. Some customers said they wanted to see cleaner waterways and for us to work in the least environmentally damaging way possible. (SP9) • Some customers want us to do more to improve visual amenity (i.e., the views and surroundings that create the backdrop to an area) at waterways at its sites. (PR24-2, SP9, SP11) • NGOs particularly respect and admire the continued commitment Thames Water has to the water courses and local natural environment of which it is the custodian. (S14)

Customers and stakeholders support improving the number and quality of bathing waters

Insights: Bathing Waters	
Support the need	• Many customers are aware that Thames Water has had some form of negative press coverage on the practice of sewer spills, which they see as the cause of the poor water quality in Wolvercote. They believe Thames Water has not invested enough in the wastewater network and are disappointed Wolvercote is in poor condition (PR24-15) • Some are concerned about the impacts on wildlife and the environment if bathing waters are not maintained and/or improved (PR24-15) • Most customers use and enjoy their local waterways and are emotionally invested in their environmental wellbeing. Even those customers that do not regularly visit their local waterways care about their environmental condition and reducing pollution. (PR24-6) • While learning that no UK river is officially safe to swim in is shocking and concerning, this is felt to be of lower importance in comparison to others where customers felt there were health risks (i.e., sewage flooding) and severe environmental risks (i.e., river pollution). However, a few are passionate about the need to improve river health further and recognise the importance of clean rivers in terms of the entire water cycle. Some feel this improvement would be an indirect consequence of other improvements, such as reducing storm overflow discharges, and therefore place this lower in importance than reducing storm overflow discharges. (PR24-12) • Customers have a very strong preference for water companies to go beyond minimum requirements for protecting the environment. (PR24-2, CX24) • Some customers want us to do more to improve visual amenity (i.e., the views and surroundings that create the backdrop to an area) at waterways at its sites. (PR24-2, SP9, SP11) • NGOs particularly respect and admire the continued commitment Thames Water has to the water courses and local natural environment of which it is the custodian. (S14) • Whilst most customers view rivers and streams as safe for recreation nearby or on the water (though less so for activities which involve entering the water) the majority (65%) want planned improvements to ensure that the river is a healthy habitat for wildlife. 10% think that ensuring that rivers are safe to swim in is most important. (R29) • Many customers would like to see a designated stretch of the River Thames suitable for bathing; while many do not swim in rivers themselves, some are still supportive of this. The majority support the creation of one designated stretch of bathing water

	during 2025-2030. However, bathing waters are a lower priority for customers than other infrastructure upgrades including replacing aging mains and pipes and upgrading sewers. River swimming is seen by some customers as a luxury compared to delivery of core services. (PR24-5). • Most customers support the establishment of a dedicated section of the River Thames for swimming. (PR24-5) • Some customers highlight the physical and mental health benefits of swimming and the fact that it simply isn't good for the water to be unclean. (PR24-5)

Customers and stakeholders support reducing abstraction from vulnerable sources

- We have to strike the right balance between costs, environmental impacts, and providing a reliable water supply for our customers, and this requires their input. We have undertaken deep-dive customer research in order to inform the development of our proposals for making licence reductions at our existing sources, due to the high cost of making these interventions and the long-term 'Environmental Destination' scenarios that we are considering
- Customers are supportive of the actions that we have taken to date, with our abstraction from some of our most sensitive chalk stream catchments having fallen by 80% since 1997. Customers acknowledge the need to abstract water in order to provide water supplies, but there is support for proposals to reduce abstraction in vulnerable catchments
- Stakeholders also encourage and support measures (e.g., reservoirs, reducing consumption etc.) to reduce abstraction of water from groundwater and directly from rivers, particularly those supporting rare or sensitive habitats and ecosystems, despite increasing demand caused by population growth and climate change
- 51% of our customers agree with our aim to reduce abstraction on all of the areas proposed during 2025-2030 and they would accept a £5 increase in yearly bills in order to enable this
- When thinking about the longer term, customers want us to have a high degree of certainty regarding the environmental benefits of reducing abstraction before investing in alternative abstraction resources, with 41% of customers saying that we should be 'completely certain' that there will be an environmental benefit before we spend money on solutions to enable licence reductions, and 27% saying that we should be 'quite certain'. Only 12% of our customers supported continuing with abstraction reduction where there is no proven environmental benefit

Insights: Sustainable abstraction	
Support the need	• Customers do not support taking more water from the rivers and groundwater in normal circumstances (PR24-1) and they want us to limit the amount of water taken from vulnerable rivers and streams, allowing groundwater to be replenished when it rains. Protecting water sources is seen as key to future sustainability and efficiency. (SP15). • Customers broadly support Thames Water's proposals to improve the environmental impact of water abstraction beyond current statutory requirements, however some customers are concerned about costs (PR24-7). When customers are asked about balancing the many challenges that the company faces, support for investing to reduce abstraction in vulnerable catchments appears less of a priority compared to other measures, with abstraction reduction to deliver environmental benefit ranked seventh out of eight priorities. The six priorities that ranked more highly were replacing mains that could be dangerous if they burst, replacing large sections of aging pipework in London to reduce leakage (rather than fixing individual leaks), increasing the capacity of our sewer network to prevent sewer overflows, reducing sewer overflows into rivers, eliminating the risk of lead in our water supplies, and achieving Net Zero carbon emissions in our operations. • The need for a high degree of certainty and the acknowledgement of the need to prioritise investment across many different areas highlights the need for us to conduct low-flow investigations to be sure of ecological benefit associated with abstraction reductions before making significant investment. • Stakeholders from Local Government and community groups want Thames Water to go further and 'remove' rather than 'reduce' the strain on rivers and want Thames Water to work collaboratively where it helps to achieve this. (S18, S20) • Stakeholders also encourage and support measures (e.g., reservoirs, reducing consumption etc.) to reduce abstraction of water from rivers, particularly those supporting rare or sensitive habitats and ecosystems, despite increasing demand caused by population growth and climate change. (CX24) • When customers are informed about abstraction, they support the work that Thames Water has already done to reduce abstraction from vulnerable waterways. They also appreciate the difficulty and cost of further reducing abstraction from vulnerable waterways. Customers want us to have a high degree of certainty regarding the environmental benefits of reducing abstraction before investing in alternative abstraction resources. (PR24-7) • When compared with other areas for improvement, reducing river abstraction is seen as a lower priority versus other areas. (PR24-7)

5. Best option for customers

Options considered

5.1 The scope of the full WINEP for AMP8 is broad, consisting of 920 actions and 569 investigations which require a wide range of interventions. Due to constraints set out earlier in this document, for AMP8 we propose to deliver 114 actions and 477 investigations, prioritising actions to improve storm overflows, the designated bathing water in Oxford and actions supporting our Water Resources Management Plan (WRMP).

5.2 To ensure that our actions represent best options for customers, we have:

- Considered a variety of options (wherever applicable), including conventional capital investments, operational expenditure, catchment and nature-based solutions
- Considered individual interventions, or combinations of interventions together to fulfil the target objective
- Used catchment optimiser tools to help find the best combination of actions required to fulfil objectives
- Considered opportunities for co-delivery with third parties
- Considered innovative approaches – including innovative permitting and innovative technologies
- Followed the Environment Agency guidance, tools and worked collaboratively to fully understand the Environmental Risks and Issues to be addressed
- Considered opportunities for using the Environment Agency's 'three-tier approach'.
- Looked for opportunities to capture synergies and achieve multiple environmental outcomes with a single action for a reduced overall cost
- Assessed each option and approach for best-value, considering whole-life costs and benefits, including indirect benefits such as wider environmental outcomes
- Tested our solutions for long-term suitability where appropriate
- Proposed a gated process for uncertain requirements under the chemicals programme

Assessment of options

A framework for optioneering

5.3 The optioneering stage of the WINEP programme followed a structured approach, in line with EA guidance[19]. Once risks and goals were confirmed, the progression of option development and assessment (ODA) commenced, starting with the broadest possible range and ending with a feasible set of options, at a conceptual design level of development (see Figure 5-1).

[19] *Environment Agency Water industry national environment programme (WINEP) - Options development guidance, July 2022*

5.4 At each stage, options were screened to remove those not considered feasible for inclusion in the final set of options. The approach to screening options focused effort on defining options, screening out at each stage those options assessed as disproportionately costly, technically infeasible or having significant and unacceptable environmental impacts.

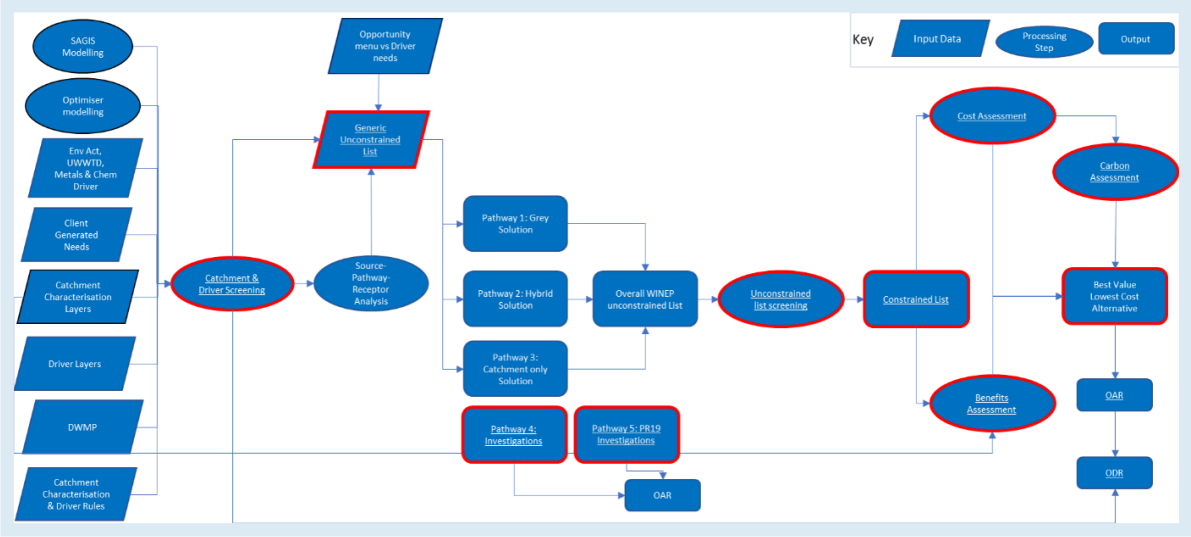
5.5 The ODA stage also determines which potential options offers 'best value', considering not only costs and forecast primary benefits targeted, but also wider environmental outcomes such as catchment resilience, net zero, biodiversity and amenity.

Figure 5-1 - WINEP Options Development

Application of the WINEP Methodology

5.6 The WINEP methodology is mapped out in Figure 5-2:

Figure 5-2 - WINEP Methodology



5.7 Brief summary of the WINEP methodology process:

WINEP methodology step 1: Confirm environmental risks and issues

Determine risks, issues to be addressed and the scale of the challenge.

5.8 Environmental risks and issues to be addressed are collated from several sources. In some instances, previous investigations (i.e., investigations carried out in AMP7) inform the need for action. In other instances, stakeholders (mainly, the Environment Agency and Natural England) provided evidences of environmental risks and issues which would require our interventions. Finally, a screening process of the catchments and waterbodies is carried out to understand shortfalls in environment quality we are required to address.

5.9 Catchments are screened by bringing together evidence to understand which set of drivers are applicable. For example, if there is an Environment Act 0.25mg/l phosphorus limit requirement, only grey solutions (Pathway 1 in Figure 5-2 above) are applicable; however if more lax permits are acceptable in a catchment, a broader range of options are applicable (Pathways 1, 2 and 3 in Figure 5-2 above). Where evidence is insufficient (e.g., eutrophication is not strongly evidenced) then an investigation can be proposed (Pathway 4 in Figure 5-2 above).

5.10 The screening process uses software, such as ArcGIS and FME, to efficiently generate outputs at the spatial level, considering multiple variables and rule sets. The SIMCAT-SAGIS modelling and the EA's catchment optimiser are also used.

WINEP methodology step 2: Develop constrained options list (long list > unconstrained > constrained)

Define a broad range of potential options, which could address identified risks and goals. Apply a series of assessments to the long list of options, at each stage, screening out those that would perform poorly in addressing the risk, e.g., unresilient against future uncertainties, is technically unfeasible under site-specific circumstances, not cost effective, etc.

5.11 Firstly, identify and develop a long list of wide ranging, generic, unconstrained options that could potentially address identified risks and goals. Combine industry derived lists with knowledge of assets, catchments and feedback from stakeholders.

5.12 The list is used to populate options for different drivers / driver groups (e.g., WFD_IMP P and WFD_ND P), with options mapped to pathways (grey / hybrid, catchment, permit changes, etc – Figure 5-2).

5.13 The unconstrained list is then assessed against WINEP requirements (primary criteria), consisting of contribution to wider environmental outcomes, technical feasibility, ability to meet obligations, and deliverability), as shown in Figure 5-2Figure 5-3. Cost has also been added as a primary criterion.

Figure 5-3 - Scoring criteria metrics

5.14 The primary criteria are comprised of a series of secondary, supporting criteria. These are scored and then averaged to give the primary criteria score, which are all added together, to give an overall score for the option. Weightings and automatic failure can be applied, for critical elements.

5.15 These processes identify which unconstrained options are taken forward for further development through constrained options assessment.

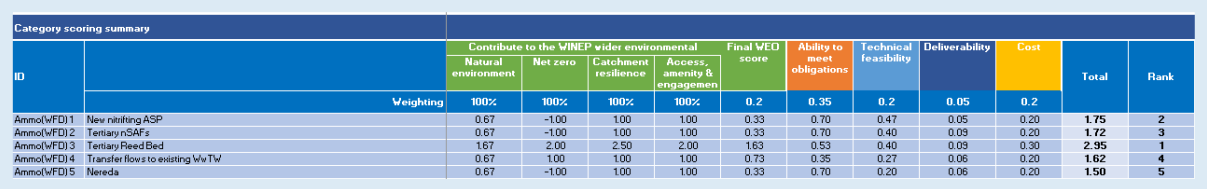
5.16 To develop a constrained list of options, the unconstrained shortlist is re-evaluated against site-specific criteria, such as the existing technology profile and population equivalent (PE). Decision trees and matrices are used for specific drivers.

WINEP methodology step 3: Develop feasible options list

Feasible options are those taken forward, following more detailed assessment of feasibility and risk; engineering complexity and cost; performance; operational impact; and environmental impact. Engage customers and stakeholders to gain input on risk and preferences on a screened list of options.

5.17 The list of constrained options are re-assessed against the scoring criteria in Figure 5-3, which is then used to feed the qualitative assessments of the benefits assessment stage (Figure 5-4).

Figure 5-4 - Example output from scored constrained list



Category scoring summary												
ID		Contribute to the WINEP wider environmental				Final WEO score	Ability to meet obligations	Technical feasibility	Deliverability	Cost	Total	Rank
		Natural environment	Net zero	Catchment resilience	Access, amenity & engagemen							
	Weighting	100%	100%	100%	100%	0.2	0.35	0.2	0.05	0.2		
Ammo(WFD)1	New nitrifting ASP	0.67	-1.00	1.00	1.00	0.33	0.70	0.47	0.05	0.20	1.75	2
Ammo(WFD)2	Tertiary nSAFs	0.67	-1.00	1.00	1.00	0.33	0.70	0.40	0.09	0.20	1.72	3
Ammo(WFD)3	Tertiary Reed Bed	1.67	2.00	2.50	2.00	1.63	0.53	0.40	0.09	0.30	2.95	1
Ammo(WFD)4	Transfer flows to existing Ww TW	0.67	1.00	1.00	1.00	0.73	0.35	0.27	0.06	0.20	1.62	4
Ammo(WFD)5	Nereda	0.67	-1.00	1.00	1.00	0.33	0.70	0.20	0.06	0.20	1.50	5

5.18 Constrained options are subject to cost and benefits assessment, to determine the preferred / lowest cost solutions and alternatives. A capital and operational carbon assessment is also conducted; however it is not included in the assessment criteria required to inform options assessment by the Environment Agency guidance.

Benefits Assessment:

5.19 The benefits assessment provides a high-level indication of the likely benefit / impact an option may have on the defined WINEP wider environmental outcomes (WEOs) relative to the baseline situation. The level of detail of the benefits assessment and the outputs are dependent on the scale of the assessment, as well as the level of detail and quantity of data available relating to each option. Whilst the Environment Agency provided the metrics to carry out the assessment of the benefits, we developed a benefit assessment tool, which supports a high-level benefits assessment but can incorporate and use greater detail where available and relevant, (see WINEP Options Development Guidance[20], Section 7.3.1, for more detail on the WEO metrics). The use of a single tool allowed for standardisation and consistency of assessment across the development of the whole WINEP programme.

Cost assessment:

5.20 The Environment Agency guidance requires the assessment of whole life costs over 30 years of life of the assets to identify the best value options in comparison to the benefits provided. We applied composite cost models are used to expeditiously cost the scope of each constrained option considering capex and opex over a 30-year period.

Carbon assessment:

5.21 Carbon is included in the WEO metric as the contribution towards carbon sequestration or reduced contribution toward climate change. In addition to that assessment, our estimating methodology includes the assessment of capital and operational carbon for each constrained option by means of Thames Water's Carbon Assessment Tool. Whilst this assessment informs our optioneering process

[20] *WINEP Options Development Guidance, EA*

and defines our baseline for capital and operational carbon targets, it is not required for the assessment of options according to the Environment Agency guidance.

WINEP methodology step 4: Submission of preferred, best value option and least cost option

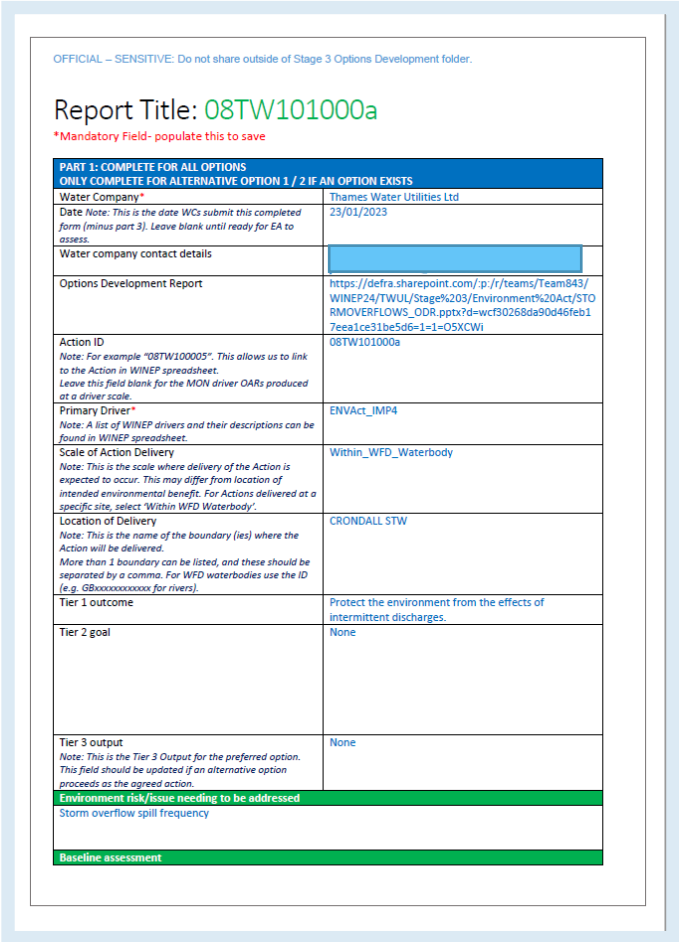
Further assessment to screen the feasible list of options to those defined as Best Value and Least Cost, and eventually, the preferred solutions.

5.22 In alignment with the WINEP guidance, the assessments of cost and wider benefits are used to produce a benefit:cost ratio.

5.23 Assessment outputs are gathered in an Options Assessment Report (OAR), for each WINEP action; each site / location and every driver having separate OARs generated.

5.24 For each class of actions, an Options Development Report (ODR) is also produced at the appropriate scale, evidencing the whole options development process, from environmental risks and issues identification to the listing of delivery risks to inform further stages of solutions engineering design. The Options Development Reports hold the key supporting information and methodology to supplement the OARs and are available in the Environment Agency PR24 WINEP development SharePoint area.

Figure 5-5 - Extract from an OAR submitted to the Environment Agency in January 2023



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Report Title: 08TW101000a

*Mandatory Field- populate this to save

PART 1: COMPLETE FOR ALL OPTIONS ONLY COMPLETE FOR ALTERNATIVE OPTION 1 / 2 IF AN OPTION EXISTS	
Water Company*	Thames Water Utilities Ltd
Date *Note: This is the date WCs submit this completed form (minus part 3). Leave blank until ready for EA to assess.*	23/01/2023
Water company contact details	
Options Development Report	https://defra.sharepoint.com/:p:/r/teams/Team843/WINEP24/TWUL/Stage%203/Environment%20Act/STORMOVERFLOWS_ODR.pptx?d=wcf30268da90d46feb17eea1ce31be5d6=1=1=O5XCWi
Action ID *Note: For example "08TW100005". This allows us to link to the Action in WINEP spreadsheet. Leave this field blank for the MON driver OARs produced at a driver scale.*	08TW101000a
Primary Driver* *Note: A list of WINEP drivers and their descriptions can be found in WINEP spreadsheet.*	ENVAct_IMP4
Scale of Action Delivery *Note: This is the scale where delivery of the Action is expected to occur. This may differ from location of intended environmental benefit. For Actions delivered at a specific site, select 'Within WFD Waterbody'.*	Within_WFD_Waterbody
Location of Delivery *Note: This is the name of the boundary (ies) where the Action will be delivered. More than 1 boundary can be listed, and these should be separated by a comma. For WFD waterbodies use the ID (e.g. GBxxxxxxxxxxx for rivers).*	CRONDALL STW
Tier 1 outcome	Protect the environment from the effects of intermittent discharges.
Tier 2 goal	None
Tier 3 output *Note: This is the Tier 3 Output for the preferred option. This field should be updated if an alternative option proceeds as the agreed action.*	None
Environment risk/issue needing to be addressed	
Storm overflow spill frequency	
Baseline assessment	

5.25 The OAR displays a comparison of the preferred, best value option, the least cost option (this may also be the preferred, best value option), and any alternative options.

5.26 Descriptions for each option are then given, along with justification behind the decisions made.

5.27 The options assessment:

- Confirms the WINEP options development guidance has been appropriately applied
- Confirms the preferred option allows statutory obligations, or non-statutory requirements, to be met
- Confirms the preferred option provides 'best value' resulting in a range of environmental benefits
- Confirms the option development decisions taken are transparent and supported by robust evidence and data
- Identifies where further challenge and scrutiny on an option is needed
- Confirms the WINEP agreed actions or identify where an option has been rejected
- Confirms the mandatory information in the WINEP spreadsheet is provided

5.28 Evidence of customer preference and support is provided. This includes showing that the additional cost associated with delivering wider environmental outcomes (i.e., best value), is supported by customers, for options which are not 'least cost'.

5.29 Evidence of collaboration opportunities is also flagged in the OAR, demonstrating where engagement with stakeholders and partners on evidence, risks and issues and options development has occurred, along with opportunities for co-design and co-delivery.

A best value framework

5.30 In most cases the outcome is simply coded as 'statutory'. In these cases, cost-benefit was not relevant for determining whether the outcome should proceed or not.

5.31 Independently to using the cost-benefit assessment to determine the justification for an outcome, each preferred option included in the programme is defined to be the 'best value' option, amongst the feasible options list.

5.32 Where the 'best value' option is not the least cost option, evidence of customer support for the additional spend are to be provided.

5.33 A best value plan is defined within the regulatory guidelines for water resources planning and is described as one that, 'considers factors alongside economic cost and seeks to achieve an outcome that increases the overall benefit to customers, the wider environment and society'[21].

5.34 To assess each solution for best value, we considered the primary and wider benefits of each option and compared it against the option's costs. Benefits were considered using the WEO metrics described above, following a natural capital framework. In most cases, least-cost solutions were also best value, however we prioritised best value options in favour of least cost options where there was evidence and specific customer support for this approach.

Preferred option (best value option)

5.35 Our preferred option is the option in the feasible option list that maximises the net present value of the whole life costs and benefits compared to other options. Wider benefits are included, aligned to the wider environmental outcomes, as per the WINEP guidance.

5.36 The overall 'best value' programme is derived by firstly selecting all the individual 'best value' actions, then further driving value by considering overlaps with other PR24 planned investment actions, either within the WINEP or for other reasons, such as growth.

5.37 To further drive value, we will programme schemes to deliver as early as the delivery capacity will allow, with preference given to the best value schemes where possible.

5.38 We developed a tool to assess benefits, including wider environmental benefits, assessed using a natural capital framework. These wider environmental outcomes are appraised and monetised where possible.

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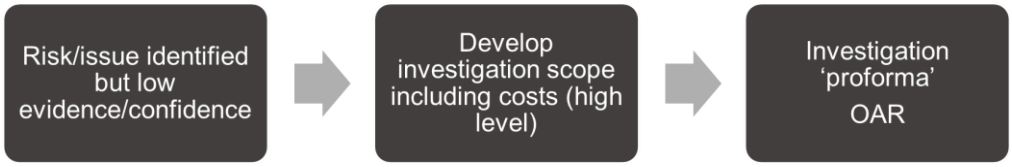
[21] *Water Resources Planning Guidelines*

Investigations:

5.39 Where an investigation driver is required, following the development of the need, from the risk issues, or where there is insufficient evidence for or confidence in moving to an improvement action, an investigation is required. As such, a separate pathway is necessary.

5.40 These drivers do not require a benefits assessment or ODR, but a detailed description of the need and costs is developed. A single OAR is produced for each action. Rather, alongside a detailed description of the need, costs need to be developed and this information submitted only via the OAR and WINEP spreadsheet.

Figure 5-6 - Pathway 4 method - Investigations



WINEP methodology step 5: Assessment of preferred option

5.41 OARs are submitted to and assessed by the EA and other regulators.

5.42 When option assessment is complete, the agreed action is moved by the EA to the agreed action WINEP spreadsheet.

Natural capital approach

5.43 We used a natural capital approach to inform our options development and benefits assessment.

5.44 A natural capital approach[20]:

- Focuses on sustainability by protecting and enhancing natural assets.
- Promotes management of ecosystems in a joined-up way.
- Delivers for people by focusing on what we value.

5.45 This approach enables the value of nature's benefits to be better accounted for in options assessment and selection for the WINEP. This supports the delivery of the WINEP wider environmental outcomes.

Catchment and nature-based solutions

5.46 We have sought to develop catchment and nature-based solutions (C&NBS) wherever these are compliant with guidance and offer a better value solution than a conventional solution, or where a conventional solution is insufficient to meet the target outcome alone.

5.47 We have included C&NBS as part of the unconstrained list of options for consideration and excluded from the constrained options list where guidance did not consider these solutions as eligible to address a certain driver. This is evidenced in our Options Development Reports and Options Assessment Reports.

5.48 We have also set up a technical governance process that challenges proposed solutions if it is felt that C&NBS have not be adequately considered – this has led to new green solutions being developed. This is evidenced in minutes of the meetings.

5.49 Typically, these solutions will also be considered against a more conventional 'grey' solution.

5.50 For each C&NBS being considered, we have assessed the forecast biodiversity gains, and recorded these in the benefits spreadsheet, then summarised this in the Options Assessment Reports.

5.51 Most frequently, nature-based solutions will be located within curtilages of our treatment assets. In this context they provide patch habitats and/or can aid with wildlife corridors, particularly as many of our assets are located in close proximity to watercourses.

5.52 We also seek to enhance ecosystem integrity through our specific biodiversity enhancement programme. This will feature:

- Site maintenance activities to improve or conserve biodiversity, including opportunities to manage assets in order to provide food and shelter for pollinators.
- Improving or conserving existing priority habitats, chalk streams and peatlands.
- Tree planting / creation of mini woodlands.
- Translocation of some of the water vole population from the Long Reach balancing pond and ditch to an appropriate place to allow for reintroduction.
- Review of the 17 sites we own with deep peaty soils.

5.53 Ecosystem integrity will be further supported by the planned water quality and low flow alleviation schemes, including the storm overflow reduction programme, which is prioritising assets partly on the river's sensitivity.

5.54 While we only put forward C&NBS where we have confidence with the predicted outcome being delivered, we do include a staged approach to delivery. This is supported by key gateways to secure certainty over delivery and if necessary, delivery will switch to a fallback reliable option.

5.55 Furthermore, some C&NBS will feature a degree of adaptive management, through the following routes:

- Revision of local drinking water quality protection schemes in line with new data and farmer activity/engagement
- Expansion of 'green solutions' to address storm overflows (e.g. SuDS) to respond to variations between modelled and recorded performance, or where growth/climate change forecasts are exceeded within the planning horizon

5.56 We are committed in embracing C&NBS. We are building our C&NBS work off a long history of effective drinking water protection measures, specific catchment trials undertaken in the Evenlode catchment and our Smarter Water Catchments programme, and a decade's worth of wider catchment management schemes for metaldehyde pollution mitigation, and many AMP7 mitigation schemes addressing nitrate and herbicide pollution. Further information and findings from previous trials

can be found here: https://www.thameswater.co.uk/about-us/responsibility/smarter-water-catchments

Climate resilience

5.57 During our options development process we considered and factored in a measure of climate resilience in line with WISER requirements.

5.58 A large part of WINEP is based on work done through DWMP and WRMP. For example, DWMP and WRMP climate scenarios are used to drive identification of schemes to be included in WINEP. Options development reports include how this requirement is addressed.

- Most regulatory requirements have relatively short deadlines to fulfil objectives, with the vast majority of actions required to be completed within AMP8. For deferred and longer-term phosphorus requirements we have tested our proposed solutions against alternative climate scenarios – i.e., through alterations to flow regimes affecting target load reductions. For more information, see Section 8.

Regulatory review

5.59 Our WINEP is submitted to, and is reviewed by, our regulators (the Environment Agency and Ofwat) in advance of the Price Review process. The submission is scrutinised as a whole, and individual outcomes and outputs are analysed by specialists within the regulators to ensure that the WINEP will deliver the best value outcome for our customers and the environment. Our regulators advised where they feel we should add to, remove, or amend actions that we are proposing; this degree of regulatory assurance gives us confidence that the schemes in our business plan are the right ones.

Application of WINEP ODA to WINEP categories

5.60 Due to the scale of the full WINEP, an example of the application of the WINEP methodology and ODA process is demonstrated for the storm overflow discharge reduction category below. Summarised optioneering outputs are provided for Bathing Water and Low River Flows categories, with lists of schemes and investigations provided in Annex A.

Storm Overflow Discharge Reduction – option development

Our storm overflow improvement methodology aligns with Environment Act requirements

5.61 The Environment Act 2021[9] drivers in Table 5.1 were developed to address new statutory requirements relating to reducing discharges from storm overflows and their impacts. They set in motion actions contributing to improvements to be delivered up to 2050 as part of the UK Government's Storm Overflows Discharge Reduction Plan[10].

Table 5-1 - Driver codes and descriptions

Driver Code	Description
EnvAct_INV 4	Investigations to reduce storm overflow discharges to protect the Environment so that they have no local adverse ecological impact.
EnvAct_IMP 2	Improvements to reduce storm overflow discharges to protect the environment so that they have no local adverse ecological impact and/or are not discharging above an average of 10 rainfall events per year for designated shellfish waters.
EnvAct_IMP 3	Improvements to reduce storm overflows that discharge to designated bathing waters to protect public health.
EnvAct_IMP 4	Improvements to reduce storm overflows discharges so that they do not discharge above an average of 10 rainfall events per year by 2050.
EnvAct_IMP 5	Improvements to reduce storm overflow aesthetic impacts by installation of screens.

5.62 The Storm Overflows Discharge Reduction Plan outlines the discharge reduction required and time-bound targets (Table 5-2) that water companies need to deliver as minimum to protect the environment, to protect health in designated bathing waters and ensuring storm overflows operate only in unusually heavy rainfall events. Each driver is statutory, with the Tier 1 outcome being 'Water company actions to protect the environment from the effects of intermittent discharges'.

Table 5-2 - Driver codes and obligation dates[22]

Driver Code	Minimum improvement delivery profile	2030	2035	2040	2045	2050
EnvAct_INV4	Investigations into storm overflows that will have a possible EnvAct_IMP2 scheme in AMP8 or AMP9. Investigations to inform PR24 EnvAct_IMP2 schemes should be completed by 30 April 2027. Investigations to inform PR29 EnvAct_IMP2 schemes should conclude by 30 April 2027					
EnvAct_IMP2	% of 'high priority site' storm overflows**	38%*	75%		100%	
EnvAct_IMP3	To be profiled over AMP8 and AMP9 (to achieve the Defra consulted target date of 2035)					
EnvAct_IMP4	% of 'to be improved' storm overflows***	14%*	28%*	52%*	76%*	100%
EnvAct_IMP5	Included in AMP8 where the storm overflow qualifies and has another improvement driver. All overflows to be screened by 2050					

5.63 In line with EA WINEP driver guidance[23], we included actions in our AMP8 WINEP to address high priority storm overflows that we considered necessary to progress, to meet our longer-term targets. We also profiled actions beyond AMP8 as part of our long-term enhancement strategy.

How we developed the Storm Overflow Programme

5.64 Figure 5-7 summarises our methodology and the staged processes we used to identify the 'total stock' of storm overflow assets; the 'to be improved' sites; the selection of the preferred option; the profiling of the investigation and improvement actions over multiple AMP cycles; and finally meet our AMP8 WINEP development obligations with the EA.

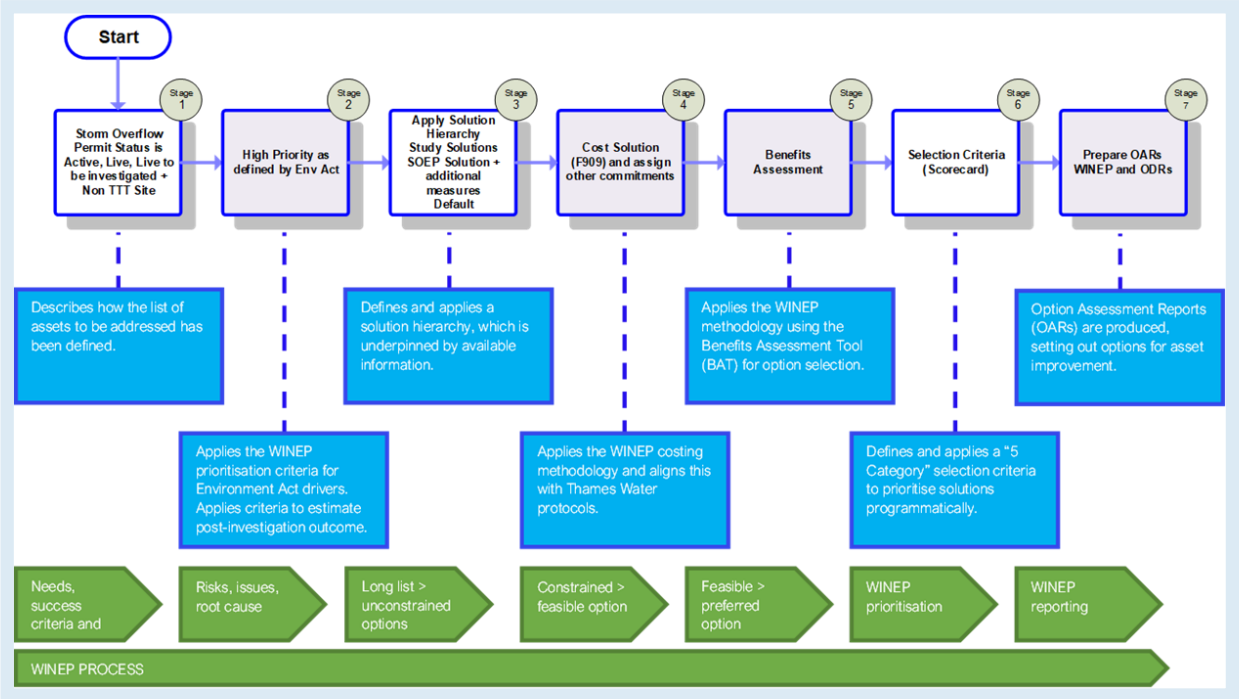
*22 *indicative target only*

*** the 'high priority site' storm overflows are those which discharge in to a water body that has a RNAG ('Confirmed' or 'Probable' for 'Intermittent Sewage') or a SOAF assessment made within PR19 and the outcome of the Stage 2 assessment identified a storm overflow causing 'environmental impact' or Storm overflows identified as discharging into or within 50m of a sensitive inland water feature.*

*** the 'to be improved' storm overflows are those requiring improvement for any of the core storm overflow drivers IMP2/IMP3/IMP4*

23 Environment Agency. PR24 WINEP driver guidance – Storm overflow reductions.

Figure 5-7 - WINEP – Storm overflow discharge reduction programme development flow chart



Stage 1: Confirming storm overflows total stock and permit status

5.65 The initial stage of the process was to confirm the total stock of assets. The Environment Act driver guidance states that the Act only applies to permitted storm overflows, however we are currently in the process of reviewing and investigating several other potential and currently unpermitted storm overflows. The EA clarified that, provided the assets are permitted by the beginning of AMP8, they would contribute towards Environment Act requirements and be eligible for improvement under the WINEP. There are a number of additional assets which will require permitting (or are in the process of being permitted) by the end of AMP7. Using the full list of overflows also aligns with Ofwat's guidance for the storm overflow Performance Commitment.

5.66 The following data sets were used to define the list of storm overflow assets that are to be included in the PR24 WINEP and long-term enhancement strategy. The total stock list includes storm overflows at STWs; sewage pumping stations (SPS) and combined sewer overflows (CSOs); unconsented sewer overflows (uCSPs); and emergency overflows (EOs):

- The storm discharge permit databases (from both Thames Water and the EA), detailing sites where a storm overflow permit is in force
- The existing storm overflow event duration monitor (EDM) list – storm overflow assets fitted with permanent discharge monitoring
- The proposed overflow EDM list – storm overflow assets proposed to be installed with permanent discharge monitoring
- Unpermitted site database – detailing sites where an overflow may exist [24]

[24] *Sites which are under investigation to be permitted as storm overflows 02/12/22*

- Emergency overflow discharge permit database – detailing sites where an EO permit is in force, and which shows signs of storm overflow operation [25]

5.67 Assets being addressed by the Thames Tideway Tunnel (TTT) are part of our overall stock. Those which are known to be 'directly' managed by TTT have been excluded from the WINEP programme as they are forecasted to meet Environment Act requirements. Others, known to be 'indirectly' managed or 'not actively managed, but influenced' (NAMBI) by TTT, have been included in the total stock.

5.68 Similarly, storm overflows known to have been surrendered have been excluded, whereas others (at the time of analysis) 'due to be surrendered', remain in the storm overflow stock until that exercise has been completed.

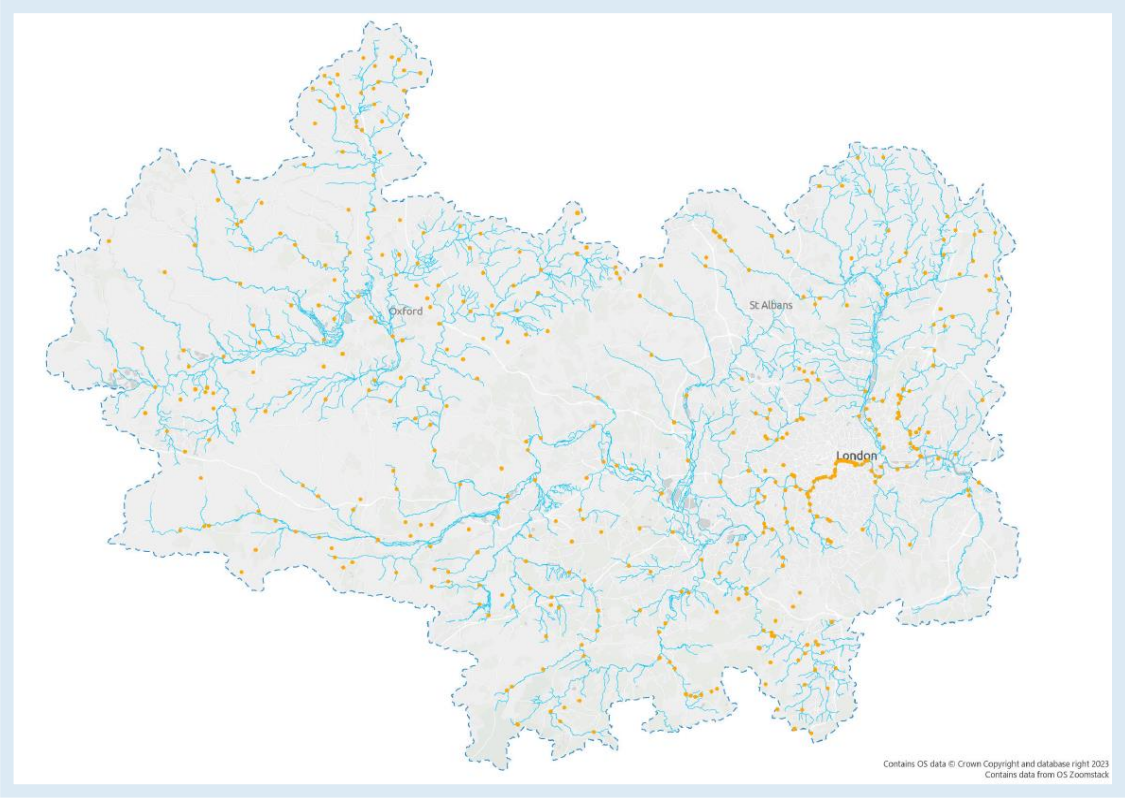
5.69 Table 5-3 shows the breakdown of the storm overflow stock by asset type excluding those 'directly managed' by TTT. Figure 5-8 maps our storm overflows (excluding unpermitted CSOs currently being investigated).

Table 5-3 - Storm overflow total stock breakdown

Storm Discharge Asset Type	No.
Storm overflows at STW	237
Storm overflows at SPS	100
Storm overflows at CSO	185
Storm overflows at CSO, unpermitted at the time of writing.	188
Storm overflows at assets permitted as EOs at SPS/STW, and considered as unpermitted CSO	24
Total Stock (excl. storm overflows 'directly managed' by TTT)	734
Overall Stock	759

[25] *Emergency Overflow which are known to have discharged for more than 2 hours*

Figure 5-8 - Storm overflows (excl. unpermitted CSOs, currently being investigated)



Stage 2: Prioritisation criteria

5.70 Stage 2 follows the criteria detailed in WINEP driver guidance on eligibility of each storm overflow for improvement under the specific drivers. A storm overflow can have multiple drivers subject to the outcome when they are assessed against the six 'trigger categories' listed in Table 5-4

Table 5-4 -Trigger Categories (Prioritisation Criteria)

Trigger Categories	Description
Reasons for Not Achieving Good (RNAG)	If the water body that a storm overflow discharges into has a RNAG (classed as 'Confirmed' or Probable' for 'Intermittent Sewage) or there has been SOAF assessment made within PR19 and the outcome of the Stage 2 assessment identified a storm overflow causing 'environmental impact', these are considered 'high priority' storm overflows for the purpose of the EnvAct_INV4 and EnvAct_IMP2 drivers.
Sensitive inland water	Storm overflows identified as discharging into or within 50m of a sensitive inland water feature including SSI, SAC, SPA, RAMSAR, chalk river, sensitive areas (eutrophic) where the requirement for improvement to ensure no local adverse ecological impact is known are considered 'high priority' storm overflows for the purpose of the EnvAct_INV4 and EnvAct_IMP2 drivers.
Designated shellfish water	Storm overflows identified as discharging into or less than 1km upstream in hydraulic continuity with a shellfish water are valid for the EnvAct_IMP2.

Trigger Categories	Description
Bathing Water designated	The 'designated bathing water' category relevant to TWUL is applicable where Storm Overflows discharge into or less than 5km upstream of the inland bathing water designated site. If a storm overflow meets this condition the overflow is valid for the EnvAct_IMP3 driver in PR24.
Discharge frequency	Storm overflows identified as having an average >10 discharges per annum on average over a 10-year period (in the absence EDM data extending back 10 years, a risk-based decision has been made) are valid for the EnvAct_IMP4 driver.
6mm screen	Where storm overflows do not have a 6mm screen that can take flows up to and including the 1 in 5-year return period flow rate, these overflows are valid for the EnvAct_IMP5 driver.

5.71 These categories define eligibility for improvement under EnvAct_IMP2 (and consequently investigation under the EnvAct_INV4 driver), EnvAct_IMP3 and EnvAct_IMP4 drivers.

5.72 The EnvAct_IMP2 driver is a requirement to reduce the discharge frequency to a level at which local adverse ecological harm is removed. An indicative target of 38% of sites assigned EnvAct_IMP2 drivers are required to be improved by the end of AMP8.

5.73 All EnvAct_INV4 investigations are required to inform AMP8 delivery and PR29 development, and hence are to be completed by 30/04/2027.

5.74 The EnvAct_IMP3 driver addresses the reduction of the frequency of storm overflow discharges to protect public health at designated bathing waters.

Reasons for Not Achieving Good (RNAG), Sensitive inland water and Designated shellfish water (EnvAct_INV4 and EnvAct_IMP2)

5.75 A GIS assessment was carried out to identify the storm overflows that:

- Discharge into a waterbody that has a RNAG (classed as 'Confirmed', 'Probable' for 'Intermittent Sewage', or where the outcome of stage 2 of the SOAF assessments made within AMP7 identified the storm overflow as causing an 'environmental impact').
- Discharge into or within 50m of sensitive inland waters (SSSI, SAC, SPA, RAMSAR, Chalk River or a Eutrophic Special Area, i.e., UWWTR sensitive area).
- Impact a designated shellfish water. No storm overflow in our stock is deemed to impact any designated shellfish water.

5.76 These storm overflows are eligible for the EnvAct_INV4 and EnvAct_IMP2, and hence they are considered as 'high priority' storm overflows.

5.77 The EnvAct_INV4 driver requires an investigation to be carried out into a storm overflow that will have a possible EnvAct_IMP2 scheme, to ascertain whether a storm overflow is causing local adverse ecological harm. As Env_Act_INV4 investigations are completed, the 'high priority' list will be updated to remove overflows which are demonstrated not to have local adverse ecological impact below 10 discharges per year or confirm the discharge frequency threshold which

would not cause local ecological harm. If a storm overflow is recorded to discharge more than 10 times per year, it would still be eligible for improvement under the EnvAct_IMP4 driver at a lower priority.

Table 5-5 - Sites qualifying for EnvAct_INV4 & EnvAct_IMP2[26]

RNAG* (EnvAct_INV4 & EnvAct_IMP2)		Sensitive Inland* (EnvAct_INV4 & EnvAct_IMP2)					
RNAG	SOAF - Stage 2 Environmental Impact	50m of SSSI	50m of SAC	50m of SPA	50m of RAMSAR	50m of Chalk River	50m of Eutrophic Special Area
324	90	34	22	13	10	112	135
Number Storm Overflows Qualifying*					454		

Bathing waters (EnvAct_IMP3)

5.78 To protect public health, EnvAct_IMP3 addresses reducing storm overflows that discharge to designated bathing waters. At the time of the development of the WINEP, there were only two designated inland bathing waters in our catchment that we can impact; Frensham Ponds, Surrey and the Wolvercote Mill Stream in Oxford.

5.79 Where a storm overflow has been assessed and found to be discharging into or less than 5km upstream of a designated inland bathing water (with good / sufficient status) and has at least one discharge per recording bathing season, the overflow is valid under EnvAct_IMP3. In these instances, a scheme will be designed and implemented that meets the specified discharge frequency target and will be profiled over AMP8 and AMP9.

5.80 It is acknowledged that there are a number of bathing water applications which may result in future bathing water designations. As it is currently unclear whether these applications will be successful the EnvAct_IMP3 driver has only been applied to the sites with existing bathing water status.

Table 5-6 - Sites qualifying for EnvAct_IMP3

	Designated Bathing Waters (EnvAct_IMP3) Discharges into or less than 5 km upstream of a designated Inland Bathing Water with good/sufficient status assess against >1 discharge per bathing season
Number of storm overflows	2

[26] **Storm Overflows may qualify for EnvAct_INV4 & EnvAct_IMP2 in >1 category*

Storm overflow discharge frequency target (EnvAct_IMP4)

5.81 The objective of EnvAct_IMP4 is to reduce storm overflow discharges so that they do not exceed an average of 10 rainfall events per year by 2050, based on a 10-year rolling average. Each storm overflow has been assessed against the available EDM data. As EDM does not extend back over ten years, a risk-based approach has been taken. The EnvAct_IMP4 driver has been assigned based on the 2020 and 2021 EDM records. If either year records greater than 10 discharges, an EnvAct_IMP4 driver has been assigned. An EnvAct_IMP4 driver has also been assigned to all sites which do not have EDM data.

Table 5-7 - Sites qualifying for EnvAct_IMP4

	Discharge (EnvAct_IMP4) Discharge > 10 times per annum
Number of storm overflows	618

6mm screening (EnvAct_IMP5)

5.82 The objective for the EnvAct_IMP5 driver is that all storm overflows discharging to inland, estuarine, and coastal waters, have screening controls to limit the discharge of persistent inorganic material (as well as faecal and organic solids).

5.83 In relation to AMP8, this driver is required where a storm overflow also qualifies for another improvement driver. However, all overflows are required to be screened by 2050.

Table 5-8 - Sites qualifying for EnvAct_IMP5

	6mm Screen (EnvAct_IMP5) Needs 6 mm Screen to 1 in 5 yr flow
Number of storm overflows	627

Overview

5.84 There is an implicit hierarchy to the application of the IMP driver codes based on delivery timelines and the minimum discharge frequency criteria. By default, any storm overflow currently discharging greater than 10 times per annum will need to be reduced to less than or equal to 10. However, for example, it might be concluded that to meet an EnvAct_IMP2 driver at a specific site may require a maximum frequency of 10 discharges per annum, or the asset impacts a bathing water location. Therefore, the EnvAct_IMP2 and IMP3 drivers should always be applied ahead of EnvAct_IMP4. The EnvAct_IMP5 driver is unconnected to discharge frequencies and should be applied only in combination to other drivers at the site.

5.85 Of the 734 (total stock) active storm overflows, 454 have been assigned EnvAct_INV4 drivers based on the EnvAct_IMP2 criteria. All of these will be investigated by 2027.

5.86 The final number of storm overflow which will qualify for EnvAct_IMP2 and therefore define the actual target number of assets to be improved by 2030 is currently unknown and is dependent on the findings of the EnvAct_INV4 investigations.

5.87 There are 2 storm overflows which qualify for EnvAct_IMP3.

5.88 Of the 734 (total stock) active storm overflows 618 discharge more than 10 times in either 2020 or 2021 EDM data returns or have no available EDM data and therefore have been assigned improvement under EnvAct_IMP4.

Stage 3: Application of a solution hierarchy

5.89 Once the environmental needs were defined, the WINEP process required optioneering to address these risks and issues.

5.90 Every storm overflow that is eligible for improvement (IMP) has been assessed against a full range of solution options according to the WINEP options development guidance. The findings are presented in our Option Development Reports (ODR) and Options Assessment Reports (OAR).

5.91 The WINEP options development guidance requires the option to consider the opportunity for green infrastructure options as well as grey infrastructure[27]. The exception is EnvAct_IMP5 which is minimum scope as it requires a screen.

5.92 The ODR provides the details on the overall methodology we adopted including the coarse screening methodology, taking a long list of potential options to a list of unconstrained options then constrained options. Thereafter, at the fine screening each of the constrained options are looked in greater depth, and these options are then developed into feasible options and ultimately the preferred options (i.e., the best value option).

5.93 Table 5-9 summarises the outcome of option screening.

Table 5-9 - Summary of option screening and outcome

	Coarse Screening – Long List > Unconstrained > Constrained List				Fine Screening – Constrained List > Feasible					
Options Considered	WINEP Criteria			Recommended for Progression	WINEP Requirements				Recommended for Progression	Screening Outcome
	Expected to meet statutory obligation(s) or meet non-statutory requirements	Deliverability, including technical feasibility	Potential impacts on, and changes to, natural assets from each option.		High level of confidence of achieving the WINEP outcomes	Net benefits provided when carbon costs are included	The option contributes to the WINEP wider environmental outcomes.	If not the least cost, the additional cost associated with delivering wider environmental outcomes		
Source control – Sustainable Urban Drainage System (SuDS) measures	Y	Y	Positive	Y	Y	Y	Y	Y	Y	In conjunction with wetlands and storage, source control, SuDS can satisfy the environmental needs and risks can be managed with sub-option at a site-specific scale.

[27] *Green infrastructure consists of more natural solutions. Grey infrastructure refers to human-made structures using hard building materials.*

Options Considered	Coarse Screening – Long List > Unconstrained > Constrained List				Fine Screening – Constrained List > Feasible					
	WINEP Criteria				WINEP Requirements					
	Expected to meet statutory obligation(s) or meet non-statutory requirements	Deliverability, including technical feasibility	Potential impacts on, and changes to, natural assets from each option.	Recommended for Progression	High level of confidence of achieving the WINEP outcomes	Net benefits provided when carbon costs are included	The option contributes to the WINEP wider environmental outcomes.	If not the least cost, the additional cost associated with delivering wider environmental outcomes	Recommended for Progression	Screening Outcome
Integrated construction wetland (ICW) downstream of a wastewater treatment works	Y	Y	Positive	Y	Y	Y	Y	Y	Y	Included as part of combined solutions.
Infiltration reduction – Cured in place pipe (CIPP) Sewer lining system	Y	Y	Positive	Y	Y	Y	Y	Y	Y	Included as part of combined solutions.
Increase network capacity by installing larger sewers Increasing capacity of wastewater sewer system	Y	Y	Neutral	Y	Y	N	N	Y	Y	This option has been incorporated with storage.
Disconnect existing surface water systems from combined sewers discharge to watercourse	Y	Y	Negative	Y	N	N	N	Y	N	This option has been deemed not feasible.
Storage tank/storage within the network and treatment works	Y	Y	Neutral	Y	N	N	Y	Y	Y	In conjunction with infiltration reduction, storage can satisfy the environmental needs and risks can be managed within sub-options at a site-specific scale.
Increase Flow to Full Treatment (FFT)	Y	Y	Positive	Y	Y	Y	Y	Y	Y	In conjunction with infiltration reduction.
Other options: Including Combined sewer separation / 'Intelligent' sewer network to control flows / Transfer flow between catchments via new connections / Screening in the network				N						Removed – all other options removed at this stage (unless included explicitly off the back of AMP7 investigations) on the basis that extensive modelling work would be required to validate and size any solution; something not done in the majority of catchments by DWMP or possible to do now within the timeframes of PR24 planning.

5.94 Through consideration of the WINEP requirements there was a list of 11 unconstrained options relevant to the storm overflow programme. Six of these were then taken forward as constrained options within the fine screening process.

5.95 Reducing the frequency of storm overflows discharges and their local ecological impacts is a complex activity that requires joint efforts. We believe that reliance on single-technology options is not resilient and would not address the environmental risks and issues in the long term. Therefore, in our constrained options list we have developed a smaller set of combined options, made of a hybrid combination of traditional grey and both established or innovative green solutions. This hybrid combination of technologies provides best value in the short term as well as climate adaptation and resiliency in the long term. Each sub-set of options was assessed according to the WINEP options development and assessment guidance, and the best value option identified for each WINEP action.

5.96 Reviewing cost benefit analyses for all feasible options, we concluded that a combination of these solutions, as an integrated stormwater management approach at a catchment level, will prove to be the most cost-efficient and environmentally best value approach.

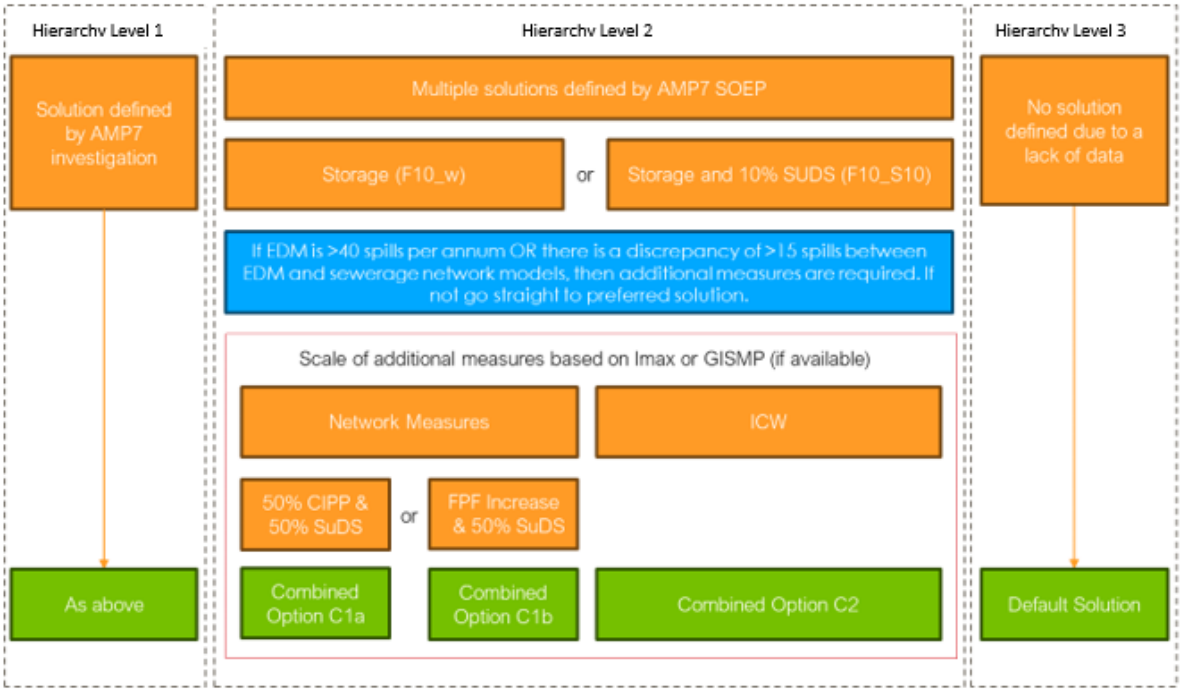
5.97 Combined options were steered by storm tank volume efficiency. Assets with lower discharge frequencies generally discharge during, or after, high intensity rainfall events, which are generally well predicted by network models. Assets with higher discharge frequencies are affected by both high intensity rainfall events and prolonged periods of rainfall. Confidence in modelled outputs and solution sizing decreases when considering longer duration storm events.

5.98 Taking this into account, the process identified two standard integrated stormwater management options. These were based upon a combination of appropriate grey and green solutions, as the feasible options which have sub-options within them:

- WINEP Combined Option 1a (C1a): Infiltration reduction with storage and SuDS
- WINEP Combined Option 1b (C1b): Flow pass forward increase and SuDS
- WINEP Combined Option 2 (C2): Integrated Constructed Wetlands

5.99 We also considered the outcomes of AMP7 studies applying the Storm Overflow Assessment Framework to influence solution choice, as well as recognising that some overflows currently have little or no data available. Therefore, we applied a solution hierarchy which is based on making the best use of all available data, as illustrated in Figure 5-9.

Figure 5-9 - Solution Definition Methodology



Sizing and selecting additional measures

5.100 In relation to hierarchy Level 2, the level of investment and sizing of additional measures are based on either information within the Groundwater Impacted System Management Plan (GISMP) or, if the asset is not within a GISMP area, the Imax observed at the site or the potential for storage / treatment within a wetland.

Combined options C1a & C1b

5.101 Fifty-four catchments have a GISMP. Within each GISMP, the sewer network is classified by the groundwater potential infiltration risk (High / Medium / Low[28]). Where sites are within a GISMP the degree of additional measures to be carried out is based on the Imax/PE[29]. Where no GISMP is developed, the following equation is used to define the network measures requirement:

$$network\ measures = \frac{I_{max}/PE}{1500} \times 9m \times PE$$

5.102 Once the overall value of the network measures is defined, 50% of the solution was assigned to surface water control measures including Sustainable Drainage Systems (SuDS) or rectifying surface water misconnections into a foul system. The remaining 50% was then either attributed to sewer lining or pass forward flow increases, depending on which option has the lower cost associated.

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[28] *Risk zone categories as defined by the GISMP, based on catchment PE.*

[29] *Population equivalent or unit per capita loading, (PE), in waste-water treatment is the number expressing the ratio of the sum of the pollution load produced during 24 hours by industrial facilities and services to the individual pollution load in household sewage produced by one person at the same time.*

5.103 We limited sewer lining measures to 50% of the total costs due to inherent uncertainties of the sewer lining process. Across the UK, sewer lining for the purpose of infiltration reduction does not always deliver the expected level of improvement due to continued infiltration from the private, customer side network. Combining sewer lining and surface measure SuDS should help manage this uncertainty and provide more consistent annual discharge reductions. Infiltration reduction measures such as sewer lining are heavily influenced by groundwater levels, which can vary significantly from year to year, whereas surface measure SuDS should produce a more consistent benefit each year. This approach should mitigate the impact of the worst-case years from groundwater but also provide measurable year on year discharge reductions. Selection between end-of-pipe and sewer lining is based on whole life least cost.

Combined option C2

5.104 Several criteria were used to determine if the location is suitable to use an Integrated Constructed Wetland (ICW) to treat flows under the C2 option, including i) outside the 1:100 flooding zone, ii) suitable land available within 250m of the existing wastewater activity, iii) the land needs to be open grassland – no trees or buildings.

Stage 4: Costing solutions

5.105 For each site, we produced cost estimates in accordance with the WINEP methodology and consistent with our PR24 scope and cost assurance methodology using our engineering estimating costing tool. This tool and the cost models therein have been externally assured.

Stage 6: Selection criteria

5.106 All storm overflows were prioritised following 'PR24 WINEP driver guidance – Storm overflow reductions', to ascertain actions to be completed within AMP8 and future AMPs.

5.107 Where a storm overflow is eligible for improvement under the EnvAct_IMP2 driver, they are considered high priority storm overflows.

5.108 To meet target overflow improvement targets we need to deliver a minimum 38% (indicative target) of all 'High Priority Sites' in AMP8 and 75% (statutory target) by the end of AMP9.

5.109 Although there are 454 storm overflows that are candidate 'High Priority Sites' based on the EnvAct_IMP2 criteria, the final number of storm overflow which will qualify for EnvAct_IMP2 depends on the findings of the associated EnvAct_INV4 investigations.

5.110 To address this, we have adopted a reasoned approach to estimate the likely outcome of the INV4 investigations.

5.111 An assessment on the 'likelihood of adverse impact' has been applied:

- High (weighting factor of 1, very high likelihood of adverse local ecological harm) was applied to each overflow where 2020 and 2021 EDM data had discharge durations greater than 87.6 hours

- Moderate (weighting factor of 0.5, moderate likelihood of adverse local ecological harm) was applied to each overflow where no EDM data is available or just one of 2020 or 2021 EDM records had discharge durations greater than 87.6 hours
- Low (weighting factor of 0.25, low likelihood of adverse ecological harm) was applied to each overflow where EDM discharge duration records from 2020 or 2021 are lower than 87.6 hours

5.112 The threshold of 87.6 hours was defined as a proxy to the UPM level 4 and 99th percentile assessment criteria, corresponding to a discharge duration of 1% of a year.

5.113 We acknowledge this assessment carries a degree of conservatism due to 2020 and 2021 being wetter than average years with higher discharge frequencies. Nevertheless, it shows that out of the possible 454 storm overflows, it is predicated that 278 of these will be confirmed as requiring EnvAct_IMP2 driver. This would equate to 106 (38%) storm overflows having to be improved by 2030, additional 103 by 2035 (to meet the 75% statutory target), additional 33 by 2040 and finally the residual 36 by 2045 to have improved all 278 by 2045. The final targets and profiling will be confirmed as the results of the EnvAct_INV4 investigations are known.

5.114 We understand that until EnvAct_INV4 investigations conclude, there is risk of not achieving the 38% indicative target and adjustments to our SORP may need to be made at PR29 to achieve the 75% statutory target.

5.115 The indicative EnvAct_IMP4 target of 14% of all total storm overflows, need to be addressed prior to 2030. This target will have been achieved in meeting the EnvAct_IMP2 driver requirements above, provided that at least 102 of the selection of 106 IMP2 sites prioritised for AMP8 are also eligible for improvement under the EnvAct_IMP4 driver (i.e., they discharge on average greater than10 times per year).

5.116 Further to the above, to enable further profiling and prioritisation of investment we have also assessed each of the storm overflow against additional criteria including deliverability (the amount of investment required to meet the objective); harm potential (based on the facts we have on a storm overflow i.e., having no data to instances where have undertaken previous investigations or have historic EDM data); and additional information (from local site knowledge such as known site constraints to wider benefits captured by other public or regulatory commitments).

5.117 Thereafter storm overflows were categorised between 1 – 5 as detail in Table 5-10.

Table 5-10 - Storm overflow categorisation

Category	Description	Score
Deliverability	Solutions will require confirmation that the site requires investment, and to what degree, to meet the objective. The following criteria are developed to score one site solution against another.	
	Deliver within 2 years - an AMP7 investigation such as a SOAF, UPM or GISMP has been carried out and recommended further works, the catchment is less than 20,000 PE and the cost of the solution is less than £5m	3
	Deliver within 2-3 years - at least two of the above are achieved.	2
	Deliver within 3-4 years - at least one of the above are achieved.	1
	Deliver 4+ years - none of the above are achieved	0
Harm Potential	Based on existing AMP7 investigation or storm overflow discharge duration, the following scoring criteria are proposed.	
	High, an AMP7 investigation such as a SOAF, UPM or GISMP has been carried out and recommended further works or the overflow is listed on the Natural England Nature Recovery site list.	3
	Moderate, both 2020 and 2021 EDM data had discharge durations greater than 87.6 hours30	2
	Only one of 2020 or 2021 EDM records had annual discharge durations of greater than87.6 hrs.	1
	No data	0.5
	Neither 2020 or 2021 EDM records had annual discharge durations of greater than 87.6 hrs	0
Additional Site Information	This criterion seeks to quantify our knowledge of the site, based on parameters including, but not limited to, site constraints, and wider benefits captured by other public or regulatory commitments. Scores are awarded depending on the impact or benefit of this knowledge upon the proposed solution. It should be noted that the default position is zero and that this criterion is only used to support selection based on other criteria. Scoring is done through expert judgement in consultation between our staff and consultants.	
	Negative benefit or impact associated with the available knowledge.	-2
	Neutral benefit or impact (Default).	0
	Positive benefit or impact associated with the available knowledge.	2

[30] *87.6 hours is a figure taken with basis from the 99-percentile standard assessment*

Categorisation into 'Ranked categories' – Storm overflow categorisation

Category	Storm Overflow Description
1	High Priority Overflows with High Harm Potential
2	High Priority Overflows
3	Non-High Priority Overflow with High Harm Potential
4	Non-High Priority Overflow with NBS Solutions
5	Residual Overflows

5.118 The 'ranked' category site selection process should be viewed as an additional selection criteria that builds on to the 'prioritisation for PR24' methodology detailed in the PR24 WINEP drive guidance – Storm overflow reductions and the profiling described above. The categories are aligned with Environment Act driver guidance targets e.g., Storm Overflows falling into Category 1 and Category 2 will help to achieve the delivery target of addressing 38% of High Priority overflows by 2030 and by so doing archive the 14% target of all core drivers. Ranked Categories 3, 4 and 5 capture those overflows in future AMPs.

5.119 The following points outline the AMP8 Storm Overflow programme (total 454 investigations and 107 improvement sites) and demonstrates how this complies with the Environment Act targets. This is from the total stock of 734 storm overflows and 728 assets eligible for EnvAct drivers IMP2/3/4.

- EnvAct_INV4 – All 454 storm overflows deemed to potentially be causing local adverse ecological harm will be investigated. It is predicted that up to 278 of these will be confirmed as requiring EnvAct_IMP2
- EnvAct_IMP2 (High Priority Sites) – To achieve a 38% reduction in storm overflows discharging to High Priority sites by 2030, at least 106 of the predicted 278 High Priority sites need to be addressed in AMP8
- EnvAct_IMP3 – both sites eligible for IMP3 drivers[31] are to be addressed in AMP8, of which 1 also eligible for improvement under EnvAct_IMP2
- EnvAct_IMP4 – To achieve a 14% reduction in storm overflows discharging more than 10 times per year by 2030, at least 101 sites need to be addressed in AMP8
- This means 107 actions being delivered in AMP8. This equates to all 61 sites in Category 1, the highest ranking 23 sites from Category 2 and 23 sites from Category 5

5.120 Table 5-11 below shows a summary of the storm overflow optioneering process, outputs and assumptions made.

Table 5-11 - Storm Overflows Optioneering Summary

<table>
<tr><th>Driver / Action</th><th>Storm overflows</th></tr>
<tr><td>Scheme / goal / risk identification</td><td>Regulatory driver/s:
• Environment Act
  • 107 storm overflow schemes included as part of PR24 WINEP

<table><tr><th>WINEP Driver</th><th>No. storm overflows with driver</th></tr><tr><td>EnvAct_INV4 & EnvAct_IMP2</td><td>Total: 454 investigations, 278 schemes (est.)
AMP8: 106 schemes</td></tr><tr><td>EnvAct_IMP3</td><td>2 (1 of which with EnvAct_IMP2 as secondary driver)</td></tr><tr><td>EnvAct_IMP4</td><td>618</td></tr><tr><td>EnvAct_IMP5</td><td>627</td></tr></table></td></tr>
<tr><td>No. sites / schemes</td><td>107 actions in AMP8, £885.0m

<table><tr><th></th><th>AMP8</th><th>AMP9</th><th>AMP10</th><th>Total</th></tr><tr><td>Actions (No.)</td><td>107</td><td>150</td><td>201</td><td>458</td></tr><tr><td>Investigations (No.)</td><td>454</td><td>0</td><td>0</td><td>454</td></tr><tr><td>Cost (£m 2022-23)</td><td>885.0</td><td>2,529.2</td><td>4,099.2</td><td>7,513.4</td></tr></table>
Please note – the AMP8 number in the table above is not aligned to our data table submission as we have discovered this has been misstated. This has been noted in the data table commentary. The correct cost is £884.992m (22/23 price). We shall address this if further cost submissions are made as part of the PR24 process.</td></tr>
<tr><td>Optioneering</td><td><table><tr><th></th><th>Units</th><th>Options</th></tr><tr><td>Long list / unconstrained</td><td>No.</td><td>11</td></tr><tr><td>Constrained</td><td>No.</td><td>6</td></tr><tr><td>Feasible</td><td>No.</td><td>6</td></tr></table></td></tr>
<tr><td>Direct Procurement (DPC)</td><td>Not suitable for DPC. Programme encompasses many different pieces of work that require different solutions and have different timings. It therefore fails to meet minimum scalability threshold.</td></tr>
<tr><td>Customer Insights: support for solutions to reduce storm overflow discharges</td><td>• Almost all customers support Thames Water's plan to upgrade 13 sewage treatment works as they believe this approach is cost-effective and will mitigate storm overflows. Some call for more transparency on the impacts of this approach, with a small minority calling for Thames Water funding the improvements themselves without increasing bills. (PR24-15)</td></tr>
</table>

	• Customers are of the opinion that upgrading sewage treatment works is an essential activity as part of Thames Water's core responsibilities to mitigate current and future pressures on the system. (PR24-15) • Some are concerned about the level of disruption associated with upgrading sewer treatment works and want to know what this will mean for them and local communities. There was also some concern around delays and costs relating to planning permission. (PR24-15) • Some wanted to know whether this would be funded exclusively from increases in customer bills, especially future customers. (PR24-15) • Despite the high cost, support for this enhancement (NEP Waste) is high, driven in particular media coverage of storm overflow discharges. (PR24-16) • When testing options for number type and scale of solutions to reduce storm overflow discharges (PR24-6), customers preferred the highest of four options: 100% less storm overflow discharges into rivers (reduced to NO storm overflow discharges) by finding and correcting 1,000 misconnected drain pipes in properties, reducing groundwater infiltration by improving 400 sewer pipes, and creating more capacity in sewer, treatment works and storm tanks at 270 locations for £10.90 additional cost per household bill. However, some felt this might be unfair on the financially vulnerable. (PR24-6) • The second most favoured option was 50% less storm overflow discharges into rivers (reduced by a half) by finding and correcting 500 misconnected drainpipes in properties, reducing groundwater infiltration by improving 200 sewer pipes, and creating more capacity in sewer, treatment works and storm tanks at 130 locations for £4.50 additional annual cost per household bill (PR24-6) • 64% of customers support a total elimination of storm overflow discharges by 2030 and are willing to pay £10.90 a year for this option. 27% of customers support the 50% reduction by 2030 and are willing to pay £4.50 a year for this option. (PR24-6) • When shown options for wastewater solutions, none were either universally supported or rejected by customers. The strongest support was shown for options that they considered to be realistic to implement and already proven to work. Customers preferred options they considered were sensible and the 'right thing to do' such as managing rainwater (green infrastructure). (SP8) • Green solutions in terms of managing rainwater, either through green infrastructure, or collection and reuse systems garner strong support. Some concerns were flagged about the practicalities of implementing rainwater collection and reuse schemes. (SP8) • Generally, customers see the benefits of both green and grey solutions and believe a mix of both is best. (PR24-9)

	• While in line with participants' strong support for green solutions, views on catchment management were mixed and tempered by a hesitancy that relying on others to deliver solutions may be of limited success. (SP8) • Stakeholders also support the extension of investment in green infrastructure and sustainable drainage to reduce flooding and provide biodiversity, recreation and water quality benefits. (S8)

WINEP ODA – category summaries

5.121 Output summaries are provided for the remaining WINEP categories, below. For lists of action and investigation locations, see Annex A.

Stage 5: Benefits Assessment

5.122 Individual benefits assessments were made for each site, done in accordance with the WINEP guidance using our Benefits Assessment Tool (BAT) developed specifically for PR24 WINEP based upon the Environment Agency WEO.

5.123 The BAT was produced by our consultants and reviewed by the EA (through various consultations). The WINEP storm overflow assessment used BAT version 5.2.

5.124 The BAT supported option selection for all schemes where full optioneering was required, according to the EA guidance. In accordance with WINEP guidance, the BAT was applied to all storm overflows where there was no existing AMP7 investigation output. There were 11 storm overflows where AMP7 UPM investigations already identified the preferred solution. For these UPM storm overflows, the BAT was not used to support option selection as it was not required by the EA guidance.

5.125 The BAT used for the storm overflow assessment is embedded in the ODR. The process used for options selection follows:

1) For each storm overflow the WINEP generic options were compiled. These comprised high level grey/green or green/grey options and their associated sub-options.
2) Each option was then assessed using the BAT (except for the 11 UPM AMP7 preferred options). This included sub-option assessment (e.g., grey source control and grey end of pipe).
3) Following the BAT assessment, the least cost option was selected as the preferred option.

5.126 Full details are provided within the ODR, available at the Environment Agency PR24 drafting SharePoint area.

WINEP ODA: Bathing Waters

5.127 Below is a summary of the Bathing Waters optioneering process, outputs and assumptions made.

Table 5-12 - Bathing Waters Optioneering Summary

Driver / Action	Bathing Waters
Scheme / goal / risk identification	The WINEP driver objective is to protect and improve the quality of bathing waters in our region. These bathing waters may be designated, likely to be designated or a potential future designation. There are three levels of objective (with relevant drivers): • All bathing water are required to meet at least 'sufficient' status (BW_IMP1, BW_IMP2, BW_INV1 and BW_INV2). • As protected under WFD regulations there is also an obligation to ensure no deterioration (BW_ND and BW_NDINV) • In addition to the main objectives of achieving 'sufficient' and preventing deterioration, there is a further objective to increase the number classified as Good and Excellent where customers support this. Need identification of bathing waters investment has followed the following nine steps: 1. Confirm the bathing water monitoring point or make a reasonable estimate if this is not available. 2. Review bacterial data collected for the bathing water. This may include official bathing water samples, Thames Water data and stakeholder data. This data then is cross-checked with prevailing environmental conditions at the time of sampling (i.e., time of day, dry/wet conditions). 3. Make an initial assessment of the bathing water classification based on collected data. 4. If Microbial Source Tracking (MST) data is already available (i.e., DNA fingerprinting) make an initial assessment of source apportionment between Thames Water operations' impacts and other sources. 5. Obtain the SAGIS[32] Optimiser model for the waterbody catchment. 6. Define the likely limits of the 'impacting catchment' during dry and wet weather using river flow velocities. 7. Assess bacterial loadings from the catchment using FarmScoper Upscale[33]. 8. Use the skeletal hydraulic model contained within the SAGIS optimiser to develop a bacterial spreadsheet model for the catchment to identify the likely impacting assets under both typical dry and wet weather flow conditions.

[32] *SAGIS – Source Apportionment Geographical Information System is a discrete digital information management and visualisation platform which serves as an integrated system for modelling water quality in rivers and lakes.*

[33] *FarmScoper is a decision support tool developed by Defra to assess diffuse agricultural pollutant loads on a farm. FarmScoper Upscale has been developed by Defra to take farm-level results of Farmscoper and elevate these estimates to the national (England) level.*

<table>
<tr><td></td><td>9. Using the model assess what interventions would be required for TW to support the target bathing water classification.</td></tr>
<tr><td>No. sites / schemes</td><td>Further to the designated site at Oxford, we are aware of eight other locations where applications for bathing water status are being pursued. These will be actioned, pending future investigations. Investment is not currently allocated under the AMP8 WINEP programme.

Investment in future AMPs will support the achievement of sufficient status for each of these locations, should they be designated.

AMP8 proposals are for delivery in line with statutory targets for:
• One investigation under the BW_INV1 driver to confirm pathogen pathways.
• Subsequent action for the Wolvercote Mill Stream at Oxford Actions under BW_IMP1.

<table><tr><th></th><th>AMP8</th><th>AMP9</th><th>AMP10</th><th>Total</th></tr><tr><td>Actions (No.)</td><td>1</td><td>8</td><td>3</td><td>12</td></tr><tr><td>Investigations (No.)</td><td>1</td><td>8</td><td>3</td><td>12</td></tr><tr><td>Cost (£m 2022-23)</td><td>7.0</td><td>159.3</td><td>53.0</td><td>219.3</td></tr></table>
Please note – the AMP8 number in the table above is not aligned to our data table submission as we have discovered this has been misstated. This has been noted in the data table commentary. The correct cost is £7.002m (22/23 price). We shall address this if further cost submissions are made as part of the PR24 process.</td></tr>
<tr><td>Optioneering</td><td>As referenced above, one action has been included in our AMP8 investment plan for the Wolvercote Mill Stream at Oxford. This BW_IMP1 action is paired with an investigation under BW_INV1 to better understand the impact of our assets on the bathing water.

The following optioneering process has been followed:
Unconstrained to Constrained

Create a long list of options capable of delivering bathing water improvements. Nine potential options were considered:
1. Use technology to improve existing wastewater treatment e.g., UV/PFA.
2. Nature based solution at STW.
3. Change STW outfall location.
4. Transfer flow between catchment via new connections.
5. Source control SuDS measures.
6. Treatment of diffuse pollution sources (inputs to river) e.g., misconnections.
7. Agreements with farmers on farming practices (catchment solutions).
8. Storm overflow improvements.</td></tr>
</table>

These options were screened at both a catchment level and individual solution.

A single option (treatment of diffuse pollution sources) was discounted between unconstrained and constrained. This option could not be progressed due to a lack of available information to assess the impact from diffuse urban sources such as misconnections. Therefore, apportionment cannot be ascribed, and solution developed.

Constrained to Preferred

Seven options were progressed from constrained to the feasibility assessment. The followed two options were assessed as feasible to deliver the required benefit The other five constrained options were assessed as 'unknown' in terms of meeting the obligation. In addition, two of the five were assessed as 'unknown' in terms of deliverability.

The following two options were priced and put through the benefits assessment tool.

- Option 1 – Use technology to improve existing wastewater treatment at Cassington STW, Church Hanborough STW and Stanton Harcourt STW
- Option 2 – Nature based solutions at Cassington STW, Church Hanborough STW and Stanton Harcourt STW

	Units	Options
Long list / unconstrained	No.	8
Constrained	No.	7
Feasible	No.	2
Best value / preferred plan	No.	1
AMP8 Cost	(£m 2022-23)	6.275

Cost / Benefit Assessment and our preferred plan.

The benefits assessment tool (BAT) was used to assess and value the benefits of our two feasible options. The assessment provides a high-level indication of the likely benefit / impact an option may have on the defined WINEP wider environmental outcomes (WEOs) relative to the baseline situation.

	Option 1 - Technology to improve three STWs (£k)	Option 2 – NbS at three STWs (£k)
Cost estimate	9,270	37,131
Benefit estimate – natural environment	-	0.069
Benefit estimate – net zero	-	-
Benefit estimate – catchment resilience	31,385	31,399

	Benefit assessment – access, amenity and engagement	820	820
	Benefit - TOTAL	32,205	32,219
	Benefit : Cost ratio	3.47	0.87

The preferred option (Option 1) was selected as it represents the best benefit: cost ratio. Note that costs are expressed as whole-life costs.

Direct Procurement (DPC)	Under current proposed spend in AMP8, the programme fails scalability test – it is below the 'DPC by default' threshold. We will revisit the programme at a later stage, should more actions are included and review it through our established DPC assessment process.
Customer Insights: Support for the proposed solution	• The vast majority of customers support Thames Water's plan to improve the number and quality of bathing waters because of the increased wellbeing of nature and residents. They perceive the bill impacts associated with protecting local wildlife and environment for communities to be negligible, however, some feel that this is a 'nice to have' and shouldn't be prioritised over other more pressing issues. (PR24-15) • Some also questioned whether customers should have to pay for this, given it is perceived to be a result of historic underinvestment by Thames Water, and wondered realistically how many customers would actually benefit from this improvement. (PR24-15) • The minority of those less supportive of this feel it simply isn't a priority for us to invest in (against a backdrop of other issues) and that some customers (including those on low incomes) may end up paying for a resource they don't use. (PR24-5) • Views on funding additional bathing areas are mixed. Only a small number of customers supported bill payers funding additional bathing waters. (PR24-5)

WINEP ODA: Low River Flows

5.128 Below is a summary of the Low River Flows optioneering process including outputs and assumptions made.

Table 5-13 - Low River Flows Optioneering Summary

Driver / Action	Low River Flows
Scheme / goal / risk identification	The WINEP driver objective is to ensure that we do not continue making abstractions where they cause environmental harm to vulnerable. Licence reductions will be made at sources either where abstraction at our existing licensed volume poses a risk of causing deterioration (to ensure that we comply with 'No Deterioration' requirements of the Water Framework Directive), or where making a licence reduction is considered very likely to result in the improvement of water body status (subject to cost-benefit analysis). Investment is required to ensure that our supplies for customers continue to be resilient when licence reductions are made. In addition to enacting licence reductions, we will also carry out a wide-ranging programme of low-flow investigations to determine licence reductions that may need to be made in the future, to help us determine our pathway to an environmental destination, including contributing towards a regional study. Regulatory driver/s: • 6 actions under WFD_IMP_WRFlow and WFD_ND_WRFlow drivers • 22 investigations under EDWRMP_INV, WFD_INV_WRFlow, WFD_INV_WRHMWB and WFD_NDINV_WRFlow drivers
No. sites / schemes	Six actions in AMP8, £58.4m AMP8 proposals are for delivery of the following: • Three investigations under the EDWRMP_INV for actions identified within the WRMP to meet regional planning requirements that do not fit with WFD driver requirements. • Three investigations under WFD_INV_WRHMWB to determine the impact of abstractions and appraisal of options for an effective solution to achieve good ecological status (surface water) at heavily modified waster bodies. • 14 investigations under WFD_INV_WRFlow to determine the impact of abstractions and appraisal of options for an effective solution to achieve good ecological status (surface water). • Two investigations under WFD_NDINV_WRFlow to determine the likelihood that future abstraction will cause deterioration in any element affecting the ecological status of a water body and identify effective solutions.

<table>
<tr><td></td><td>

Six actions under WFD_ND_WRFlow to protect / ensure no deterioration in status (surface water). The locations of these actions are listed below:

Netley Mill WTW
Bradfield Windmill WTW
Upper Swell WTW
Chinnor WTW and reservoir
Northern New River Wells sources
Hornsey WTW

<table>
<tr><th></th><th>AMP8</th><th>AMP9</th><th>AMP10</th><th>Total</th></tr>
<tr><td>Actions (No.)</td><td>6</td><td>1*</td><td></td><td>7</td></tr>
<tr><td>Investigations (No.)</td><td>22</td><td>1</td><td></td><td>23</td></tr>
<tr><td>Cost (£m 2022-23)</td><td>58.4</td><td>109.8</td><td></td><td>168.2</td></tr>
</table>
*This is based on the solution for the licence reduction at Epsom WTW (£109.5m). This solution was rejected by the Environment Agency because it was not cost beneficial. There is a requirement for further investigation, jointly with SES Water, into alternative wider catchment options / other options with abstraction reduction proposed for AMP9. We have costs allocated to a study in AMP8 to look at alternative solutions. We have chosen to include this indicative cost in our forecast to align with WRMP and an abstraction reduction by 2035. Therefore, there is a need for a solution in AMP9 and we will update this if better value solutions are identified by the AMP8 study.
</td></tr>
<tr><td>Optioneering</td><td>
As referenced above, six actions have been included in our AMP8 investment plan at various locations:

Netley Mill WTW – River Tillingbourne
Netley Mill WTW's existing licence will be reduced or revoked as part of a number of sustainability reductions to reduce the impact that Thames Water abstractions have on chalks streams.

Two unconstrained options were investigated for this need:

Replace 9.5km trunk main between Shalford WTW and Netley WTW with 500mm (ID) pipe.
Reinforce the 9.5km trunk main between Shalford WTW and Netley WTW with a 400mm (ID) pipe, resulting in a dual main.

A single option (Option 2) was retained for the subsequent optioneering phases. Option 1 was discounted due to the higher cost with no additional benefits and unnecessary disruption to customers.

Option 2 makes good use of the proposed assets designed under the AMP7 study and adds resilience to the system. The solution will ensure that abstractions from this chalk stream will be reduced. The flow recovery in the river Tillingbourne will have the added benefit of enhancing water quality through improved dilution.
</td></tr>
</table>

	Units	Options
Long list / unconstrained	No.	2
Constrained	No.	1
Feasible	No.	1
Best value / preferred plan	No.	1
AMP8 Cost	(£m 2022-23)	29.1

Bradfield Windmill WTW – River Pang

The River Pang is a chalk stream which is classified as a UK priority habitat. As part of the WINEP programme, we are required to reduce the impact of abstractions on chalk streams. We are required to avoid any increase in abstraction in the Pang catchment to ensure no deterioration under WFD. The Pang is also a flagship catchment and closing abstraction at this source will mean we have no remaining abstraction with direct impact on the River Pang.

Five unconstrained options were investigated for this need:

1. New 225mm connection from transfer pipeline between Theale and Thatcham to Bradfield Windmill WTW booster pumps by-passing the WTW
2. New connection from Pangbourne WTW
3. New connection from Ufton Nervet WTW
4. New 8km connection main from Tilehurst Reservoir to Bradfield Windmill WTW booster pumps by-passing the WTW. A New 7.4km 700mm main from Fobney to Tilehurst Reservoir
5. New 225mm connection from the 355mm transfer pipeline between Theale and Thatcham to Bradfield Windmill WTW booster pumps by-passing the WTW

A single option (Option 1) was retained for the subsequent optioneering phases. The other four options were discounted for the following reasons:

- Option 2 – High cost and complicated M4 motorway crossing
- Option 3 – High cost, complicated River Kennet crossing and requirement to upgrade existing booster stations
- Option 4 – Significantly higher cost than Option 1
- Option 5 – Requires replacement of Bradfield WBS and higher operational costs

	Units	Options
Long list / unconstrained	No.	5
Constrained	No.	1
Feasible	No.	1
Best value / preferred plan	No.	1
AMP8 Cost	(£m 2022-23)	2.8

Upper / Lower Swell sources – River Dikler

A reduction to the Upper and Lower Swell aggregate licence to meet recent actuals to meet requirements of WFD driver for no deterioration in the River Dikler.

Two unconstrained options were investigated for this need:

1. Increase the flow from Donnington Service Reservoir to Upper Swells WTW to account for reduction in licence to ensure no deterioration. This involves 1.84km of trunk main upsizing and upgrading of Stowell Park SPS
2. Provide the extra flow from the 14-inch main that supplies Donnington SR from Stowell Park. This involves a new 1.18km trunk main connection to Upper Swell and upgrading of Stowell Park SPS

Option 2 was discounted due to uncertainties on how the supply would affect the existing rising main, the higher construction complexity due to an under pressure connection and the increased number pf services diversions / land purchase.

Option 1 was progressed as the single feasible solution as it is easier to implement, is more resilient (due to gravity supply) and involves less maintenance costs.

	Units	Options
Long list / unconstrained	No.	2
Constrained	No.	1
Feasible	No.	1
Best value / preferred plan	No.	1
AMP8 Cost	(£m 2022-23)	3.1

Chinnor WTW and Reservoir – Cuttle Brook

A reduction to the Chinnor abstraction licence to meet recent actuals is proposed to meet requirements of the WFD driver for no deterioration in the WFD water body.

Two unconstrained options were investigated for this need:

1. Reduce the Chinnor abstraction licence by 1.41 Ml/d to meet recent actuals, requiring no capital investment.
2. Replace the Chinnor abstraction licence by an amount which would require capital investment.

Option 2 was discounted as this option requires capital investment, whereas Option 1 can meet the need with an Opex only solution.

	Units	Options
Long list / unconstrained	No.	2
Constrained	No.	1
Feasible	No.	1
Best value / preferred plan	No.	1
AMP8 Cost	(£m 2022-23)	0.002

Northern New River Wells – River Lee

The Northern New River Wells (NNRW) is a group of groundwater sources which abstract from the Chalk aquifer. To meet requirement of WFD no deterioration in the River Lee abstraction licence reductions are required.

Two unconstrained options were investigated for this need:

1. Reduce the NNRWs licenses aggregate total of 17.96 Ml/d
2. Replace the NNRWs licences aggregate total by an amount which would require capital investment.

Option 2 was discounted as this option requires capital investment, whereas Option 1 can meet the need with an Opex only solution.

	Units	Options
Long list / unconstrained	No.	2
Constrained	No.	1
Feasible	No.	1
Best value / preferred plan	No.	1
AMP8 Cost	(£m 2022-23)	0.002

Hornsey Bromate Reduction

This need is required to enhance bromate removal to achieve the TW target of 7.5µg/l following agreed reductions in the abstraction at New Gauge. This action is also a no-regret action in preparation for future (AMP9) actions in the area and unlock the opportunity for further abstraction reductions. These opportunities will be investigated by one of the WINEP investigations in AMP8.

Eight unconstrained options were investigated for this need:

1. Blending / partial reduced abstraction.
2. Ion exchange (IX).
3. Reverse osmosis (RO).
4. Catalytic GAC (cGAC).
5. Advanced reduction process.
6. UV Photolysis @190nm.
7. Zero Valent Iron.
8. Chemical reducing agent such as Ferrous Sulphate.

Options 2 and 3 were discounted as these options are not ready for implementation in AMP8. They would require significant Capex and therefore wouldn't be a 'no regrets' solution.

Options 5, 6, 7 and 8 are not considered proven technologies to address the drinking water quality requirements at this scale.

The preferred option for this need is a combination of Option 1 and Option 4 as it should allow the raw water bromate to be maintained below the target level of 7.5 µg/l. Enhanced bromate monitoring would

<table>
<tr><td></td><td>be included as part of this option to better understand the bromate levels in the groundwater and allow optimisation of the raw water blending. Option 4 is included both as a trial to refine the understanding of using cGAC in this context and to allow the operation of Hornsey WTW in a larger range of conditions, and therefore coupled with a larger investigation in the scale of requirements of cGAC in the long term, when more stringent reduction of abstraction in the area are expected. In this sense, the installation of cGAC is seen as a no-regret action, to unlock greater abstraction reductions in AMP9.

<table><tr><th></th><th>Units</th><th>Options</th></tr><tr><td>Long list / unconstrained</td><td>No.</td><td>8</td></tr><tr><td>Constrained</td><td>No.</td><td>2</td></tr><tr><td>Feasible</td><td>No.</td><td>2</td></tr><tr><td>Best value / preferred plan</td><td>No.</td><td>1 (with contingency)</td></tr><tr><td>AMP8 Cost</td><td>(£m 2022-23)</td><td>9.5</td></tr></table></td></tr>
<tr><td>Preferred plan</td><td>Our programme of abstraction reductions largely fall under the WFD no deterioration driver: Netley Mill, the Swells, NNRWs (Northern New River wells), and Chinnor. In the case of our Bradfield source, we have extended this to full closure of the source to address the catchment-wide requirement for no deterioration. The closure of Bradfield will ensure we have no abstractions remaining in the Pang catchment that adversely affect flows in the river.

We have also included a reduction at New Gauge which will be resource neutral because the water can be abstracted at our intakes lower on the River Lee. This scheme will need further treatment for bromate due to the lack of dilution provided by the New Gauge abstraction. We will also enter into a water resources agreement with the EA to allow us to increase abstraction if our London storage is at risk.

This combination of reductions represents a significant level of reductions but is a relatively lower cost programme than other options that could be progressed. The options have been costed by third party consultants based on assessment of several alternative solutions. We also plan for a significant programme of further investigations to inform our future environmental ambition as set out in our WRMP.

The investigations are necessary to confirm the need for further reductions requiring significant investment. The investigations are costed based on experience of previous investigations successfully delivered in previous AMPs.

It is vitally important to deliver these schemes in AMP8 as they are featured in our revised draft Water Resources Management Plan and so form the first step on the pathway to delivering our environmental</td></tr>
</table>

	destination in line with the Government's Plan for environmental improvement by 2050.
Direct Procurement (DPC)	Programme is below the 'DPC by default' value and has not been assessed. DPC is not deemed suitable.

Customer Insights: support for solutions for sustainable abstraction	• Support for this enhancement is high given the negligible bill impact and that customers recognise that 'protecting the environment' is a good thing and that chalk streams are rare. (PR24-16)
	• Most customers were impressed by the commitment to reduce water taken from sensitive sources by 80Ml/d, however, some put less importance on protecting sensitive sources and questioned where the additional 80Ml/d would come from. (PR24-16)
	• Some customers also highlighted the environmental impact of installing new trunk mains (PR24-16)
	• When presented with different Options of solutions for abstraction reduction, customers prefer a medium reduction scenario (230 million litres reduction per day, ~10% compared to current abstraction) as they believe the bill impact of high reduction (535 million litres per day) may be too costly. They believe this is the best option because it represents significant progress while being affordable. Options tested:
	  • Low reduction- 110 million litres per day, on 8 sources in Kent, London & Herts and 9 sources in Thames Valley, with bill increases of £5 in 2030-2035, £11 in 2036-2040, £17 by 2060.
	  • Medium reduction- 230 million litres per day, on 11 sources in Kent, London & Herts and 14 sources in Thames Valley, with bill increases of £10 in 2030-2035, £14 in 2036-2040, £24 by 2060.
	  • High reduction- 535 million litres per day, on 18 sources in Kent, London & Herts and 31 sources in Thames Valley, with bill increases of £12 in 2030-2035, £20 in 2036-2040, and £50 by 2060 (PR24-7).
	• Customer research has shown that 100% of the customers we asked were supportive of a bill impact of £2.50 or more (approximately £200m capex) during AMP8 in order to deliver environmental benefit. All of our customers told us that the natural environment is very important to them, and when we explained the issues associated with vulnerable catchments, they were keen that action should be taken.
	• Regarding longer term investments, most customers (61%) were supportive of a 'medium' scenario of future licence reductions, with bill increases of £10-24 over the longer term associated with enabling river health seen as acceptable. Customers raised the issue that

	future 'high' Environmental Destination scenarios could result in unaffordable bills for some customers. • Customer research has shown that most customers (68%) think that we should either be completely certain, or quite certain, that making sustainability reductions will deliver ecological benefits prior to making them. • When asked about their opinions on increasing bills to provide infrastructure solutions to enable abstraction reductions, customers initially responded positively towards the idea. However, when asked to balance priorities for investment in different areas of our business, our customers prioritised abstraction reductions much less highly, with replacement of trunk mains, increasing sewer capacity, replacing distributions mains, reducing river discharges, replacing lead pipes, and achieving net zero being prioritised more highly than making abstraction reductions. (PR24-7) • 51% of our customers agree with our aim to reduce abstraction on all of the areas proposed during 2025-2030 and they would accept a £5 increase in yearly bills. (PR24-7)

Customer insights: solutions for improving river health

5.129 The following customer insights were also gained relating to solutions to improve river health. This is relevant to all of the AMP8 categories, as well as wider WINEP drivers, as insights were gained prior to re-profiling of the WINEP programme into AMP9 and beyond. Insights are summarised below.

Insights: Improving River Health
• Almost all customers support Thames Water's plan to improve river health, with the majority accepting of the proposed timescales for achieving 'no river pollution' by 2050 given the current scale of the problem, as long as Thames Water are doing everything they can to expedite improving river health. (PR24-15) • In addition, some wanted this to happen before then and for Thames Water to implement partnerships in all catchments, where possible, by 2035. (PR24-15) • 'Working with partners' to improve river water quality in their area is the preferred option by all customer groups, as customers recognise there is a potentially greater chance of yielding the greatest environmental benefit, which customers interpret as 'higher water quality'. (PR24-15) • Customers support the roll-out of partnerships in catchment areas (3 to 14 by 2030 and 27 by 2035) because of the extra funding, resources and expertise gained, and additionally because it does not impact their bills (PR24-15) • However, as this is an untested approach in some areas of Thames Water's region, they feel this should be introduced gradually. Therefore, customers view Thames Water 'working alone' i.e., in areas it is responsible as a tried and tested approach, and a much-needed short term solution which could complement partnership working. (PR24-15) • A concern for some about Thames Water working alone were the uncertainty around associated bill impacts. (PR24-15)

- Despite the high cost, support for this enhancement (NEP Waste) is high, driven by media coverage of storm overflow discharges. Customers perceive the goal to reduce phosphorous entering rivers by 90% to be impressive, however, some felt this figure lacked credibility. (PR24-16)
- In the enhancement package options research, customers informed Thames Water that the goal to remove 90% phosphorous was the most impressive of all waste goals, with the overall goal felt to have positive implications for drinking water quality and an investment in the entire cycle. (PR24-12)

6. Cost efficiency

6.1 Please refer to TMS33 Capital Cost, Efficiency and Assurance for more detail on the historical cost efficiency benchmarking methodology, which has been applied to all categories.

6.2 Here is a deep dive example of how this methodology was applied for storm overflows costing.

Storm Overflow – cost efficiency

6.3 In this section, we cover the approach we have taken to arrive at our option costs and how we have considered the top-down efficiency of our proposed option for storm overflows.

6.4 Firstly, we set out the overall approach we have taken to developing our costs for this case. In section one, we describe in detail the bottom-up engineering costing. In section two, we demonstrate how we have challenged these bottom-up costs through the application of different operational efficiency levers. We describe the process we have followed and show how we arrived at our costs alongside the supporting evidence, calculations, and key assumptions.

6.5 We then set out how we have considered the cost efficiency of our proposed costs using an econometric benchmarking model in section three. We describe our approach and how this has informed the considerations Ofwat should make when assessing the cost efficiency of our Enhancement Case in Section 4.

6.6 In the final section, we provide a recommendation for how Ofwat should assess the cost efficiency of our proposed enhancement, taking specific factors into consideration.

How we arrived at our bottom-up engineering costing

6.7 In this section, we set out how we have applied our bottom-up approach. See section 5 above for how we selected sites.

6.8 We have used different methods to estimate credible and reasonable costs, adopting the most suitable method for each solution considered.

6.9 The tiered process of options development and assessment defined within the WINEP methodology requires us to consider alternative ways of achieving a given outcome, and different interventions which could be adopted. Testing different solutions means that we ensure that the option that we take forward is cost efficient and presents best value.

6.10 WINEP investment has historically been considered as ‘enhancement’ expenditure, although there are increasingly some overlaps with asset health, particularly when considering dealing with the consequences of excess flow in the system (overflows). We have only included investment that relates to new requirements to address storm overflows in this case, with separate investment plans to address capital maintenance root causes and infiltration.

6.11 Some solutions are also driven by growth, although they are distinct from the growth programme as the WINEP element will reflect either requirement changes dependent on STW size or prevention of deterioration within existing permit levels –

i.e., where we have sufficient capacity to accommodate growth within the current permit/asset capability, but this would cause river deterioration.

6.12 Costs for selected options were analysed using F909 and Asset Planning System (APS) data. The F909 data covering base cost[34], on-cost[35], complexity[36], and programme risk[37]. 832 F909s were produced for storm overflows overall. For areas not covered under F909s, composite models containing a series of engineering estimation system (EES) codes were used. Within our EES codes, a solution is broken down into its constituent parts to allow for cost estimation for each scheme, with new cost models developed to reflect the latest market information. This approach allows us to use our experience of delivering similar projects to estimate the cost of something new.

6.13 Catchment and nature-based solutions have been scrutinised, particularly where these only offer better value than conventional solutions by virtue of additional wider benefits.

6.14 Our bottom-up costing approach values storm overflow costs at £797 million (17/18 price base) excluding investigations (£68 million) and have gone through technical independent and external assurance.

6.15 We have made the following key assumptions in our bottom-costing approach:

- Storm overflow reduction drivers apply to *all* permitted storm overflows including Combined Sewer Overflows (CSOs) on the sewer network, storm discharges at pumping stations, inlet CSOs at sewage treatment works and storm tanks
- AMP8 targets (outlined in the guidance) are merely indicative and that the delivery of INV4[38] investigations programme is key to confirm the exact number of schemes eligible for improvement under the IMP2[39] driver, hence defining the AMP8 target
- There are 741 eligible storm overflows with a storm overflow discharge duration in 2020 of 243,937 hours
- The potential of a storm overflow to cause 'adverse ecological harm' is largely based on discharge frequency/duration; if a storm overflow discharges less than 1% of the time, then we assumed it has a low likelihood of causing adverse ecological harm

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[34] Base cost includes labour, plant, materials, sub-contract cost.

[35] On-cost includes contractor costs, Thames Water costs i.e., other project costs (OPC), design and procurement timesheet (DPT) and risk at 5%.

[36] Complexity covers design maturity and ranges depending on default or designer's view. Some smaller 'PE' schemes were adjusted to use only 20%.

[37] A further 20% overlay allows for scope risk (i.e. uncertainties in guidance, scope, cost models and targets).

[38] Investigations to reduce storm overflow discharges to protect the Environment so that they have no local adverse ecological impact.

[39] Improvements to reduce storm overflows discharges to protect the Environment so that they have no local adverse ecological impact.

How we have challenged our proposed costs

6.16 We have considered seven efficiency levers in defining our enhancement costs. For this specific Enhancement Case, the application of each lever is summarised in Table 6-1.

Table 6-1 - Efficiency Lever Opportunities

Efficiency Lever	Opportunity
1. Asset Standards	Zero
2. Programme Optimisation	Low
3. Solution Optimisation	High
4. Productisation / Standardisation	Low
5. Strategic Procurement	Low
6. Innovation	Low
7. Digital & Data	Low

Cost efficiency – tiered options development and assessment process

6.17 The tiered process of options development and assessment defined within the WINEP methodology requires us to consider alternative ways of achieving a given outcome, and different interventions which could be adopted. Testing different solutions means that we ensure that the option that we take forward is cost efficient and presents best value.

Cost adjustment

6.18 WINEP investment has historically been considered as 'enhancement' expenditure although there are increasingly some overlaps with asset health, particularly when considering dealing with the consequences of excess flow in the system (discharges). We have only included investment that relates to new requirements to address storm overflows in this case, with separate investment plans to address capital maintenance root causes.

Our approach to determine cost efficiency for storm overflows

6.19 Using the approach set out in the Cost Efficiency Technical Appendix, we have reviewed this Enhancement Case against each of the criteria to determine whether we could undertake benchmarking modelling, unit cost assessment, or demonstrate efficiency through our bottom-up engineering estimates.

6.20 We have considered the most appropriate approach to assess efficiency of storm overflows expenditure is a benchmarking model, using the framework set out in section 7 of the Cost Efficiency Technical Appendix. Ofwat used a benchmarking model in PR19 and, based on the data requested by Ofwat as part of the PR24 business plans data submission, we expect Ofwat to use a similar approach.

6.21 However, we urge Ofwat not to roll over the PR19 models for the following reasons:

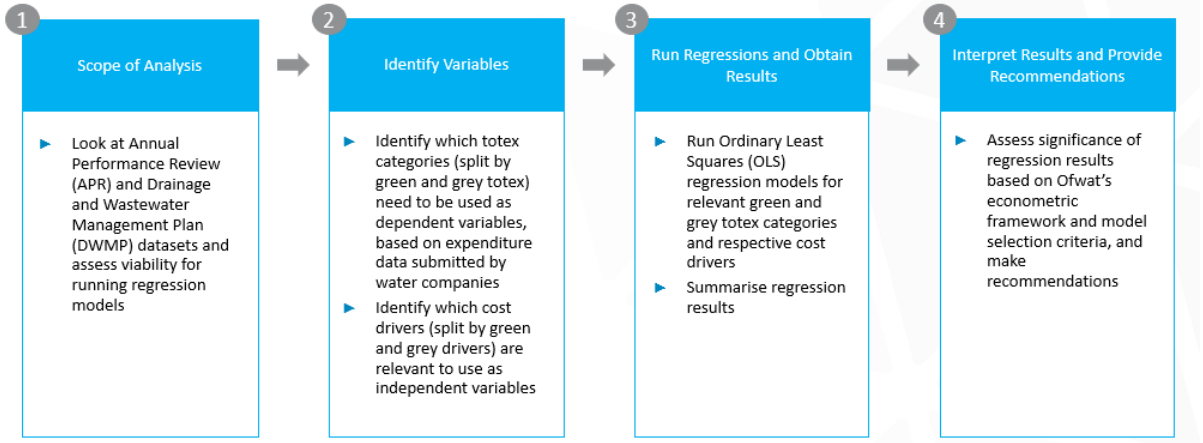
- The PR19 models did not differentiate between totex related to green and grey schemes. The requirements of such schemes differ significantly, given their specific costs and requirements. Ofwat has already recognised this and has re-

designed the business plan tables to differentiate between these costs categories. Hence, we strongly encourage Ofwat to assess in detail the disaggregated information on costs and costs drivers that will be provided by companies in their business plans.

- The PR19 models in their current form do not adequately capture the new requirements set by Ofwat in the draft methodology. The regulations around combined sewer overflows (CSOs) have changed from PR19 to PR24. They now focus on CSO discharges per location, whereas previously, the CSO discharges were counted on aggregate. This has the effect of restricting the ability of companies to optimise their enhancement projects across all CSO locations, and thus can increase costs.

6.22 Figure 6-1Figure 6-1 below displays the different stages we have followed for a top-down assessment. Each stage is explained in detail below.

Figure 6-1 - Top-down costing approach



6.23 Scope of analysis: We have assessed the following data sources to form our recommendations to Ofwat:

- A benchmark analysis based on 2020-22 APR data: we found 2020-22 APR data is not suitable for modelling purposes and recommend that Ofwat not use the actual data for the following reasons:
  - There has been a structural break on the data in 2020-21 where more disaggregated costs data has been requested to companies. This makes the historical data (2011-12 to 2021-22) not comparable across time, which could produce misleading results
  - Pre-2020-21 expenditure is based on different requirements set by Ofwat and the EA. Hence, using this data will not adequately identify companies' efficient costs
  - Most companies will start their sewer overflows projects in the middle of the AMP. Hence, most companies report close-to-zero costs in their 2020-22 APR data. This makes these data not suitable for econometric benchmarking analysis

- Therefore, we conducted a benchmark analysis based on the drainage and wastewater management plans (DWMPs) published in early June this year. This data allows developing more aligned models to PR24 statutory requirements.

6.24 Identifying variables: In their DWMP data, companies have provided, amongst other information, the expected expenditure on sewer overflows relating to both grey and green schemes alongside relevant costs drivers. The information is also disaggregated for storage and volume required in the network, and in the sewage treatment works (STW). It is also important to note here that Ofwat may include additional cost drivers in their benchmarking model, based on the future cost data requested by them. There is risk here of variable data quality, data that is not assured, and spurious data undermining the credibility of models.

6.25 Run regressions and obtain results: We have run different benchmarking models (regressions) using the costs and costs drivers explained above.

6.26 Interpret results and provide recommendations: we have formulated our recommendations based on Ofwat's econometric framework criteria: coefficients, R squared and range of efficiency scores. If a model reports a coefficient with a sign in the opposite direction of what it is expected from an economics and engineering reasoning, then the model is removed automatically from our list of recommended models. Based on our evaluation, described above, we have identified some models that Ofwat could use to assess costs, as shown in Table 6-2 below.

Table 6-2 - model specifications to assess storm overflows costs

Benchmark on DWMP industry	
Costs	**Models and Drivers**
Grey Network Storage	Model 1 - Additional grey storage / containment volume to be delivered in the network Model 2 - The number of individual schemes in the network for grey schemes
Grey WwTW storage	Model 1 - Additional grey storage volume required at WwTW Model 2 - The number of individual schemes in WwTW for grey schemes
Green Network Storage	Model 1 - Permeable area inflow removed from entering the network or stored in environment Model 2 - The number of individual schemes in the network for green schemes
Green WwTW Storage	Model 1 - The number of individual schemes in WwTW for green schemes

Further considerations Ofwat should make when setting our efficient costs

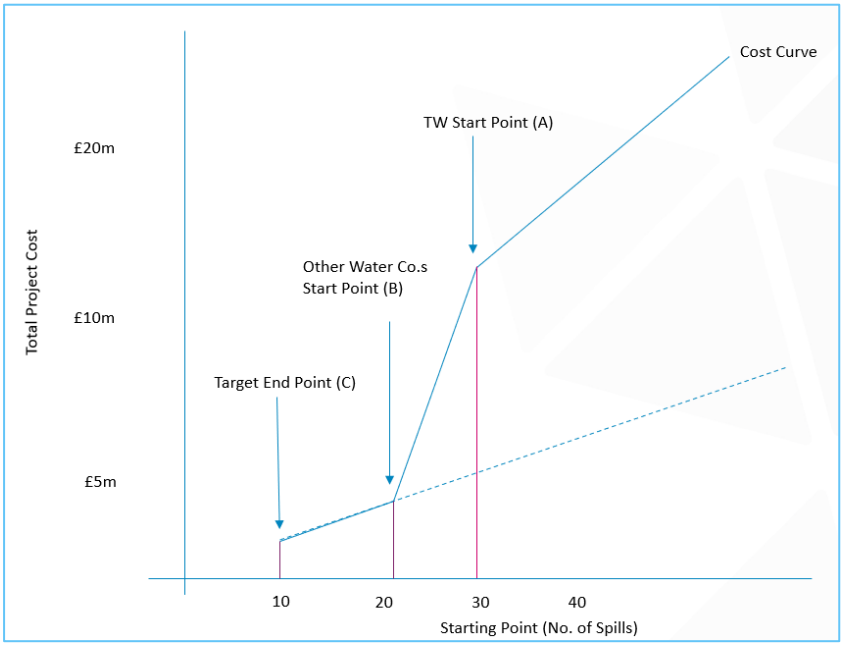
6.27 The following factors, which our outside our management controls, should be taken into consideration by Ofwat when reviewing results from the econometric benchmarking model and setting efficient costs:

- London costs: We face higher labour and logistics costs due to our operations in London. Additionally, green solutions are proven to be more resilient in the future, however they require to be delivered in public and currently constructed

spaced, and hence driving the need to purchase land, which is expensive and extremely more expensive than other areas in the Country

- Proportion of storm overflow sites: We have a higher proportion of STW sites compared to most other water companies. It is more expensive to fix storm overflows at STWs compared to networks, hence adding to our increased costs
- High-priority sites: We have approximately 454 sites deemed as 'high-priority sites', which constitutes around 80% of total selectable sites. Whilst the requirements for these sites will be only defined after the completion of the investigations, it is likely the storm overflows reduction requirements will be more stringent than the basic requirements for non 'high-priority sites'. Our proportion of high-priority sites is greater than most other water companies, leading to us incurring above average costs at these sites. Our AMP8 programme constitutes only of 'high-priority sites'
- Disparate group of sites: Most of our sites are wide-spread, making it complex to aggregate them to stem storm overflows and achieve economies of scale
- Number of discharges per site: We have an average of 30 discharges annually per STW sites, whereas most other water companies have around 20 discharges annually per site. Reducing from 30 to 20 discharges is generally quite expensive due to uncertainty around which solutions to deploy and the need to empty existing storage. However, costs are cheaper from 20 discharges onwards as the solutions are straightforward and generally involve building additional storage. Figure 6-2 below exemplifies this:

Figure 6-2 - Total costs to reduce discharges annually



6.28 The incremental cost of deploying solutions is linear when reducing annually up to 20 discharges. Nevertheless, these costs increase exponentially when reducing from 20 discharges onwards. The dotted line demonstrates how total project costs

would have looked like had costs remained linear regardless of the number of discharges annually.

6.29 Assuming that our start point is typically 30 discharges annually per site (point A) and our target is 10 discharges annually per site, then the total cost we incur is the area under the cost curve between point A and point C. This is considerably higher than the total cost incurred by other water companies whose starting point, on average, would be 20 discharges annually per site at point B. The total cost they incur is the area under the cost curve between point B and point C.

6.30 If Ofwat were to develop a variable (current discharge to target discharge) to include as a cost driver in their econometric benchmarking model, they should include a squared term to account for the non-linear relationship between costs and number of discharges.

6.31 We also identified issues with the DWMP dataset:

- Expenditure related to green schemes in wastewater: We didn't identify reported expenditure related to green schemes in wastewater treatment works for three companies
- DWMP data: Not all cost elements are adequately captured in the DWMP dataset

Our recommendation

6.32 We recommend that Ofwat take account of the factors outlined above that are outside management control and involve data quality issues either by:

- Making an explicit modelling adjustment to account for non-linear variables in the model, as the current benchmarking model is linear and aggregated across all water companies
- Making a specific non-modelling adjustment that accounts for the factors listed in the previous section by considering additional cost adjustments to the hypothetical allowance produced by the benchmarking model

7. Customer protection

Establishing the necessary mechanisms to ensure customers are protected.

7.1 The investment in this plan reflects the final programme requirements agreed with the Environment Agency and Natural England. As such, the investment need is certain and we will need to achieve the outcome by the regulatory date listed on the WINEP.

7.2 There is inherent uncertainty around some solutions that will be put forward in terms of both cost and the ability to achieve the target outcome. Solutions that have a higher cost/outcome risk include:

- Catchment and nature-based solutions
- Measures to address storm overflows (data evidence is at low maturity)
- Solutions to achieve STW permit limits at the limit of technology
- Solutions to achieve chemical standards
- River quality monitoring schemes where we do not own the land to install the equipment on and have no statutory powers to compel landowners to sell

7.3 There are also risks that new environmental obligations arise within period that we are required to deliver, but without associated funding. Historically adjustment mechanisms have existed to protect both customers and companies, however the draft methodology has only a one-way adjustment associated with the Price Control Deliverable (PCD). This will protect customers if the need falls away.

Performance Commitments and PCDs

7.4 Our ambitions will principally be demonstrated and tracked through the storm overflow common Performance Commitments, and the proposed PCD below.

- Storm Overflows are protected through a PCD, combining the PCDWW4 & PCDWW5 proposed Ofwat groupings. This PCD is described below
- Low Flow Alleviation costs are in PCDW8, however the totals do not meet the 1% materiality threshold and no PCD is not proposed
- Bathing Waters costs allocated to the CWW3.88 data table line does not pass the 1% materiality threshold, so no PCD is proposed

Storm Overflows PCD

7.5 We propose a price control deliverable for the cumulative number of schemes, sized small, medium, large and very large.

7.6 The PCD will cover the data table line items for storm overflow PCDWW4 & PCDWW5. PCDWW6 (Storm overflow screens) does not pass the 1% materiality threshold and is therefore not included in this PCD.

Table 7-1 - Storm Overflows PCD – delivery expectations

Scheme delivery expectations	
Description	Reducing storm overflow discharges that impact watercourses, with an approach to incorporate nature-based solutions. The company will deliver enhancement to a combination of small, medium, large and very large schemes, with a cumulative total of 107 actions.
Output measurement and reporting	The cumulative number of schemes enhanced, reported to zero decimal places. The delivery of outputs will be monitored and reported through the APR process.
Conditions on scheme	The company will deliver the storm overflow schemes set out in the WINEP. Any scheme substitutions will be agreed with the EA through a revised WINEP to prioritise assets that have high environmental impact.
Assurance	The company must commission an independent, third-party assurer to assure, to our satisfaction, that the above conditions have been met and the outputs of the scheme set out above have been delivered.

7.7 We propose the deliverable outputs as the number of sites delivered against the following deliverables forecast. While the regulatory output is set for the end of the period, we have set a profile to allow us to complete our investigations before proceeding with solution development. Annex A sets out the action size per WINEP action for storm overflow improvements.

7.8 We have set out forecast deliverables for the storm overflow programme in Table 7-2 below, matching the regulatory delivery date set out in the WINEP. We will aim to deliver some of these schemes in earlier years to deliver our Storm Overflow Performance Commitment forecast profile, although until the investigations complete in Year 2, it is not possible to determine which outputs can be delivered in Years 3 and 4.

Table 7-2 - Forecast deliverables

Scheme size	Unit	Forecast deliverables				
		2025/26	2026/27	2027/28	2028/29	2029/30
Small schemes (£0-£3m)	Number					12
Medium schemes (>£3m-£5m)	Number					53
Large schemes (>£5m-£10m)	Number					19
Very large schemes (>£10m)	Number					23
Total (all schemes)	Number					107

PCD payment

7.9 We reviewed Ofwat's guidance on whether consider an average unit cost or a named list of each site and associated unit cost. We reviewed our costs and distribution across our sites and considered it appropriate allocate our schemes across four cost categories. We adopted this approach for our phosphorus sites as part of the AMP7 WINEP uncertainty mechanism.

7.10 We propose to calculate our end of period PCD payment rate based on an average cost for each scheme category:

Table 7-3 - PCD payment

PCD payment unit	Average unit cost per scheme (£m)
£m per small scheme (£0-£3m)	1.8
£m per medium scheme (>£3m-£5m)	4.2
£m per large scheme (>£5m-£10m)	6.4
£m per very large scheme (>£10m)	19.4

7.11 We propose the PCD payment should be calculated from the difference between cumulative forecast for storm overflow schemes and the cumulative actual schemes delivered for AMP8.

ODI Impacts

7.12 There is an estimated improvement in performance in AMP8 as a result of the number of schemes in this case.

7.13 The common Performance Commitment is expected to be based on average discharges per year per asset (total number of discharges divided by total number of discharging assets).

7.14 Our current performance is lower than Ofwat's expectations of an average of 20 discharges by the end of AMP7, however this is largely due to 2022 being a dry year. We are also anticipating that there will be a material increase in the number of assets being monitored as unpermitted CSOs have EDMs installed. Our investment is forecast to achieve an end of AMP8 position of an average of ~16 discharges per asset on a wet year.

Table 7-4 - Forecast incremental benefits

Performance Commitment impacted	Unit	Baseline	Forecast benefits				
		2024/25	2025/26	2026/27	2027/28	2028/29	2029/30
Average discharges per year	Number	1.25	1.27	1.2	0.33	1.12	2.71

7.15 We do not propose a bespoke Performance Commitment on the basis that such a Performance Commitment would likely double-count performance against the above common Performance Commitments.

Time Incentive (TI)

7.16 We note that the ODI impacts from this case below the 3.5% threshold and therefore no additional time incentive payment is required.

7.17 For annualised customer protection for late delivery, we propose a time incentive payment rate based average cost per scheme:

Table 7-5 - Time Incentive payment rate

TI payment unit	Calculation (PCD payment * 3.5%)	TI payment (£m/yr)
£m per scheme/yr	£810.099 m ÷ 107 x 3.5%	0.265

7.18 We propose the time incentive payment should be calculated from the difference between forecast deliverable and actual deliverable.

7.19 Where schemes are delayed due to agreement with the EA via a revised WINEP, these schemes should not be subject to the delay incentive.

8. Adaptive Planning

8.1 Adaptive planning provides a framework for exploring how sensitive a plan may be to alternative scenarios, risks and uncertainties, to ensure that the plan is flexible and resilient to different futures. The approach identifies where thresholds and trigger points for alternative adaptive pathways exist, providing the basis for monitoring and review of the strategy and interventions, mitigating the risk that short-term decision making might reduce or jeopardise choices in the future.

8.2 Adaptive pathways provide clarity on the decisions that may need to be taken to address future uncertainties, and agility/flexibility to the latest data; for example, climate science, population growth, or understanding and innovation in the range and type of options that may be deployed. This avoids the risk of being 'locked-in' to specific inflexible solutions and helps communicate and make more timely decisions on investment.

8.3 Adaptive planning is central to Ofwat's Long Term Delivery Strategy (LTDS) guidance. We have followed this guidance by prioritising no or low regret activities, demonstrating the benefits of planned investment against future uncertainties and risks; and deferring investment until the benefits are more certain. Our approach to adaptive pathway planning has considered:

- A range of plausible futures
- A broad range of feasible solutions that could be deployed to meet the future scenarios
- Thresholds and trigger points that determine alternative decisions or pathways
- A framework for monitoring against those thresholds and trigger points
- Those solutions that are common to all futures and which may form the core of the strategy formulation
- The range of alternative decisions or pathways and the potential trade-offs and risks of investing in emerging options sooner or later

Adaptive Planning and the WINEP

8.4 The regulatory timeframe for each WINEP action is shown in . Due to these timeframes, adaptive pathways were not required for the majority of the actions. As such, we focused on phosphorus reduction in rivers and storm overflows where delivery is longer-term with objectives to be achieved by 2037 and 2050 respectively.

Table 8-1 - WINEP action regulatory timeframes

Action	AMP8	AMP9	AMP10	AMP11	AMP12
Phosphorus reduction in rivers					
Ammonia & BOD reduction in rivers					
Storm overflows					
New monitoring equipment					
Reducing chemicals in discharges					
Investigations / CIP / N-TAL / Microplastics					
Bathing waters					
Drinking water protected areas					
Water resources (addressing low river flows / fish / river restoration)					
INNS / Biodiversity / SSSI / Habitats / Eels					
Rethinking Rivers					

8.5 We initially discounted most WINEP actions as they all needed full implementation within AMP8 and/or were too small scale to warrant development of adaptive pathways. After the majority of the programme was rephased we revisited this decision but concluded that the completion of delivery within AMP9 means that the scenarios being tested would have no or little impact on the programme.

8.6 We tested our storm overflows plan against scenarios for climate change, growth / demand and technology.

8.7 We tested our phosphorus reduction in rivers plan against scenarios for climate change and technology.

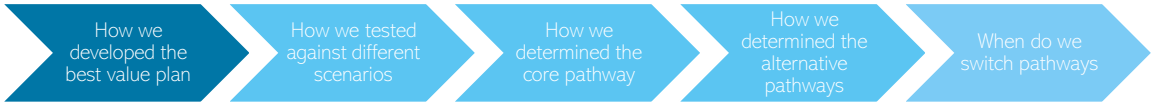
Storm Overflows

8.8 The WINEP proposals for storm overflow improvements in this Enhancement Case focus on the AMP8 programme. The longer-term programme of actions to 2050 have been taken from our Drainage and Wastewater Management Plans. The DWMP plan was aligned to our initial storm overflow programme for AMP8, established in January 2023. Through the WINEP development process, we have refined and updated our plans for improving storm overflows. Consequently, the two programmes, while similar, do not fully align. However, the DWMP programme is still suitable for testing long-term scenarios and the assessment outputs are still applicable for testing the solutions we have put forward in this plan and the longer-term investment necessary.

8.9 The chevron graphic below shows how we have structured our narrative on adaptive planning. Full details can be found in Appendix G[40] of our DWMP.

[40] *DWMP – Appendix G: Adaptive Pathway Planning*

How we developed the best value plan



8.10 A best value plan is described as one that, 'considers factors alongside economic cost and seeks to achieve an outcome that increases the overall benefit to customers, the wider environment and society'[41]. We utilised this approach in developing our optioneering stage via the DWMP framework.

8.11 A best value approach can differ from cost-benefit analysis as it can consider broader range of factors, rather than just cost and monetised benefit. Some wider benefit factors cannot always be monetised with sufficient robustness, including natural capital, biodiversity enhancement and wellbeing; hence the best value assessment is based on a benefit scoring system. The selection of a best value plan takes into consideration many competing factors, opinions and influences, e.g., encompassing technical, environmental, social and economic aspects. A full account is provided in our DWMP Optioneering Technical Appendix[42] .

8.12 The full storm overflow enhancement programme comprises detailed plans for AMP8 made following WINEP guidance (as set out in previous sections of this document) and long-term plans following DWMP processes.

8.13 The DWMP also defines our investment to reduce sewer flooding and to maintain compliance at sewage treatment works in accordance with current applicable standards.

8.14 Our preferred plan is based on the most likely growth/demand and climate change forecasts in the near term.

8.15 The modular design of sewage treatment works upgrades and the small to medium, dispersed nature of network solutions (with surface water management being considered first) make the plan easy to adapt. There is no reliance on single locality, large infrastructure solutions that risk being stranded assets if forecasts don't materialise.

8.16 The regular monitoring using leading (e.g., system capacity) and lagging measures (e.g., system performance) will ensure we can change the plan at the most appropriate point in time.

8.17 The key aspects of our best value plan are:

- We assume that full compliance with current permits will be achieved, and shortfalls will be addressed by capital maintenance expenditure under base
- We have included a wider range of benefits in our assessment of best value options including; wellbeing, carbon, biodiversity, greenhouse gas emissions and traffic disruption

[41] *Water Resources Planning Guidelines*

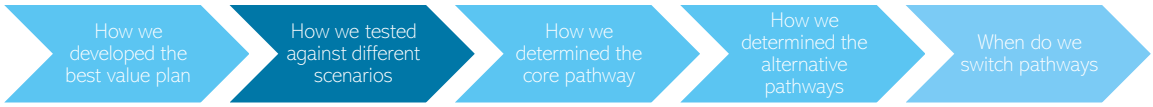
[42] *DWMP Technical Appendix: Options Development and Appraisal*

- We have selected a plan that scores highest in our value criteria framework used in DWMP and in the near term the optimum in our public value framework
- Our best value plan includes improvements to 107 locations in AMP8

Table 8-2 - Best value pathway

Storm Overflows	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050	Total
Totex (£m)	815.2	2529.2	4099.2	3774.8	2255.0	13,473
% of high priority site storm overflows improved	38%	75%	87%	100%	100%	100%
% of total storm overflows improved	14%	28%	52%	76%	100%	100%

How we tested against different scenarios



8.18 We followed Ofwat's LTDS guidance by considering 'common reference scenarios' to test against our preferred plan. The common reference scenarios are a set of benign and adverse scenarios covering four material drivers of uncertainty (climate change, technology, demand / population growth and abstraction reductions).

8.19 Table 8-3 below summarises how we defined the forecast for the different scenarios. For climate change our best value plan assumes a benign/low scenario and low global emissions. Our demand forecasts for solutions that reduce storm overflow discharges are closer to the adverse/high scenario than the benign/low scenario. Regarding the technology forecast, our best value plan assumes an adverse/high scenario and slower technological improvements.

8.20 We tested our storm overflow plan against different scenarios for climate change, growth and technology (e.g., monitoring and smart meter penetration) in line with Ofwat's requirements. The table below shows the sensitivity of our storm overflows investment to different future scenarios.

Table 8-3 - Common reference scenarios[43]

Common reference scenarios		Reducing Storm Overflow discharges
Climate change	High (Adverse)	Latest climate change tools used to create annual rainfall representative of a high global emissions scenario. Adverse climate change driver of uncertainty: UKCP18 probabilistic projections, RCP8.5, 50th percentile probability level.
	Low (Benign)	Our preferred plan is representative of a benign scenario; no changes required. Benign climate change driver of uncertainty: UKCP18 probabilistic projections, RCP2.6, 50th percentile probability level.
Demand	High (Adverse) and Low (Benign)	Forecasts used: • Local Plan: the use of forecasts based on Local Plan data, as prepared by the Local Planning Authority • Office of National Statistics: the use of forecasts derived by the Office of National Statistics, which are based on extrapolation of historical trends When considering the preferred plan at a company-wide level, Local Plan forecasts provide a high (adverse) scenario, but when considering at a catchment level, the opposite may be true. We separately assessed every catchment against Local Plan and Office for National Statistics forecasts, to create a new adverse (high) or benign (low) forecast, depending on which forecast was used in our Best Value plan.
Technology	Faster and slower	We compared the forecasts in our best value plan for a large sample of catchments, against forecasts representative of the definitions for adverse and benign scenarios in the LTDS guidance (arising from variation in the extent of smart water meters installed in properties). From this analysis, we created a new adverse (high) or benign (low) forecast for all catchments, depending on which forecast was used in our preferred plan.

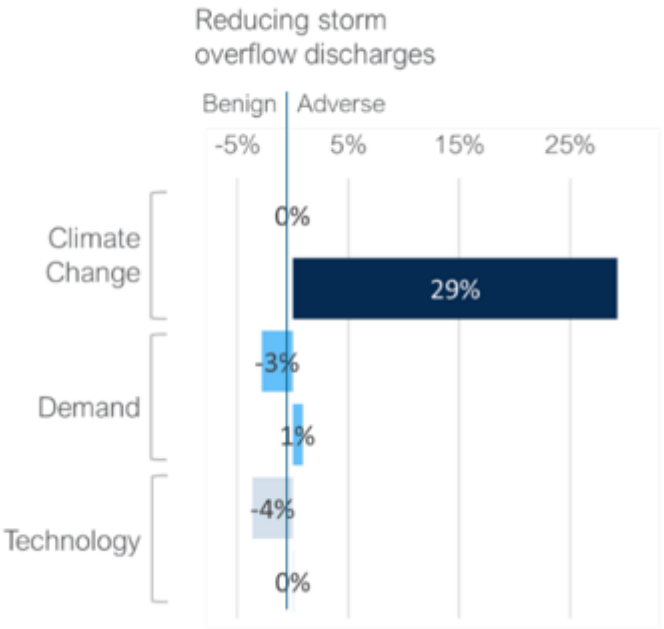
[43] *DWMP Appendix G: Adaptive Planning (Table 4-2, page 26)*

Common reference scenarios		Reducing Storm Overflow discharges
Abstraction reductions	N/A	Deemed to have a negligible impact on our solutions that reduced the number of storm overflow discharges.

Table 8-4 - Storm overflow scenarios - Totex

Solution type	Unit	Planning period	Best value plan	Climate change benign 2040	Climate change adverse 2040	Climate change benign 2045	Climate change adverse 2045
Total cost	£bn	2025 - 2050	13.5	13.0	17.0	13.0	17.0

Figure 8-1 - Impact on investment to 2050 in reducing storm overflow changes under different scenarios



8.21 We tested the climate change scenarios against our solutions designed to reduce the number of storm overflow discharges.

8.22 The adverse climate change scenario has the most significant cost impact on our solutions for addressing storm overflow discharges. This is because rainfall has the biggest impact on hydraulic deficit.

8.23 Demand and technology scenarios show a significantly lower impact compared to climate change scenarios. This is because the timing and scale of solutions in our preferred plan is driven primarily by future storm overflow discharge volumes. These will be significantly impacted by rainfall under future climate change scenarios. This significantly outweighs the potential impact of future demand and technology scenarios on wastewater generated by our customers.

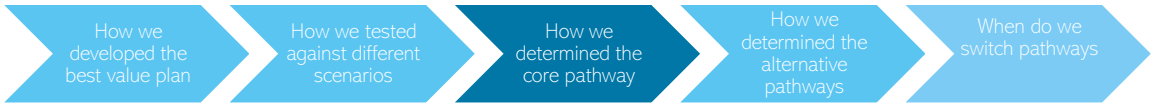
8.24 Considering the definition of the technology scenario from the Ofwat LTDS guidance, the one aspect that has a material impact on the solutions in our preferred plan is for full smart water meter penetration by 2035, as opposed to 2045. This will create different scenarios for wastewater that is generated from the properties served by our sewer network (as the installation of a smart water meter is likely to change water usage, which in turn changes the amount of wastewater that drains to our sewer network).

8.25 The following key observations are made for each of the solution types:

- Surface water management (hectares managed): There is limited variation when our preferred plan is compared to the pathways arising from the common reference scenarios. When devising our preferred plan, we have included what we consider to be the maximum achievable implementation of surface water management in London. Therefore, other solution types will increase in number and scale, for scenarios that require an increase when compared to our preferred plan. We have also prioritised surface water management over network improvements when considering any reductions (i.e., associated with benign pathways). Therefore, the limited variation arises from a change in the scale of our preferred plan in the Thames Valley and Home Counties planning area
- Network improvements (storage, 000s of m^3): This solution type has significant increases for the climate change adverse scenario, largely associated with increases required to achieve our storm overflow targets, as our preferred plan represents the benign scenario
- Network improvements (new sewers, km): Noting there are constraints placed on other solution types (e.g., surface water management and sewer lining), and our package of investment to address storm overflow discharges is largely comprised of surface water management and network improvements by providing storage, variation in this solution type is largely associated with the package of investments to protect properties from sewer flooding, across the scenarios tested
- Storage at sewage treatment works (storage, 000's of m^3): This solution type has significant increases for the climate change adverse scenario, associated with increases required to achieve our storm overflow discharge targets, noting that our preferred plan represents the benign scenario
- Sewer lining (km): When developing our sewer lining programme, we used a targeted approach to identify the sewers that are most impacted by groundwater. The package of investments was not altered as the demand and technology scenarios do not affect groundwater, although we expect technology

to improve our understanding of the risk of groundwater flooding. Advances in technology, generating efficiencies when implementing our ambitious sewer lining programme, is assumed/implicit. Further work is required to understand and quantify the impact climate change may have on the rate at which groundwater is recharged (and the resulting impact on our networks). We will explore this in cycle 2. Besides addressing groundwater ingress into our network, our sewer lining programme will have a benefit where there is a risk of exfiltration from our networks to groundwater

How we determined the core pathway



8.26 Based on the results of our testing of the preferred plan against common reference scenarios, we then determined a range of plausible futures. Each common reference scenario represents a 'plausible extreme' However, if combined, they would represent a very low probability scenario. Therefore, when assessing the range of plausible futures, we avoided combining high or low drivers of uncertainty. This aligns with LTDS guidance.

8.27 We used the same approach to identify a 'core adaptive pathway'. This is a pathway that drives a programme of no and low regret investments, as per LTDS guidance.

Table 8-5 - Comparing the best value plan to the core pathway

Preferred solution type	Unit	Planning horizon	Best value	Needed in all scenarios	Needed in most scenarios	Needed in the short term	Core pathway
Reducing storm overflow discharges							
Surface Water Management	Hectares managed	2025-2030	57	Yes		Yes	57
		2030-2035	20	Yes			20
		2035-2040	360	Yes			360
		2040-2045	190	Yes			190
		2045-2050	470	Yes			470
Network Improvements (storage)	000's of m3	2025-2030	77	Yes		Yes	77
		2030-2035	1,448		Yes		1,445
		2035-2040	1,574		Yes		1,545
		2040-2045	1,391		Yes		1,332
		2045-2050	311		Yes		222
Network Improvements (new sewers)	Km	2035-2040	4	Yes			4
		2045-2050	10		Yes		7
Storage at STWs	000's of m3	2025-2030	670	Yes		Yes	670
		2030-2035	289		Yes		289
		2035-2040	481		Yes		473
		2040-2045	621		Yes		570

		2045-2050	15		Yes		11
Sewer Lining	Km	All	661	Yes		Yes	661
Total cost	£bn		13.5				13.0

Key

The scope (and cost) of solutions are the same or more than the preferred plan
The scope (and cost) of solutions are less than the preferred plan

8.28 We have combined different climate change and population growth forecasts to determine realistic best (core) and worst case (adverse) future pathways as defined by Ofwat. Our preferred plan in the near term tracks the core pathway. This pathway sets out the lowest requirement and, therefore, drives a programme of no- and low-regret investments, including investment in monitoring, investigations and other activities to ensure other options can be efficiently implemented should the need to switch pathways arise in the future. Therefore, our preferred plan can be considered a no-regrets plan as it is based on the most certain climate change and population growth forecasts.

8.29 Beyond 2040, significant climate change uplifts are forecast, and our preferred plan tracks a central position between the core and adverse forecasts. This enables us to more easily accelerate or decelerate the pace of the plan, retaining flexibility.

How we determined the alternative pathways

How we developed the best value plan | How we tested against different scenarios | How we determined the core pathway | **How we determined the alternative pathways** | When do we switch pathways

8.30 Having established our best value plan and core pathway we developed and tested alternative pathways that meet our long-term ambition over a range of plausible futures.

8.31 The most adverse pathway was assessed using the adverse climate change scenario, adjusted to reflect a central forecast for the demand and technology scenarios.

8.32 The adverse climate change scenario has the most significant impact on our solutions for reducing storm overflow discharges (a 26% increase).

8.33 Demand and technology scenarios show a significantly lower impact compared to climate change scenarios. This is because the timing and scale of solutions in our preferred plan is driven primarily by storm overflow discharge volumes which are significantly impacted by rainfall under future climate change scenarios. This significantly outweighs the potential impact of future demand and technology scenarios on wastewater generated by our customers.

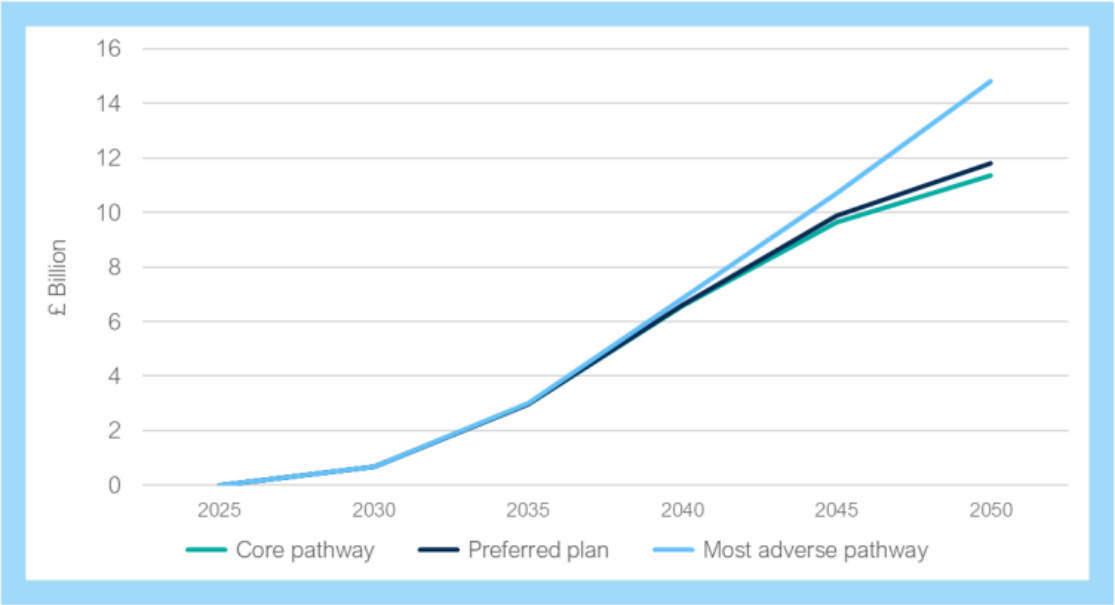
When do we switch pathways?

How we developed the best value plan | How we tested against different scenarios | How we determined the core pathway | How we determined the alternative pathways | **When do we switch pathways**

8.34 As climate change forecasts drive most change to the best value plan, these forecasts drive a switch to a different pathway. There are no specific one-off 'hard'

triggers for considering moving to an alternative pathway. Rather, what will put us onto a different path is the emergence of evidence about the impact of climate change on rainfall intensity. It is future changes in planning forecasts, particularly late in the planning period which will determine whether we need to move to different pathway.

Figure 8-2 - Preferred plan cumulative cost compared to the core and more adverse pathways.[44]



8.35 Figure 8-2 shows that there is little difference between the overall cost up to 2040 following any pathway; the departure in investment to address future drivers of uncertainty occurs between 2040 and 2050, principally due to significant divergence in the forecasts for climate change scenarios.

8.36 Therefore, the forecast for climate change might drive a switch to a different pathway. We expect similar forecasts in the near term but in 15 years the forecast might diverge, meaning 2035-2040 is taken as the planning period when we need to decide whether to follow a new pathway (starting at 2040) or remain on the preferred plan pathway.

8.37 Similar decisions will be required during the following planning period (2040-2045), depending on the pathway taken during the previous planning period. The planning forecast at that time will provide the evidence as to whether the best course of action is to:

- Switch to the most adverse pathway
- Remain on the preferred plan pathway
- Switch to the core pathway

8.38 Further pathways between these ranges can be considered, both ahead of and beyond the 2040 'trigger point'. These have not been subsequently considered in

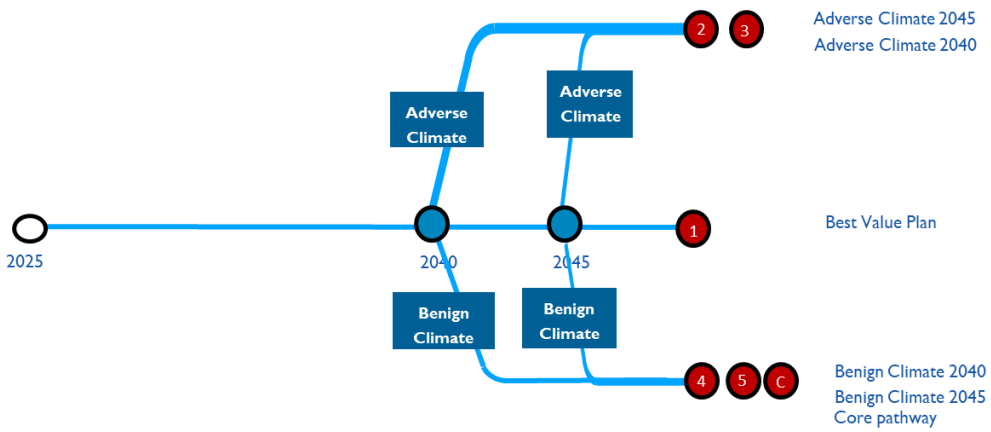
[44] *DWMP Appendix G: Adaptive Planning (Fig 5-1, page 46)*

this document to avoid the complexity of multiple decision points (which will result in many alternative pathways).

8.39 Based on the above we have identified four alternative pathways to the preferred plan:

- Switch from the preferred plan to the most adverse pathway in 2040
- Switch from the preferred plan to the core pathway in 2040
- Switch from the preferred plan to the most adverse pathway in 2045
- Switch from the preferred plan to the core pathway in 2045

Figure 8-3 - Alternative pathways diagram[45]



8.40 In summary, adaptive planning for our storm overflow improvement investment will largely be driven by climate change outcomes, with the most impact in the last decade of the planning period. In response, we may have to adjust our long-term plans as volumes increase. This may include additional storage at treatment works and/or in the network, or alternative actions such as increasing flow to full treatment or development of wetland solutions to accommodate the additional flow. Our increasing network of intelligent monitoring points will allow us to identify catchment wide trigger points for investment. The trigger points will relate to the reduction of system capacity relative to our performance objective target. For example, when the peak water levels exceed a risk-based threshold then an investment decision will be required.

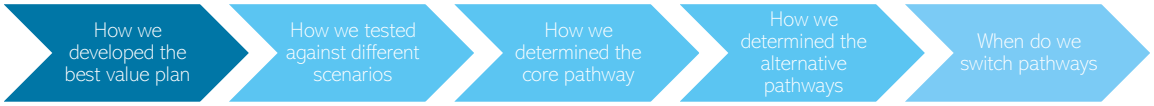
8.41 Our approach is flexible, comprising options for other network solutions such as sewer relining, as well as multiple small to medium surface water management solutions that can be scaled up or down, or delivered sooner or later, in response to differing growth and climate change patterns. This flexible approach also allows us to better understand surface water interaction, and how we can best manage that working in collaboration with others, to deliver environmental and wellbeing benefits. In the case of treatment solutions, these can be implemented depending on changing futures.

[45] *DWMP Appendix G: Adaptive Planning (Fig 5-3, page 48)*

8.42 Our hierarchy of network solution types (and for all storm overflows, whether located in our networks or at our sewage treatment works) commences with surface water management in our London catchments. These provide the basis for the development of a strategy to support an adaptive response. Our approach allows us to flex the scale of the programme based on our developing understanding and innovation in the delivery of these schemes, as well as improving our understanding of future risks. This will support the development of an adaptive plan in future cycles, using catchment wide trigger points to identify system capacity changes.

Phosphorus Reduction in Rivers

How we developed our best value plan



8.43 Our plan does not include any investment for phosphorus reduction for AMP8, however we have identified the actions necessary to meet long-term environmental targets, including achieving our contribution towards good ecological status in rivers we discharge into and the Environment Act targets for nutrient reduction.

8.44 This future investment comprises a combination of end-of-pipe sewage treatment works upgrades, nature-based solutions and catchment management measures. Improvements are needed to reduce the risk of eutrophication in rivers, lakes and canals, which in turn impacts on the quality of rivers for wildlife and recreation. It can also increase flood risk and increase water treatment costs. In some cases, investment is needed to counteract impacts of growth (within permit), preventing waterbodies from deteriorating. The requirements are driven by multiple regulatory drivers, including Water Framework Regulations, Environment Act, Habitats Regulations and Urban Wastewater Treatment Regulations. Two requirements are to achieve 'nutrient neutrality', a legal requirement anticipated to be included in the forthcoming Levelling Up and Regeneration Act.

8.45 The key aspects of our best value plan are:

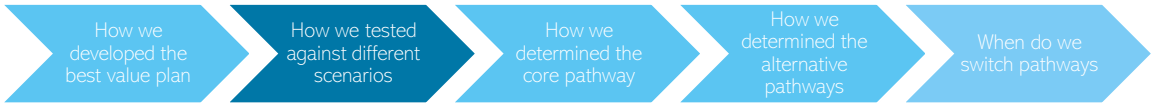
- We have considered 14 different potential options types
- We have narrowed this down to six constrained options (five on-site options and one catchment option)
- We assessed best value on a site-by-site level by considering a wide range of benefits following the WINEP options development and assessment methodology. This includes amenity, natural environment, greenhouse gas emissions and catchment resilience
- The resulting programme offers the best value to customers to achieve our long-term regulatory targets
- The programme assumes that all assets are currently operating within their permit conditions, with costs and benefits assessed simply on the enhancement element of the investment requirements

- All AMP8 spend has been phased into AMP9/10. In combination with the planned AMP9/10 spend to achieve the Environment Act target, this features 156 STW upgrades
- Further investment may be needed beyond AMP9 to address impacts of population growth, climate change and outcomes of investigations into potential phosphorus impacts. These are represented by TBC in 2040-2050, and an indicative forecast cost has been made

Table 8-6 - Best value pathway

Phosphorus reduction	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050	Total
Totex (£m) *(22/23)*	0	1786.3	704.9	105.0	105.0	
Number of schemes	0	127	33	TBC	TBC	

How we tested against different scenarios



8.46

8.47 Table 8-7

8.48 Table 8-7 below summarises how we defined the forecast for the different scenarios. For climate change our Best Value plan assumes river flows will not be significantly different from current flows and that incremental improvements can be made as climate change impacts materialise. For technology, our best value plan assumes that the nationally agreed technically achievable limit (TAL) does not alter and that alternative approaches using more catchment-based approaches are not available due to constraints within the Environment Act.

8.49 The adverse climate change scenario is based on an average flow reduction of 14% in rivers, the benign climate change scenario also assumes river flows will not be significantly different from current flows and that incremental improvements can be made.

8.50 For the adverse scenario, the Environment Agency's PR24 SAGIS-Simcat model was used, with river flows reduced by 14% to determine phosphorus concentrations in TWUL discharges that are consistent with Polluter Pays load reductions. It was assumed that the volume of each discharge remained unchanged. This is likely to be a conservative or 'worst case' scenario as there is a strong correlation between reduced rainfall and reduced discharge volumes.

Table 8-7 - Scenario forecasts

Common reference scenarios		Phosphorus reduction in rivers
Climate change	High (Adverse)	• Reduced flows by 14% • Adverse climate change driver of uncertainty: UKCP18 probabilistic projections, RCP8.5 • Based on the UK centre of Ecology and Hydrology eFLaG dataset • The data comprise an ensemble of 11 time series of projected flows driven by 11 different climate models, all using the same emissions pathway of RCP 8.5 • RCM_08 was identified as the most suitable ensemble member as it produced the median percentage change between baseline and future flows at two sample sites in the TWUL catchment of all 11 members • Across 10 sample sites in the TWUL catchment, mean flows are predicted to reduce by between 0 and 24%, with an average reduction of 14%, in the period 2041-70 relative to the baseline 2015-2020
	Low (Benign)	• No material change from current flows
Technology	Faster	• No change to TAL of 0.25mg/l • Policy change effected through increased evidence availability at catchment level provided by Rethinking Rivers breaks requirement for phosphorus to be treated within the curtilage of our operational sites (or upstream) • Lower value end of pipe phosphorus schemes are replaced either entirely or partially with better value catchment interventions
	Slower	• No change from core-pathway

What we learned from our testing of the best value plan

8.51 A summary of our testing is presented below in Table 8-8:

Table 8-8 - Scenario testing

Investment	Planning horizon	Best Value Plan (£m)	Climate Change Low (£m)	Climate Change High (£m)	Tech Faster (£m)	Tech Slower (£m)
Phosphorus reduction in rivers	2025-2030	0	No change	No change	No change	No change
	2030-2035	1786.3	No change	+100	-3	No change
	2035-2040	704.9	No change	+300	-10	No change
	2040-2045	105.0	No change	No change	No change	No change
	2045-2050	105.0	No change	No change	No change	No change
	Total	£2,701m	No change	+£400m	-£13m	No change
		The scope (and cost) of solutions is the same or more than the best value plan				
		The scope (and cost) of solutions is less than the best value plan				

8.52 For climate change, our testing found that reducing river flows by 14% resulted in the need for considerably tighter permit limits for phosphorus to meet equivalent river quality objectives as the core plan achieves. This is because there is less flow to dilute the phosphorus loads from our operations.

8.53 There is considerable uncertainty around this assessment as the future flow dataset contains very limited points for predicted flows, so heavy extrapolation has been employed.

8.54 To achieve this potential additional load reduction, further actions would be required compared to our core plan. This would vary on a site-to-site basis – some locations would need upgrades to the existing phosphorus programme with additional capital equipment (such as tertiary filtration units) others could be adapted though increased ferric dosing (opex only) and some others would require upstream interventions to counter the impacts of decreased dilution. In some cases, no conventional pathway was identified to fully counter the impacts.

8.55 We also assessed the impact of this adverse climate scenario on sites that are not scheduled for improvement to meet environmental targets through WINEP. This revealed that some sites would need first time phosphorus treatment and others would fall into the same categories as above – amendments to processes or upstream interventions.

8.56 Each of the solutions we have identified to achieve long-term phosphorus targets have been assessed to consider if they are adaptable, with a modular approach employed to enable upgrades where climate change impacts have materialised.

This was not applied to sites already at the TAL, where it is assumed that alternative catchment-based measures will need to be sought to counter the climate change impacts.

8.57 This review found that the options selected were adequately flexible within the context of phosphorus removal, however if a phosphorus site also has future chemical limits that require micro-filtration with membranes, there could be a risk of making tertiary filtration for phosphorus redundant.

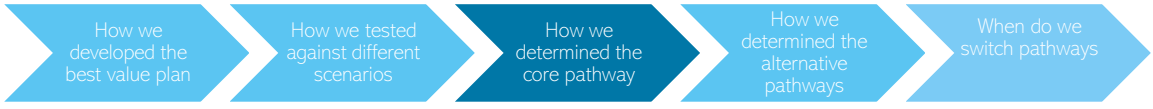
8.58 We also reviewed each option against the fast and slow technology scenarios. Overall, there would be little impact on the programme selected, with the most notable being;

- Lower flows in sewers will result in more concentrated flows. Alkalinity dosing will become critical to achieving nitrification as alkalinity is reduced through ferric dosing
- Space for future modular installations will be important
- With the rise of electrocoagulation instead of ferric doing, ferric dosing equipment could be re-purposed for alkalinity dosing
- As data becomes more accessible, partial and whole catchments could be operated at river basin level. This could allow performance blips to be compensated by using the headroom on other works in the catchment. This has the potential to reduce standby equipment requirements such as tertiary treatment typically provided. This approach is currently gated behind Environmental Performance Assessment ratings, with a minimum of 3* required to proceed
- In the short term, if construction techniques continue to decarbonise new build biological phosphorus removal may become viable in more locations. This would particularly be the case if retrofit intensification options that can free up existing aeration basin capacity to allow accommodation of anaerobic zones within existing structures prove successful on commercial scale
- Electrocoagulation may also offer an alternative to conventional ferric dosing, although this is yet to be established. This approach may enable a degree of phosphorus recovery from liquor treatment, so could offer circular economy advantages

8.59 As most phosphorus treatment equipment has a 20-year design-life, new technologies can be installed in 2050, in line with the expected timeline for availability.

8.60 We also considered how opportunities for employing more catchment-based solutions could be realised to reduce costs and/or increase benefits if rules around how Environment Act targets are achieved are amended. This found potentially up to £13m of savings could be achieved by 2037.

How we determined the core pathway



8.61 Our core pathway for phosphorus sees investment commencing in AMP9, with AMP8 constrained by deliverability and financing limitations.

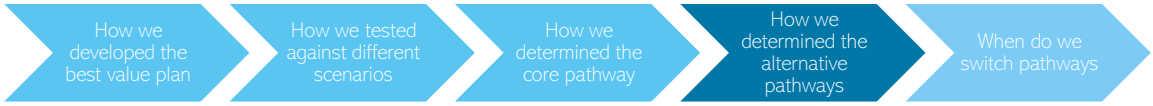
8.62 Further research is planned to improve modelling to decrease uncertainty around local climate change impacts and their timing before solutions are implemented.

8.63 We have assumed that:

- The Technically Achievable Limit is not lowered, with use of stretch permits employed to enable improvements without excess regulatory risk
- Climate change impacts, while potentially material, can be adapted for through modular technology design, top-up catchment interventions and additional upstream upgrades
- Significant advances in technology can be employed as replacements for existing assets as they are life-expired, with similar timelines
- Phosphorus permits are calculated considering maximum permitted dry-weather flow, therefore sites with permit headroom for flow will be outperforming target load reductions, significantly limiting climate change risk to the environment in the short to medium term

8.64 We have therefore built our core pathway around the current river flow regime, where accurate SIMCAT-SAGIS models have been deployed. This avoids the risk of installing excessive scope that may not be needed either at all, or too soon.

How we determined the alternative pathways



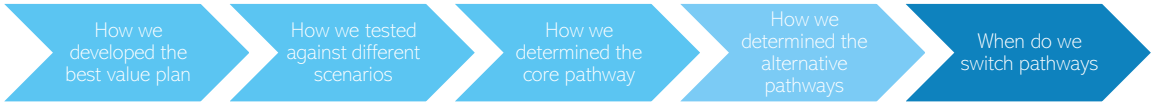
8.65 Due to the uncertainties around the climate change impacts, and the flexibility available to adjust the core plan as it materialises locally, we have not developed a specific alternative pathway to represent high or low climate change scenarios.

8.66 While the impact could be as high as an additional £400m, there would not be a single trigger point for an alternative pathway. Some locations will be more sensitive to change than others due to local drainage features and other physical catchment characteristics, dry-weather flow permit headroom and variations in observed rainfall patterns.

8.67 Further research will be undertaken to better understand catchments at risk in advance of investment being undertaken.

8.68 We have created an alternative pathway to represent acceptance of greater catchment management actions from a regulatory perspective, combined with better local evidence of where such actions could yield benefits with sufficient confidence.

When do we switch pathways?



8.69 For the benefits linked to adoption of catchment management technology, we have assumed this may be available from 2030 as evidence of the advantages may enable a policy shift by this point.

Annex A

Best option for customers – action and investigation locations summaries

Storm Overflows

Please note that some scheme locations changes are expected mid-period once investigations conclude.

WINEPID	Primary driver	Secondary driver	Tertiary driver	Name	Size category
08TW101072a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	ABBESS RODING STW	Large
08TW101098a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	ALICIA AVENUE (2) CSO UNPERMITTED CSO	Medium
08TW101099a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	ALICIA AVENUE CSO UNPERMITTED CSO	Medium
08TW100978a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	ANDOVERSFORD STW	Large
08TW101059a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	AUCKLAND ROAD STORM TANKS SPS	Medium
08TW101111a	ENVAct_IMP2	ENVAct_IMP4		BAMPTON STW	Very large
11TW100011a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	BARKWAY STW	Small
08TW101050a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	BEECH HALL CRESCENT, WALTHAMSTOW CSO	Medium
08TW101093a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	BENTLEY STW	Medium
08TW101093a	ENVAct_IMP2	ENVAct_IMP4		BENTLEY STW	Very large
08TW100982a	ENVAct_IMP2	ENVAct_IMP4		BLEDINGTON STW	Medium
08TW100985a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	BODDINGTON STW	Large
08TW101080a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	BOX HILL SPS	Small
08TW100987a	ENVAct_IMP2	ENVAct_IMP4		BRICKENDON STW	Small
08TW101094a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	BROOK ROAD, LOUGHTON CSO	Medium
08TW101060a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	BROOK WAY, CHIGWELL CSO	Medium
08TW100980a	ENVAct_IMP2	ENVAct_IMP4		BUCKLEBURY (BRIFF LANE) STW	Large
08TW100988a	ENVAct_IMP2	ENVAct_IMP4		BURGHFIELD STW	Very large
08TW101075a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	BURSTOW STW	Very large
08TW101113a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	BURSTOW STW SPS	Medium
08TW101055a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	CASCADE ROAD STORM TANKS, BUCKHURST CSO	Medium

WINEPID	Primary driver	Secondary driver	Tertiary driver	Name	Size category
08TW100989a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	CHADLINGTON STW	Large
08TW101016a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	CHARLBURY STW	Large
08TW100992a	ENVAct_IMP2	ENVAct_IMP4		CHARLTON-ON-OTMOOR STW	Very large
08TW101076a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	CHILTON FOLIAT STW	Medium
08TW100993a	ENVAct_IMP2	ENVAct_IMP4		CHINNOR STW	Very large
08TW100996a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	CLIFTON STW	Medium
08TW101082a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	COBHAM BRIDGE, ADJ COBHAM PS CSO	Medium
08TW100997a	ENVAct_IMP2	ENVAct_IMP4		COMBE STW	Small
08TW100998a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	COMPTON (BERKS) STW	Very large
08TW101066a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	CROFTON ROAD, SUNNYDALE CSO	Medium
08TW101000a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	CRONDALL STW	Very large
08TW101079a	ENVAct_IMP2	ENVAct_IMP4		CROPREDY STW	Large
08TW101001a	ENVAct_IMP2	ENVAct_IMP4		CUDDINGTON STW	Large
08TW101071a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	DAINTRY CLOSE CSO	Medium
08TW101081a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	EAST GARSTON SPS	Medium
08TW101005a	ENVAct_IMP2	ENVAct_IMP4		EAST GRAFTON STW	Small
08TW101006a	ENVAct_IMP2	ENVAct_IMP4		EAST SHEFFORD STW	Very large
08TW101095a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	EASTERN AVENUE, WANSTEAD CSO	Medium
08TW101007a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	EYDON STW	Medium
08TW101018a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	FINSTOCK STW	Medium
08TW101008a	ENVAct_IMP2	ENVAct_IMP4		FYFIELD (WILTS) STW	Very large
08TW101062a	ENVAct_IMP2	ENVAct_IMP5		GAP ROAD (CEMETERY) CSO	Small
08TW101009a	ENVAct_IMP2	ENVAct_IMP4		GERRARDS CROSS STW	Very large
08TW101010a	ENVAct_IMP2	ENVAct_IMP4		GREAT BEDWYN STW	Small

WINEPID	Primary driver	Secondary driver	Tertiary driver	Name	Size category
08TW101091a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	HADHAM MILL SPS	Medium
08TW101084a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	HAMBLEDEN STW	Medium
08TW101012a	ENVAct_IMP2	ENVAct_IMP4		HAMPSTEAD NORREYS STW	Large
08TW101013a	ENVAct_IMP2	ENVAct_IMP4		HAMSTEAD MARSHALL STW	Small
08TW101014a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	HANWELL STW	Large
08TW101058a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	HIGH ROAD, WOODFORD CSO	Medium
08TW101073a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	HOLYBOURNE SPS	Medium
08TW101069a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	HONEYPOT LANE (WINCHESTER AVENUE) CSO CSO	Medium
08TW101017a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	HORLEY (SURREY) STW	Very large
08TW101019a	ENVAct_IMP2	ENVAct_IMP4		HORTON-CUM-STUDLEY STW	Medium
08TW101030a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	HUCKERS LANE (SELBOURNE) SPS	Medium
08TW101020a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	HUNGERFORD STW	Small
08TW101021a	ENVAct_IMP2			IRONSBOTTOM (SIDLOW) STW	Medium
08TW101022a	ENVAct_IMP2	ENVAct_IMP4		KINTBURY STW	Very large
08TW101024a	ENVAct_IMP2	ENVAct_IMP4		LITTLE HALLINGBURY STW	Large
08TW101057a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	LONGBRIDGE ROAD CSO	Medium
08TW101025a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	MARKYATE STW	Very large
08TW101028a	ENVAct_IMP2	ENVAct_IMP4		MORTIMER (STRATFIELD) STW	Very large
08TW101056a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	MULBERRY COURT, HALL ROAD CSO	Medium
08TW101029a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	NEW MILL (EVERSLEY LOWER COMMON) STW	Medium
08TW101085a	ENVAct_IMP2	ENVAct_IMP4		NEWBURY STW	Very large
08TW100976a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	NEWMANS LANE SPS	Small
10TW100031a	ENVAct_IMP2	ENVAct_IMP4		NORTH WEALD STW	Very large
08TW101068a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	OUTSIDE 135 LEESIDE CRESCENT (FORMERLY BROOKSIDE ROAD, GOLDERS GREEN)	Large

WINEPID	Primary driver	Secondary driver	Tertiary driver	Name	Size category
08TW101053a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	PROSPECT ROAD , WOODFORD CSO (MONKHAMS LANE)	Medium
08TW101052a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	RAY LODGE ROAD (RAY PARK 1) CSO	Medium
08TW101061a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	REDBRIDGE LANE WEST, WANSTEAD CSO	Medium
08TW101063a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	ROAD A3, ROEHAMPTON VALE CSO	Medium
08TW101078a	ENVAct_IMP2	ENVAct_IMP4		RUSPER STW	Medium
08TW101089a	ENVAct_IMP2	ENVAct_IMP4		SELBORNE STW	Small
08TW101090a	ENVAct_IMP2	ENVAct_IMP4		SEVENHAMPTON VILLAGE STW	Medium
08TW101051a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	SOUTH PARK, ILFORD CSO	Medium
08TW101033a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	STANDLAKE STW	Very large
08TW101035a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	STEWKLEY STW	Large
08TW101036a	ENVAct_IMP2	ENVAct_IMP4		STONE STW	Very large
08TW101003a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	STONEBRIDGE SSO, BROCKHAM CSO	Large
08TW101096a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	STREATHAM STORM RELIEF CSO A	Large
08TW101064a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	STREATHAM STORM RELIEF CSO B	Large
08TW101097a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	STREATHAM STORM RELIEF CSO E	Medium
08TW101065a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	STREATHAM VALE STORM RELIEF CSO	Medium
08TW101037a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	TAKELEY STW	Very large
08TW101038a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	THERFIELD STW	Large
08TW101039a	ENVAct_IMP2	ENVAct_IMP4		THEYDON BOIS STW	Very large
08TW101040a	ENVAct_IMP2	ENVAct_IMP4		THORNWOOD STW	Large
08TW101070a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	UPPER RICHMOND ROAD, PRIESTS BRIDGE CSO	Medium
08TW101077a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	WARDINGTON SPS	Medium
08TW101086a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	WEALDBRIDGE, NORTH WEALD SPS	Medium
08TW101045a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	WHEATLEY STW	Very large
08TW101046a	ENVAct_IMP2	ENVAct_IMP4		WHITWELL STW	Medium
08TW101047a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	WIDFORD AND WARESIDE STW	Medium

WINEPID	Primary driver	Secondary driver	Tertiary driver	Name	Size category
08TW101100a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	WINN VALLEY SPS, LB REDBRIDGE 1 UNPERMITTED CSO	Medium
08TW101101a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	WINN VALLEY SPS, LB REDBRIDGE 2 UNPERMITTED CSO	Medium
08TW101102a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	WINN VALLEY SPS, LB REDBRIDGE 3 UNPERMITTED CSO	Medium
08TW101103a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	WINN VALLEY SPS, LB REDBRIDGE 4 UNPERMITTED CSO	Medium
08TW101104a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	WINN VALLEY SPS, LB REDBRIDGE 5 UNPERMITTED CSO	Medium
08TW101105a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	WINN VALLEY SPS, LB REDBRIDGE 6 UNPERMITTED CSO	Medium
08TW101106a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	WINN VALLEY SPS, LB REDBRIDGE 7 UNPERMITTED CSO	Medium
08TW101107a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	WINN VALLEY SPS, LB REDBRIDGE 8 UNPERMITTED CSO	Medium
08TW101092a	ENVAct_IMP2	ENVAct_IMP4		WINTERBOURNE STW	Small
08TW101054a	ENVAct_IMP2	ENVAct_IMP4	ENVAct_IMP5	WORCESTER CRESCENT CSO	Medium
08TW100986a	ENVAct_IMP3	ENVAct_IMP2	ENVAct_IMP5	CHURT SPS	Large
08TW101087a	ENVAct_IMP3	ENVAct_IMP4	ENVAct_IMP5	CASSINGTON STW	Very large
Various	ENVAct_INV4			454 investigation locations on WINEP	N/A

Bathing Waters

WINEP ID	Primary Driver	Secondary Driver	Tertiary Driver	Location
08TW100261a	BW_IMP1			Wolvercote Mill Stream, Oxford
08TW100262a	BW_INV1			Wolvercote Mill Stream, Oxford (investigation)

Addressing low river flows

WINEP ID	Primary Driver	Secondary Driver	Tertiary Driver	Location
08TW100043a	WFD_IMP_WRFlow			Hornsey WTW
08TW100002a	WFD_ND_WRFlow			Netley Mill (Shere) WTW
08TW100003a	WFD_ND_WRFlow			Bradfield Windmill WTW
08TW100046a	WFD_ND_WRFlow			Upper Swell WTW
08TW100045a	WFD_ND_WRFlow			Chinnor WTW
08TW100044a	WFD_ND_WRFlow			NNRWs sources

WINEP ID	Primary Driver	Secondary Driver	Tertiary Driver	Location
08TW100032a	WFD_IMP_WRFlow	WFD_ND_WRFlow		New Gauge Investigation
08TW101405a	EDWRMP_INV			Vulnerable catchments investigations
08TW101373a	EDWRMP_INV			Regional plan for Environmental designations (contribution)
08TW101462a	EDWRMP_INV			Hogsmill Environmental Destination investigation
08TW100029a	WFD_INV_WRFlow	EDWRMP_INV		Eynsford, Horton Kirby, Lullingston sources investigation
08TW100030a	WFD_INV_WRFlow	EDWRMP_INV		Sundridge, Westerham, Darenth, Green St Green, Wilmington, Dartford sources investigation
08TW100031a	WFD_INV_WRFlow			Lower Lee source investigation
08TW100034a	WFD_INV_WRFlow	EDWRMP_INV		Waddon and Brantwood Road Sources investigation
08TW100035a	WFD_INV_WRFlow			Pann Mill and Radnage sources investigation
08TW100036a	WFD_INV_WRFlow	WFD_ND_WRHMWB		Hampden Bottom source investigation
08TW100037a	WFD_INV_WRFlow			Pangbourne source investigation
08TW100038a	WFD_INV_WRFlow	EDWRMP_INV		Bexley source investigation
08TW100039a	WFD_INV_WRFlow			Bibury source investigation
08TW100040a	WFD_INV_WRFlow			Latton source investigation
08TW101467a	WFD_INV_WRFlow			Investigation into deterioration in waterbody in Crane catchment
08TW104005a	WFD_INV_WRFlow			Upper Kennet investigation with Wessex Water
08TW101379a	WFD_INV_WRFlow			Mogden STW abstraction investigation
08TW101376a	WFD_INV_WRHMWB			Heavily modified WB Grimsbury Reservoir investigation
08TW101377a	WFD_INV_WRHMWB			Heavily modified WB Thames Cookham to Egham investigation
08TW101378a	WFD_INV_WRHMWB			Heavily modified WB Thames Egham to Teddington investigation
08TW101460a	WFD_NDINV_WRFlow			Investigate deterioration risk on River Lee investigation
08TW104009a	WFD_NDINV_WRFlow			Unused licence investigation in Coln catchment investigation

It's everyone's water