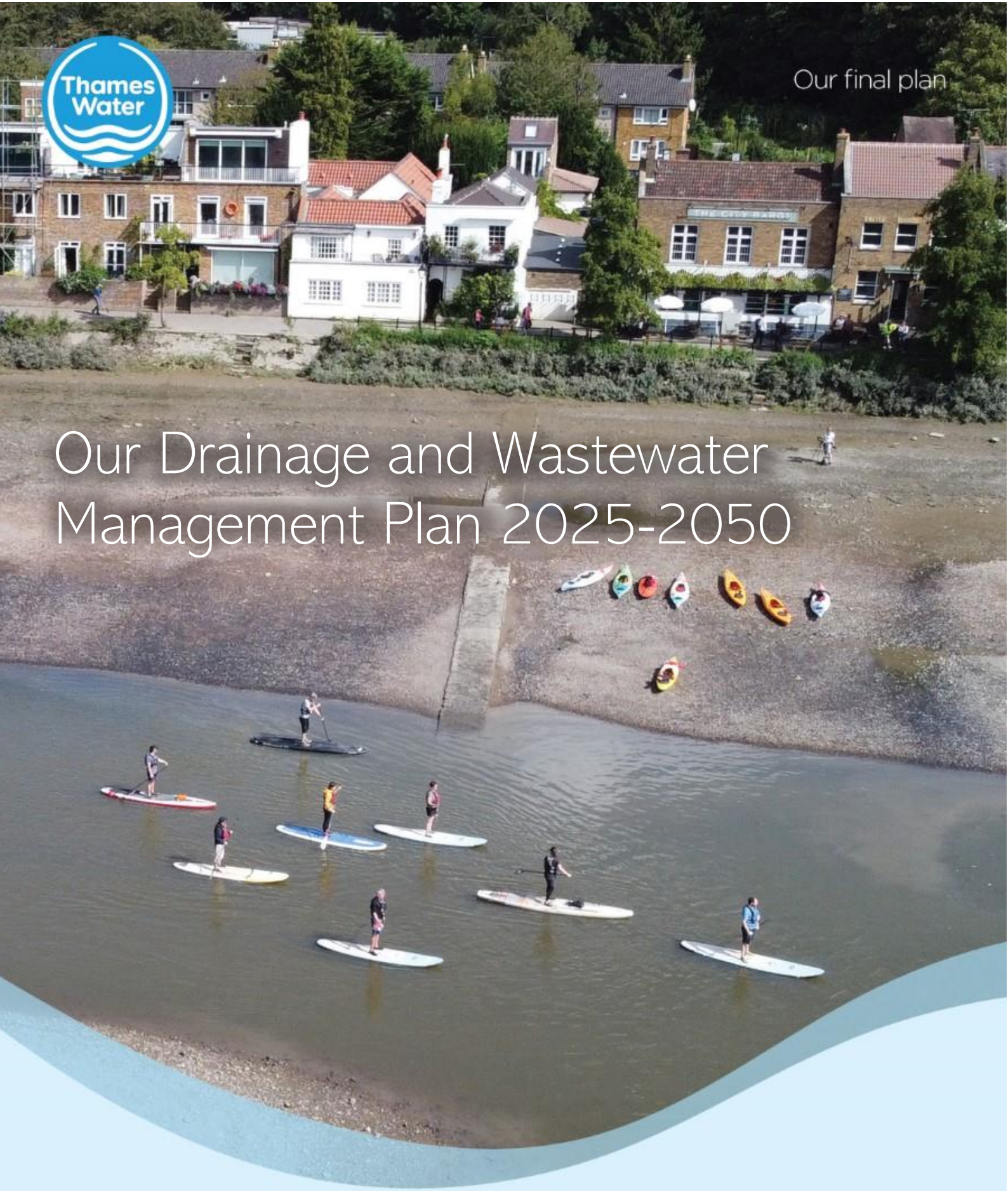
Thames Water

Our final plan

Our Drainage and Wastewater Management Plan 2025-2050



Technical Summary

May 2023

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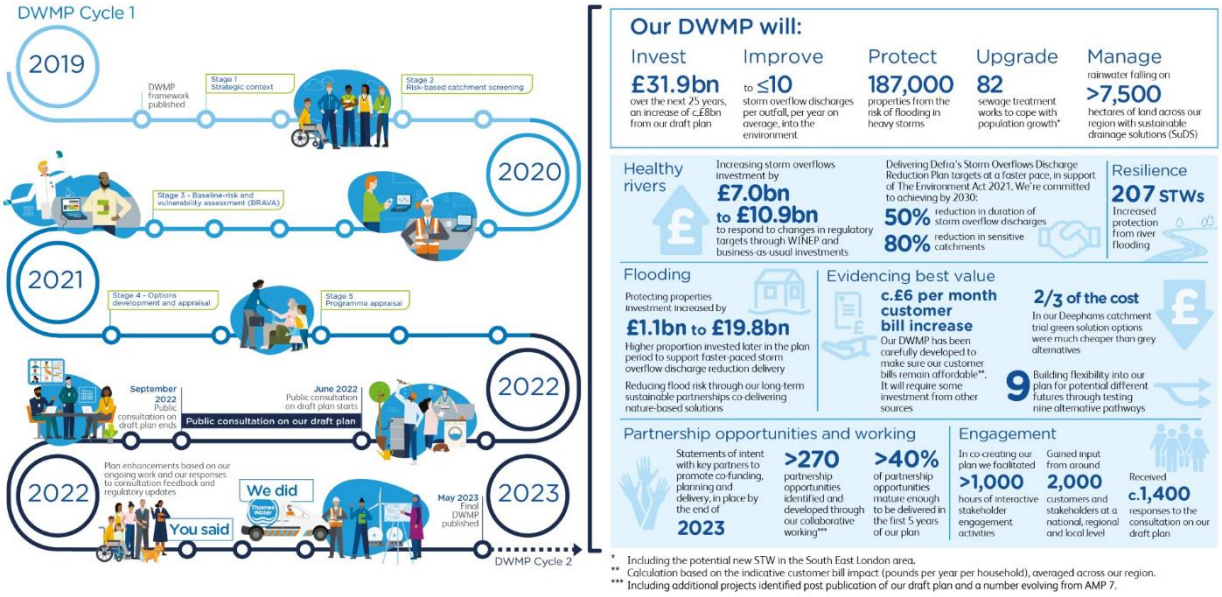
Preface

We're proud to present our first Drainage and Wastewater Management Plan (DWMP) and encouraged by the level of positive feedback we've received. Over the last four years, we've engaged and worked collaboratively with around 2,000 of our customers and stakeholders, to deepen our shared understanding and develop new ways to manage drainage and wastewater across our region. We illustrate our DWMP Cycle 1 and its headlines below.



We've progressed and enhanced our DWMP since we published it for public consultation in June 2022. We were pleased to receive lots of positive comments and support on the quality and ambition of our draft plan as well as useful ideas for making our final DWMP even stronger.

We've updated our draft plan based on our ongoing DWMP work, regulatory updates and our responses to the consultation feedback wherever possible*. Our updates include providing more detail where you felt it was needed and creating new appendices to answer technical queries. For more details on how we've progressed our final plan and responded to the consultation feedback, please see our Non-technical summary and You said, We did Technical appendix.

* Some public consultation feedback didn't require further action or wasn't relevant to the DWMP process. Other feedback was relevant to future DWMP planning cycles and will be used to inform this work.

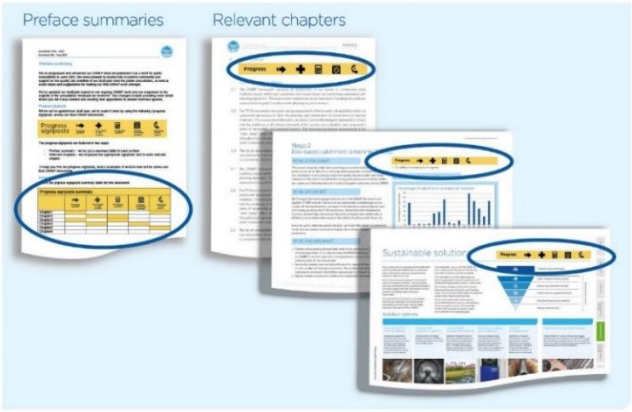
Progress signposts

We want to make it easy for you to see what's changed. You can spot all the places we've updated our draft plan with our 'progress signposts' which we've used across our final DWMP documents.

Here's where they'll be:

- Preface summaries – we've put a summary table in each document's preface (excluding Summary documents and CSPs)
- Relevant chapters – we've placed the appropriate signposts next to each relevant chapter (including Summary document and CSPs)

To help you find our progress signposts, here are examples of what to look out for:



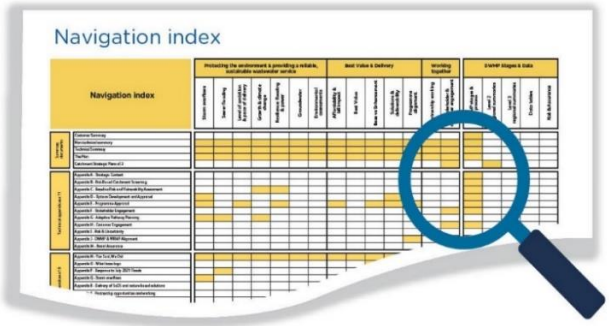
Progress summary table

The progress signposts summary table for the chapters in this document is outlined below. We've used orange cells to indicate where our draft plan has been updated with progress.

Progress signposts summary: Technical Summary	Progress updated	More detail or new content	Number(s) updated	Delivery timeframe updated	Informing DWMP cycle 2
2 Introduction and background					
3 Stakeholder engagement					
4 Setting shared planning objectives					
5 The impact of growth and climate change					
6 A summary of the plan					
7 Plan development					

Navigating our documents

To help you navigate around our final DWMP document suite and find where key DWMP content features, we've placed a Navigation index at the back of this document.



1 Our Drainage and Wastewater Management Plan (DWMP)

Our DWMP vision

1.1 Working in partnership to co-create a 25-year plan for drainage and wastewater that sustainably benefits communities and the natural environment in our region.

Our DWMP aim

1.2 To identify future catchment risks to our drainage and wastewater treatment systems and develop sustainable, efficient solutions to address them.

What we're trying to achieve

1.3 The plan is designed to help protect the environment, look after the health of our rivers, improve resilience to the risks of flooding and generate wider benefits to the communities we serve. The plan aims to deliver positive outcomes for:

- Customers and communities – fair charges for the services we provide, improved health and wellbeing, increased amenity, and a resilient service
- Drainage and wastewater services – reduce sewer flooding and achieve 100% Sewage Treatment Works (STW) compliance
- The environment – restore river health, increase biodiversity, environmental net gain

Description of the plan

1.4 A DWMP is a long-term costed plan focused on partnership working, which sets out the future risks and pressures facing our drainage and wastewater systems. It identifies the actions that are required to make sure we can continue delivering our services reliably and sustainably, along with positive outcomes for our customers, communities and the environment.

1.5 Our long-term collaborative plan aims to ensure a resilient and sustainable wastewater service for the next 25 years and beyond.

Framework

1.6 This is the first time we have produced a long-term plan for our wastewater business. Based on the national DWMP framework[1] developed jointly by regulators and industry bodies including Ofwat, Defra, the Environment Agency, Water UK, Welsh Government, Natural Resources Wales, Consumer Council for Water, Association of Directors of Environment, Economy, Planning and Transport and Blueprint for Water, the DWMP creates a roadmap for how we adapt our wastewater service to cope with future challenges.

[1] https://www.water.org.uk/wp-content/uploads/2019/09/Working-together-to-improve-drainage-and-environmental-water-quality-an-overview-of-Drainage-and-Wastewater-Management-Plans.pdf

2 Introduction

Progress 

2.1 It is a privilege to have the responsibility to lead the delivery of drainage and wastewater in the river Thames catchment, where our network provides services to more than 15 million customers. To manage our network effectively we must plan to address future challenges, or the service we provide may deteriorate impacting our customers and damaging the natural environment.

2.2 Resilient, robust, and sustainable drainage and wastewater systems are essential for a healthy society, prosperous economy and the protection and enhancement of the environment. Future challenges which may compromise our ability to deliver these services effectively include:

- **Population growth**: We expect the population in our region to grow by more than 2 million people by 2045. That is the same as the entire population of Birmingham and Leeds.
- **Climate change**: We already see impacts from climate change, and these are forecast to increase, with more extreme weather expected. This includes droughts, heatwaves and summer rainstorms becoming up to 20% more extreme[2].
- **Loss of green space**: We are continually losing green and permeable areas to housing, transport infrastructure, and many other uses. This means that more rainwater cannot soak into the ground, and it runs into sewers and rivers more quickly, increasing the risk of flooding.
- **An environment in need**: Of the 501 waterbodies in the river Thames basin, 94% are at less than good ecological status[3]. 32% of the reasons for not achieving good status are down to water company activities, the remainder are principally attributed to activities such as urban and transport, and agricultural and rural land management[4].

2.3 A Drainage and Wastewater Management Plan (DWMP), as defined in guidance published by Water UK[5], as '*a long-term strategic plan that will set out how wastewater systems, and the drainage networks that impact them, are to be extended, improved and maintained to ensure they are robust and resilient to future pressures.''*

2.4 Developing a DWMP is a way to understand how challenges and demands impact on the wastewater service and subsequently on the communities and the environment they serve.

2.5 The DWMP process identifies catchments most at risk of service failure and/or adverse environmental impacts due to future pressures. It sets out a strategic, unconstrained

[2] Betts, R.A. and Brown, K.(2021) Introduction. In: The Third UK ClimateChange Risk Assessment Technical Report [Betts, R.A.,Haward, A.B. and Pearson, K.V.(eds.)]. Prepared for the Climate Change Committee, London

[3] Thames river basin district river basin management plan: updated 2022

[4] Thames Water River Health Plan

[5] WaterUK, Working together to improve drainage and environmental water quality, an overview of Drainage and Wastewater Management Plans, September 2021: https://www.water.org.uk/wp-content/uploads/2021/10/Working_Together_an_overview_of_Drainage_and_Wastewater_Management_Plans.pdf

investment plan to ensure that services to customers are resilient against the uncertainties of population growth and climate change and that we continue to protect and enhance the natural environment.

2.6 As responsibilities for drainage are spread across several different organisations the development and delivery of a successful DWMP requires working in partnership with a wide range of stakeholders and regulators. Many of these have shared responsibilities for drainage and the environment. Collaboration across organisations is a core principle of the DWMP. Through co-creation with stakeholders, the DWMP has the potential to develop more sustainable, better value solutions than organisations working independently.

DWMP and Price Reviews

2.7 PR24 (Price Review 2024) is the regulated process water companies go through to determine costs, benefits, targets, and expenditure for their next Asset Management Period (AMP). It is the regulatory mechanism that funds the first five years of DWMP, subject to Ofwat approval.

2.8 Price reviews are strategic delivery plans. They are constrained to ensure affordability and deliverability. They set the key expenditure and targets a company needs to achieve in the subsequent 5 years to meet all sector requirements. DWMP feeds into price reviews albeit only part of price reviews as DWMP focuses on part of the wastewater sector requirement.

2.9 The final DWMP is published on 31 May 2023 and the PR24 submission to Ofwat is due to be submitted in October 2023. Our consultation feedback from regulators stated the requirement for the first five years of the DWMP and the PR24 submission to be in alignment. This includes the Water Industry National Environment Programme (WINEP) proposals on storm overflows. The alignment was challenging for storm overflows as these plans are still under discussion with regulators at the time of DWMP publication.

2.10 We anticipate parts of DWMP (data tables) will need to be revised as part of the October 2023 price review submission. This is to ensure the DWMP continues to align to near-term investment proposals.

2.11 We will review and update our DWMP every five years ahead of price reviews. These are known as cycles and our May 2023 submission is known as cycle 1. This DWMP is non-statutory while future cycles will be statutory.

Our Wastewater service region

2.12 We serve customers across London and the wider Thames Valley region. Figure 2-1 is a map showing the area we serve. Our wastewater service includes:

- Taking wastewater away from 15 million customers every day.
- Maintaining and enhancing 68,000 miles (or 109,000 km) of sewer with 5,168 pumping stations and 1.77 million manholes.
- Treating 4,600 million litres of wastewater at 354 treatment works that discharge treated effluent to local rivers.

Figure 2-1: Our wastewater region

Planning Framework

2.13 DWMPs are region specific as they are developed by different companies. Regulators and national government require water companies to adopt a consistent approach when carrying out long term planning, especially to inform the National Infrastructure Commission (NIC) assessments. The first NIC assessment was published in July 2018[6] with a refresh expected in autumn 2023.

2.14 The framework consists of 5 main stages represented in Figure 2-2.

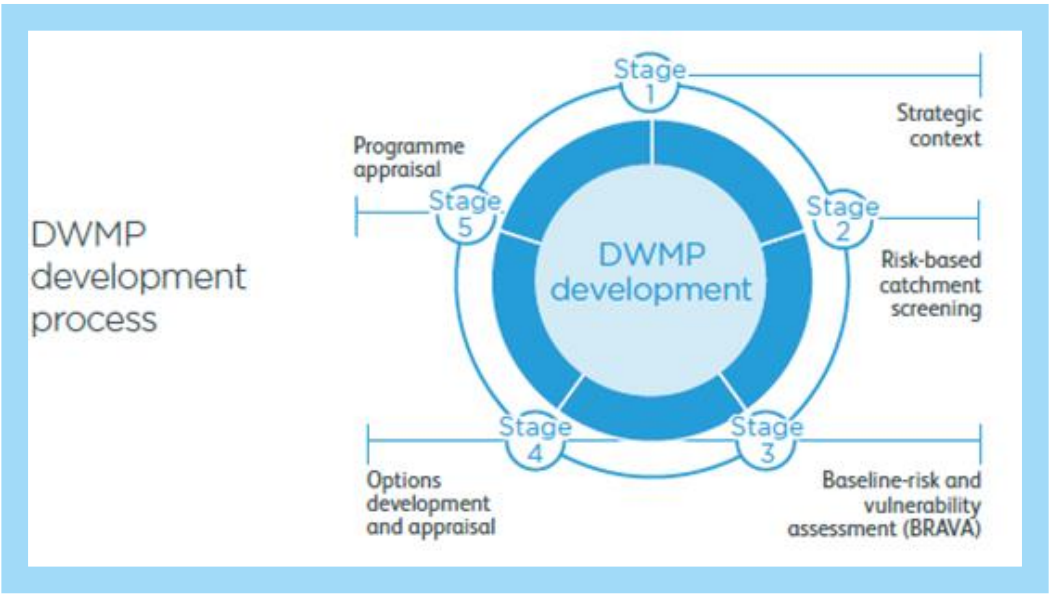


Figure 2-2: The five stages undertaken in a DWMP

[6] https://nic.org.uk/app/uploads/CCS001_CCS0618917350-001_NIC-NIA_Accessible-1.pdf

2.15 In February 2022 the UK and Welsh Governments and the environmental and economic regulators (Natural Resources Wales, Environment Agency and Ofwat) outlined their priorities and expectations for the DWMP in the form of Guiding Principles[7]. These are illustrated in Figure 2-3.

Figure 2-3: DWMP Guiding Principles (February 2022)

2.16 We have developed our DWMP in compliance with the national DWMP framework and Guiding Principles.

Geographical structure of the DWMP

2.17 We serve very different areas across our region, from the densely populated commercial centre of London to rural communities in the Thames Valley. To ensure the DWMP considers all stakeholders, we divide our region into four planning levels shown in Figure 2-4, as advised by the DWMP framework.

- Level 1 is our company region. For the plan outputs we have also provided a split between Thames Valley and London.
- Level 2 consists of thirteen Thames Regional Flooding and Coastal Committee (TRFCC) partnerships.
- Level 3 is the 382 tactical planning catchments.
- Level 4 was only used in London and is the sub-catchments, called risk zones. This was used because the catchments are so large, decision making needs to be more granular than at catchment level.

Figure 2-4: The four levels of geography used in our DWMP

[7] https://www.gov.uk/government/publications/drainage-and-wastewater-management-plans-guiding-principles-for-the-water-industry/guiding-principles-for-drainage-and-wastewater-management-plans

3 Stakeholder engagement

Progress

3.1 'Be collaborative' is a core principle in developing a DWMP. The fundamental 'Working Together' principle of DWMP has arisen from having the shared responsibilities for drainage across every region and from the opportunity to generate efficiency in pooled resources. The Working Together guide[8] describes DWMP as *'… much more than just a water company plan…It's an opportunity to plan together, to generate efficiencies and maximise outcomes arising from co-creation and delivery of solutions…'*

3.2 We recognise that there is a wide interest in the sustainable management of drainage and wastewater. Over the development of the plan, we have engaged with stakeholders including customers, regulators, lead local flooding authorities and river catchment partnerships. We shared work at each stage in the framework, providing the opportunity for stakeholder input and feedback. This ensured that we developed a shared DWMP that recognises interests and risks beyond our own. Figure 3-1 represents how stakeholders were engaged at each of the stages.

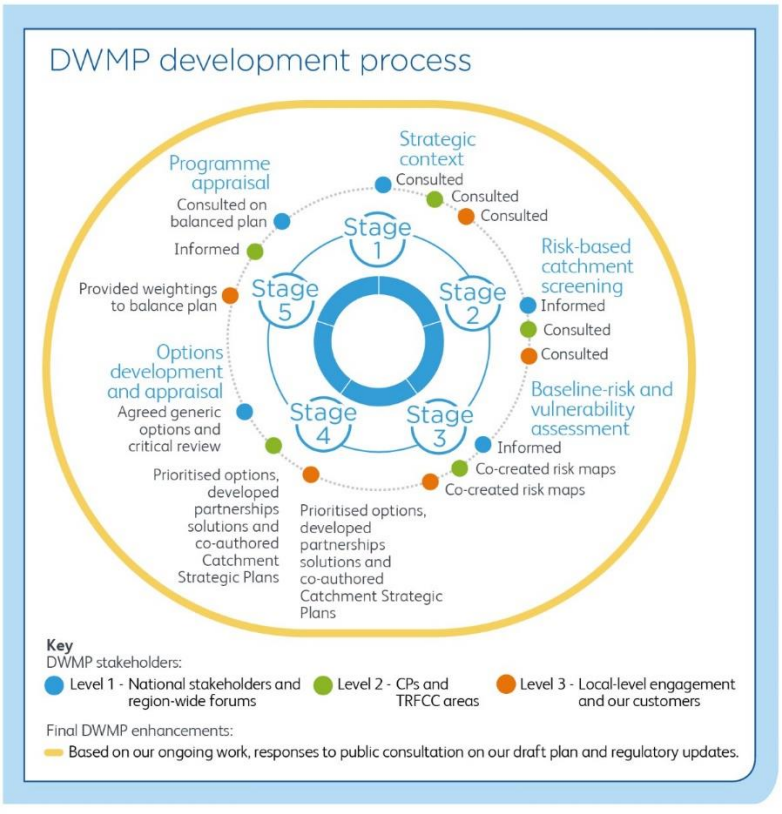


Figure 3-1: Stakeholder engagement through the DWMP process

[8] WaterUK, Working together to improve drainage and environmental water quality, an overview of Drainage and Wastewater Management Plans, September 2021: https://www.water.org.uk/wp-content/uploads/2021/10/Working_Together_an_overview_of_Drainage_and_Wastewater_Management_Plans.pdf

3.3 We worked with the Thames Flood Advisors (TFAs) to provide the interface into many of our DWMP stakeholder groups. TFAs have existing relationships with Lead Local Flooding Authorities to deliver projects to manage surface water flooding. We part-funded the TFAs to help nurture partnerships and this provided an invaluable channel and source of input into our shared plan.

3.4 The TFA team, together with a dedicated DWMP stakeholder lead, facilitated over 900 hours of interactive stakeholder engagement activities with input from across 550 customer households, 70 local authorities, 50 organisations and numerous environmental action groups at a national, regional, and local level. We've used over 20 different collaborative channels, methods, and tools, including a phased customer research programme. Our key aim was journeying together throughout the DWMP process. A simplified representation of that stakeholder journey is shown in Figure 3-2.

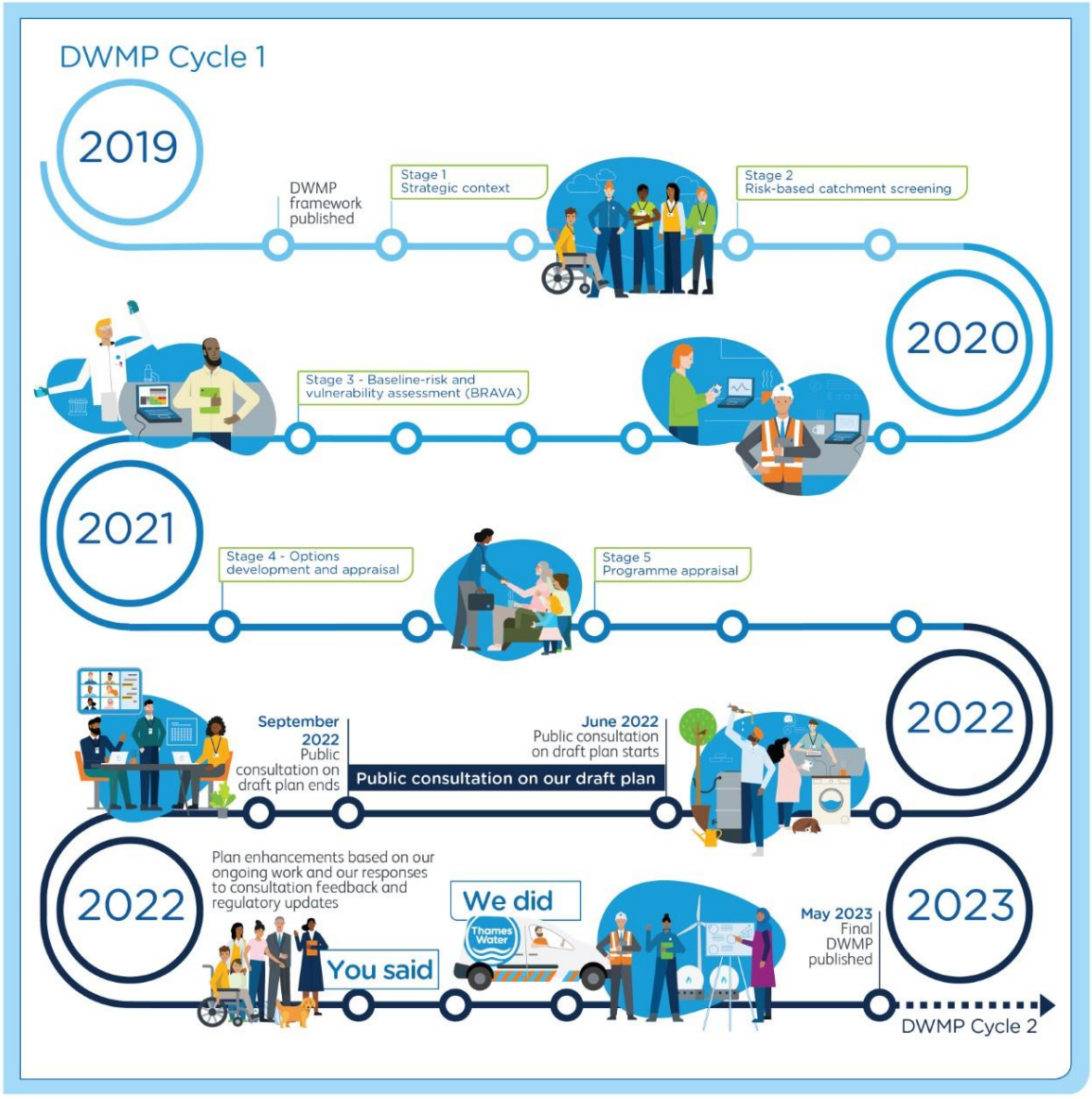


Figure 3-2: Our DWMP stakeholder journey

3.5 Our customers' views played a vital part in shaping our DWMP. We engaged customers throughout the plan's development. In particular, we established:

- Customer priorities for long-term wastewater planning
- Customer preference for different types of interventions
- Customer weightings of the planning objectives

3.6 Customers, stakeholders, and regulators were actively involved and continually contributed their feedback. Figure 3-3 summarises how we engaged with them.

Figure 3-3: Examples of the diverse range of stakeholder engagement activities

3.7 In developing our DWMP, stakeholder collaboration has led to a more comprehensive, better plan because it has:

- Broadened the scope, increasing the original 6 proposed objectives to 12, to include for example wellbeing and carbon emissions
- Identified over 500 localities of shared risks as a platform for working together
- Generated 271 potential partnership projects with co-funding potential
- Generated customer weightings for multiple objectives to help balance the plan
- Created a platform to share the ownership of this plan and its suggested solutions

Consultation phase

3.8 Our draft DWMP was published in June 2022 and was followed by a formal consultation phase from 30th June – 22nd September 2022. We facilitated this phase through an online consultation form, interactive workshops, bespoke online sessions with customers and various meetings. We also encouraged feedback through our Thames Flood Advisors, Catchment Partnerships and across our digital channels and platforms, with information

and updates across our social media feeds, website and both our DWMP Customer and Practitioner portals.

3.9 We were delighted with the engagement we had from stakeholders, with over 1,300 customer online surveys responses, 95 separate consultation forms completed and feedback from every strategic planning area across our catchment, together with separate responses from regulators.

3.10 A summary of the nature of the feedback is provided in Figure 3-4 and more detail is provided in our "You Said, We Did" Technical Appendix[9]. The substantial number of responses has led to significant additions to our plan since publication of the draft DWMP:

- Adaptive planning extended across the whole DWMP using Ofwat's common reference scenarios
- More detail on the integral role that maintenance activities play in a hierarchy of options to mitigate growth and climate change
- More detail on our optioneering and programme appraisal stage to demonstrate how the best value framework was applied and a fuller account of how options and plans were discounted. Also included are the bill impacts of alternative plans
- A more mature understanding of the opportunities from partnership working
- Details of investment needed to comply with the Storm Overflow Discharge Reduction Plan[10] compliance
- More detail on how the delivery of Sustainable Drainage Solutions (SuDS) needs to change to meet the challenge of a 'SuDS first' approach
- Incorporating the lessons learnt from the July 2021 storms in London and supporting ongoing work on pragmatic solutions to the most extreme weather events

[9] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-n-you-said-we-did.pdf
[10] https://www.gov.uk/government/publications/storm-overflows-discharge-reduction-plan

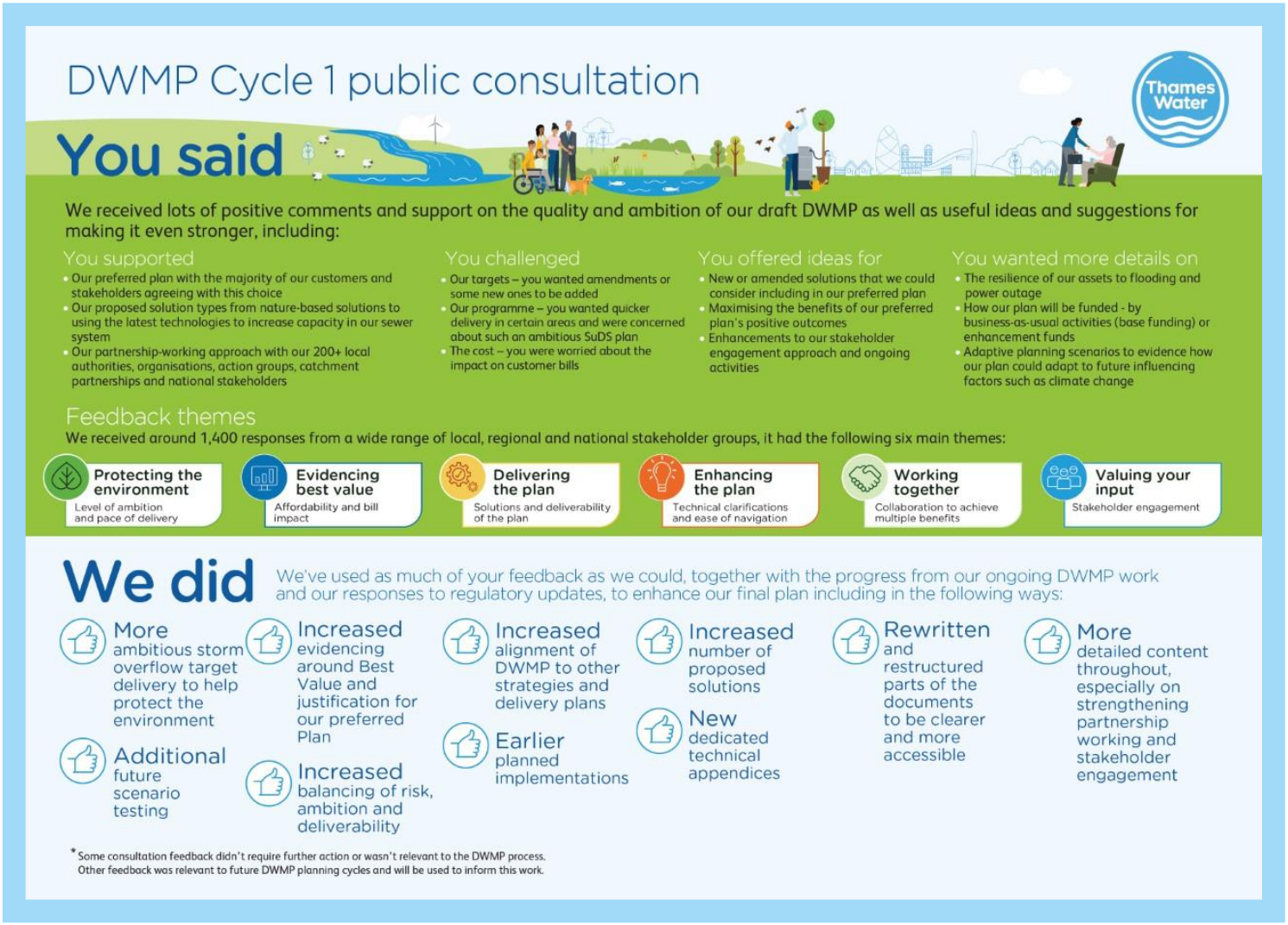


Figure 3-4: Summary of feedback received and our response to stakeholder engagement

4 Setting shared planning objectives

Progress 

4.1 The planning objectives for DWMP are set by stakeholders at the upfront Strategic Context[11] phase (completed in 2020) and remain unchanged between draft and final publication. They are reproduced in Figure 4-1. As expected, our objectives focus on protecting the environment and reducing the risk of sewer flooding whilst delivering wider benefits to communities, recognised by additional objectives on carbon and wellbeing.

4.2 As we developed our plan, the planning objectives have been translated into metrics and targets which we call our Level of Service: these are shown in Table 4-1. We have aligned these targets to our corporate Vision 2050.

Metric	Unit	Target for London	Target for Thames Valley
Storm overflow	Annual average number of spills	No more than 10*	No more than 10*
Sewer Flooding Resilience Risk (1:50)	Percentage of properties not at risk	95%	100%
Treatment Works Compliance	Percentage of works that are compliance	100%	100%

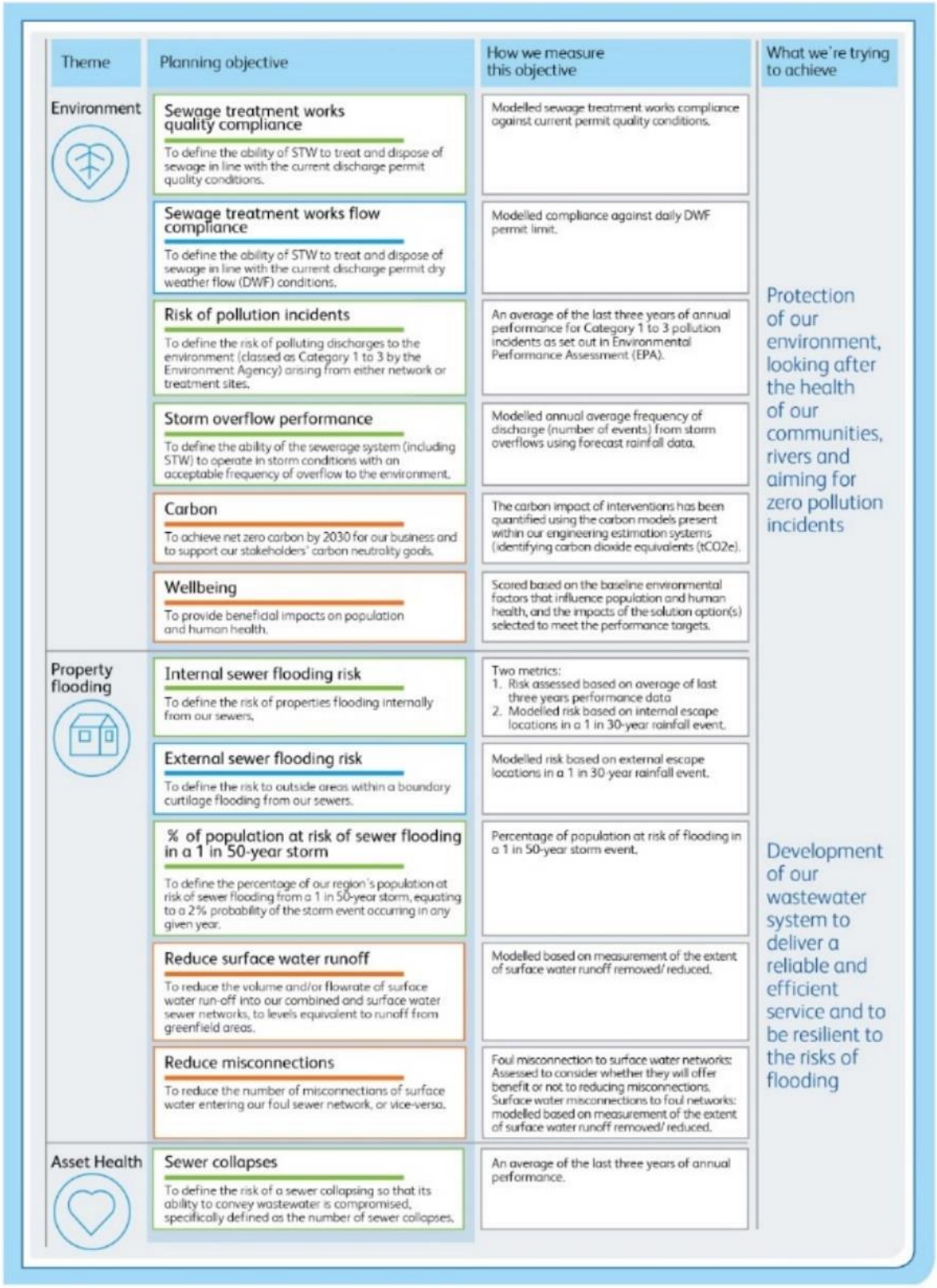
Table 4-1: Core metric targets for London and Thames Valley

4.3 Our core metrics are based on storm overflows, flooding, and capacity at our treatment works. We have retained our ambitious targets from our draft to the final plan, however the scope and profiling of the projects has been amended to ensure we meet these targets.

4.4 The storm overflow metric is part of meeting our statutory requirement, as set out in the Environment Act 2021[12], to progressively reduce the adverse impacts of discharges from storm overflows and aligns to the targets set out in the Storm Overflow Discharge Reduction Plan[13], which also includes targets on ecological harm, bathing waters and screens on outfalls. A full account of how DWMP aligns to this metric is provided in a separate technical appendix on storm overflows[14].

4.5 Our target is for 100% of properties in the Thames Valley and 95% of properties in London not to be at risk of sewer flooding in up to a 1:50-year storm event.

[11] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/strategic-context-document.pdf
[12] https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted
[13] https://www.gov.uk/government/publications/storm-overflows-discharge-reduction-plan
[14] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-q-storm-overflows.pdf



Theme	Planning objective	How we measure this objective	What we're trying to achieve
Environment	**Sewage treatment works quality compliance** To define the ability of STW to treat and dispose of sewage in line with the current discharge permit quality conditions.	Modelled sewage treatment works compliance against current permit quality conditions.	Protection of our environment, looking after the health of our communities, rivers and aiming for zero pollution incidents
	Sewage treatment works flow compliance To define the ability of STW to treat and dispose of sewage in line with the current discharge permit dry weather flow (DWF) conditions.	Modelled compliance against daily DWF permit limit.	
	Risk of pollution incidents To define the risk of polluting discharges to the environment (classed as Category 1 to 3 by the Environment Agency) arising from either network or treatment sites.	An average of the last three years of annual performance for Category 1 to 3 pollution incidents as set out in Environmental Performance Assessment (EPA).	
	Storm overflow performance To define the ability of the sewerage system (including STW) to operate in storm conditions with an acceptable frequency of overflow to the environment.	Modelled annual average frequency of discharge (number of events) from storm overflows using forecast rainfall data.	
	Carbon To achieve net zero carbon by 2030 for our business and to support our stakeholders' carbon neutrality goals.	The carbon impact of interventions has been quantified using the carbon models present within our engineering estimation systems (identifying carbon dioxide equivalents (tCO2e).	
	Wellbeing To provide beneficial impacts on population and human health.	Scored based on the baseline environmental factors that influence population and human health, and the impacts of the solution option(s) selected to meet the performance targets.	
Property flooding	**Internal sewer flooding risk** To define the risk of properties flooding internally from our sewers.	Two metrics: 1. Risk assessed based on average of last three years performance data 2. Modelled risk based on internal escape locations in a 1 in 30-year rainfall event.	Development of our wastewater system to deliver a reliable and efficient service and to be resilient to the risks of flooding
	External sewer flooding risk To define the risk to outside areas within a boundary curtilage flooding from our sewers.	Modelled risk based on external escape locations in a 1 in 30-year rainfall event.	
	% of population at risk of sewer flooding in a 1 in 50-year storm To define the percentage of our region's population at risk of sewer flooding from a 1 in 50-year storm, equating to a 2% probability of the storm event occurring in any given year.	Percentage of population at risk of flooding in a 1 in 50-year storm event.	
	Reduce surface water runoff To reduce the volume and/or flowrate of surface water run-off into our combined and surface water sewer networks, to levels equivalent to runoff from greenfield areas.	Modelled based on measurement of the extent of surface water runoff removed/reduced.	
	Reduce misconnections To reduce the number of misconnections of surface water entering our foul sewer network, or vice-versa.	Foul misconnection to surface water networks: Assessed to consider whether they will offer benefit or not to reducing misconnections. Surface water misconnections to foul networks: modelled based on measurement of the extent of surface water runoff removed/reduced.	
Asset Health	**Sewer collapses** To define the risk of a sewer collapsing so that its ability to convey wastewater is compromised, specifically defined as the number of sewer collapses.	An average of the last three years of annual performance.	

Figure 4-1: DWMP planning objectives

5 The impact of population growth and climate change

Progress

5.1 A summary of the increased risks between London and Thames Valley is highlighted in the bullet points below:

- For properties at risk of internal sewer flooding in a 1:30 year rainfall return period, the increase in risk over time is even across London and the Thames Valley with a 54% and 61% increase respectively.
- For properties that will be at risk of external sewer flooding in a 1:50 year rainfall return period, the increase in risk is higher for Thames Valley than in London with 54% and 30% increases respectively.

5.2 The implications of these changes are staggering. If we do nothing the risk of sewer flooding into homes and businesses may increase for 4,000 properties every year. We have mapped future risk hotspots on our DWMP GIS portal to facilitate common solutions. An extract of this BRAVA mapping is shown in Figure 5-1.

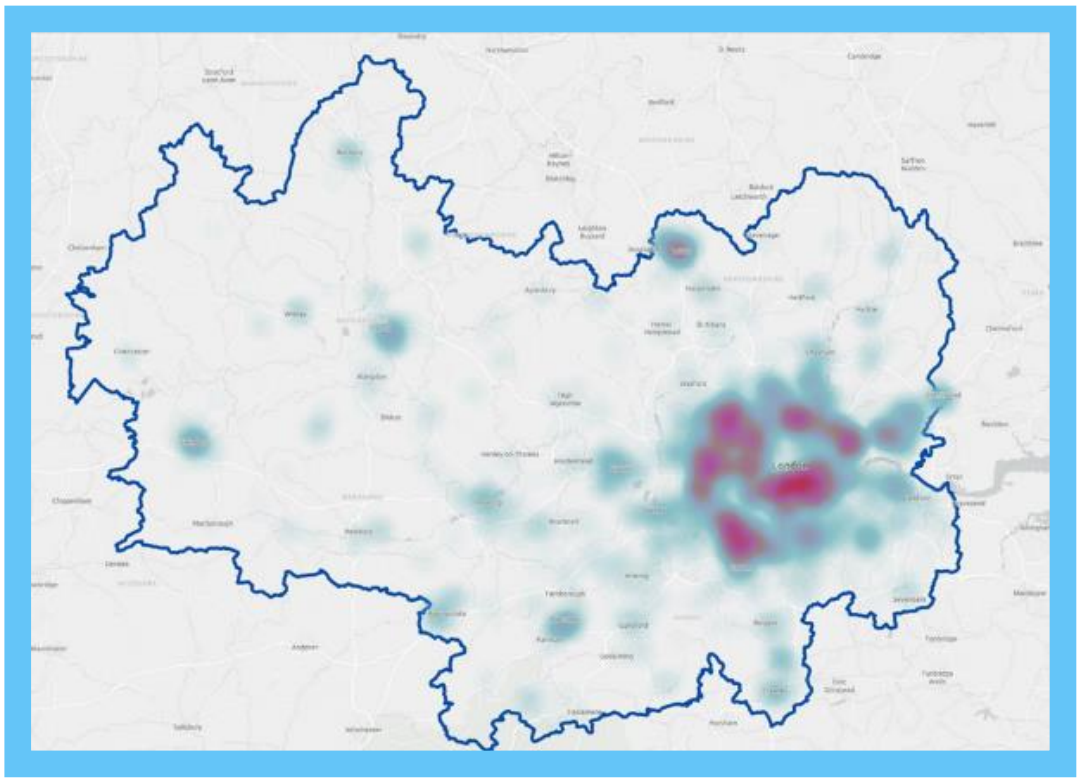


Figure 5-1: Extract from our GIS portal of risk hotspots for sewer flooding in a 1 in 50-year storm

6 A summary of the plan

Plan headlines

6.1 Our DWMP is different to past plans. Previously our investment focused on addressing shortfalls in our existing infrastructure and was heavily reliant on grey engineering solutions. In the DWMP, we intend to use green engineering solutions alongside traditional grey engineering to provide the best value and wider benefits for our communities. The technical solutions we propose aim to reduce unwanted flow from rainfall and groundwater into our network. This will decrease the flow entering our networks by attenuating surface water, where practical to do so, and preventing wastewater from impacting our customers and the environment. Table 6-1 provides a summary of the main costs and benefits in our plan.

6.2 The key headlines are:

- 1,853 km sewer relining
- 7,598 Ha of impermeable area managed through SuDS
- 82 sewage treatment works upgraded to accommodate for growth
- 207 sewage treatment works made resilient towards fluvial flooding
- 187,019 properties protected from sewer flooding in 1:50
- 271 partnership opportunities identified pre screening

fDWMP	Unit	2025 - 2030	2030 - 2035	2035 – 2040	2040 - 2045	2045 - 2050	Total
Capex	£m	1,494	3,215	6,096	9,062	12,075	31,943
SuDS	ha.	180	68	971	2,631	3,748	7,598
Sewer relining	Km	278	271	816	166	321	1,853
Treatment Works upgraded	No.	30	48	4	0	0	82
Treatment Works resilient to fluvial flooding	No.	0	80	60	67	0	207
Properties protected in a 1:50	No. of properties	2,472	16,502	15,737	26,180	126,128	187,019
Storm overflows reduced	No of discharges prevented*	10,657	1,098	322	423	520	13,020
Carbon	Net carbon per AMP tCO_2	111,588	668,735	816,760	1,111,461	1,211,962	3,920,507
* This is based on a modelled forecast of the number of sewage discharges that would occur without investment Note: All values are in this DWMP are in 2020/21 price base.							

Table 6-1: The quantum of investment required to meet our core metrics.

6.3 Our approach to delivery has also shifted, to work in partnership with our stakeholders to collaborate on projects and deliver green engineering solutions where possible. Our SuDS

programme will extend from our 20 hectares of impermeable area removed in AMP6 (2015-2020) to 150 hectares in AMP8 (2025-2030) and eventually to 3,748 hectares in AMP12 (2045-2050). Our Technical Appendix SuDS and nature-based solutions[15] has more information on how we plan to achieve this.

Changes between draft and final

6.4 Total capex for our draft DWMP was £22.4bn[16]. Between draft and final this has increased to £31.9bn, mostly driven by new requirements for storm overflows. Prioritising delivery of the new storm overflow discharge reduction obligations upfront has had a significant impact on our sewer flooding plan. This is shown in Figure 6-1 and Figure 6-2. In the final DWMP, overall PR24 deliverability constraints due to potential WINEP investment in the near term (AMP8) have resulted in a reduction in the available delivery capacity to address flood risk.

6.5 In summary the main drivers of the profiles shown in Figure 6-1 are:

- Growth upgrades at our treatment works prioritised for the first 15 years to meet the expected demand
- The regulatory dates in the Storm Overflow Discharge Reduction plan
- Deliverability concerns on meeting the storm overflow programme restricting sewer flooding investment in the near term and then driving significant investment in the medium to long term to meet targets by 2050

[15] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-r-delivery-of-suds-and-nature-based-solutions.pdf

[16] Due to the change in cost base, this value is does not match that reported in our draft plan. It has been adjusted to be in the same cost base as the final plan.

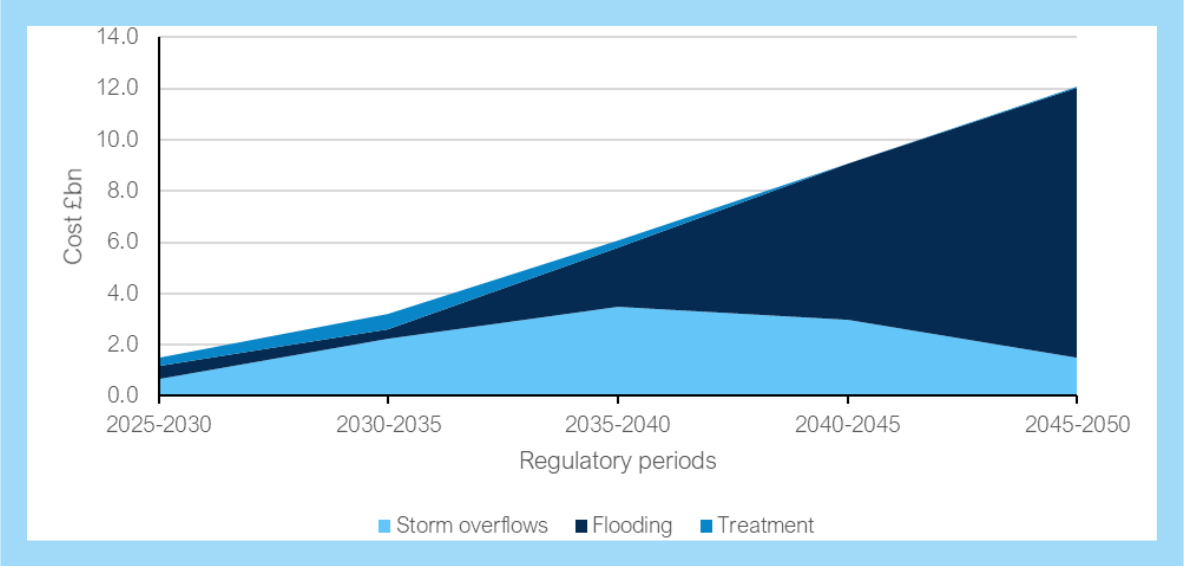


Figure 6-1: Planned investment for storm overflows, flooding and treatment works upgrades for the final DWMP

6.6 This graph needs to be contrasted to the draft DWMP planned investment that is shown in Figure 6-2.

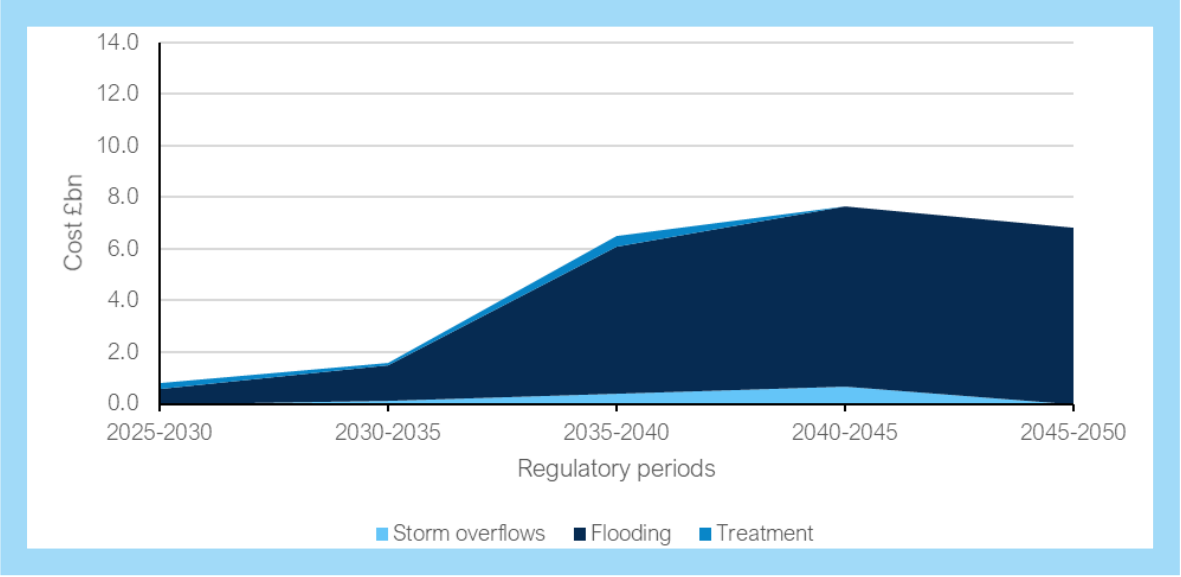


Figure 6-2: Planned investment for storm overflows, flooding and treatment works upgrades for the draft DWMP

A plan for storm overflows

6.7 Discharging untreated sewage into the environment is unacceptable to Thames Water, our customers and stakeholders. Following the publication of our draft DWMP we received significant customer and stakeholder feedback relating to storm overflows. At the same time, new industry regulatory requirements were published. Stakeholders wanted us to meet our regulatory targets, some wanted more ambitious programmes than the statutory requirements and there were many comments on the transparency of data from monitoring.

6.8 We have gone further than our regulatory requirements, committing to achieving at least a 50% reduction in the total annual duration of untreated discharges by 2030, and within that an 80% reduction in sensitive catchments, against a 2020 baseline. This commitment is part of our approach (as detailed in our River Health Action Plan[17]) to 'speak up' – by stating clearly that there are serious problems that we need to fix; to 'open up' – by providing full and open information about what is happening; and of course to 'clean up' - by doing more of what we know needs to be done to improve the situation and doing it as quickly and effectively as possible.

6.9 We illustrate in Figure 6-3, a high-level view of the main stakeholder and regulatory influences around our storm overflow discharge reduction plan. We have aligned our DWMP AMP8 programme with our WINEP Storm overflow discharge reduction drivers as submitted to the Environment Agency in January 2023. This is subject to change as we work with the Environment Agency and Ofwat to refine the programme, however the scale of our ambition will not change.

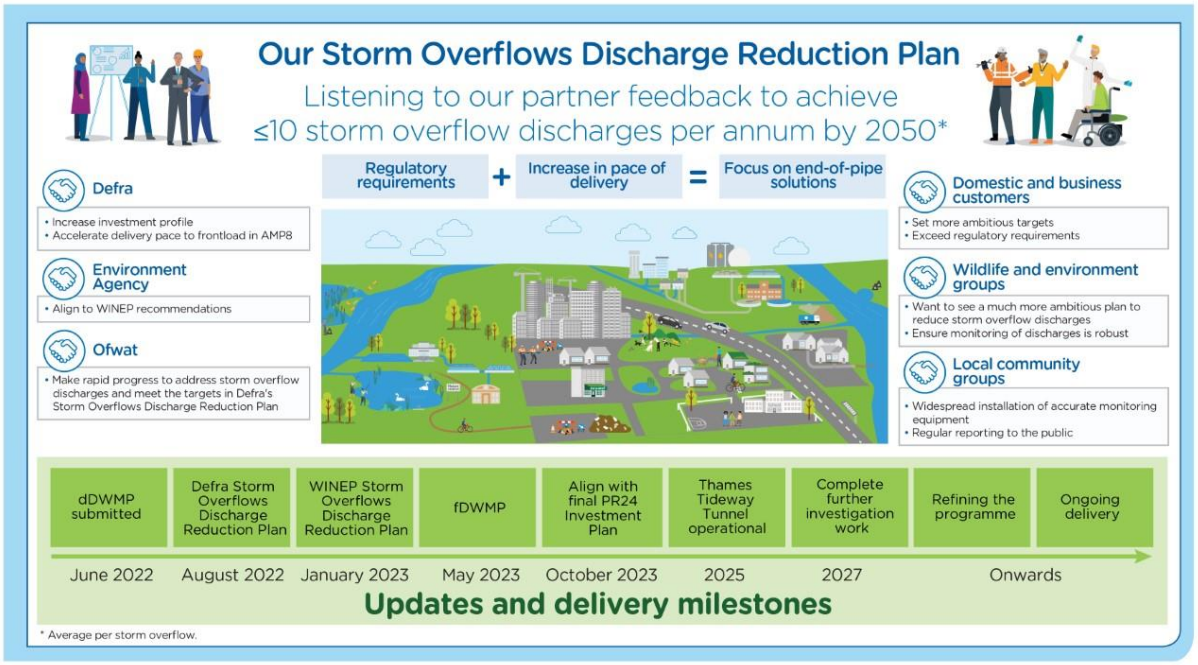


Figure 6-3: Storm overflow reduction plan stakeholder and regulatory engagement

[17] https://www.thameswater.co.uk/media-library/home/about-us/performance/river-health/river-health-report.pdf

6.10 Table 6-2 summarises the incorporation of the storm overflow discharge reduction plan targets into our DWMP.

Discharge targets	Storm Overflows Discharge Reduction Plan	Final DWMP
No ecological harm	No ecological harm by 2050	≤10 discharges in a typical year by 2045
Discharges to sensitive waterbodies	No ecological harm by 2045	≤10 discharges in a typical year by 2035
Discharges to designated bathing waters	≤ 3 discharges by 2035	≤ 3 discharges in a typical year by 2030
Storm overflow discharge frequency (all overflows)	≤10 discharges in a typical year by 2050	≤10 discharges in a typical year by 2045
Screening controls	All overflows to have screening control	100% coverage of screens by 2045

Table 6-2: Storm overflow reduction plan targets

6.11 Our storm overflow discharge reduction plan requires an ambitious scale of delivery as there are a significant proportion of high-priority sensitive sites to be resolved by 2035. This has resulted in a front-loaded programme and has meant that a large part of our DWMP investment in AMP8 and AMP9 will need to be devoted to the reduction of discharges.

6.12 To comply with the Storm Overflow Discharge Reduction Plan, we forecast expenditure of £10.9bn between 2025 and 2050. This is a significant increase from our draft DWMP forecast of £3.8bn[18]. Our plan for storm overflows is outlined in Table 6-3 and compares our accelerated pace of delivery with the requirements in the storm overflow reduction plan.

fDWMP	Unit	2025 - 2030	2030 - 2035	2035 – 2040	2040 - 2045	2045 - 2050	Total
Capex	£m	682	2,254	3,494	2,982	1,485	10,897
%Total storm overflows improved (Defra Storm Overflow Discharge Reduction Plan target)	%	14	28	52	76	100	n/a
%Total storm overflows improved (Company)	%	20	51	89	99	100	n/a

Table 6-3: Cost and benefit profile on storm overflow performance

6.13 Aligning our plan with regulatory guidelines has an impact on the technology that we will be using to deliver our plan; our project programmes will be delivering an increased number of "end of pipeline" solutions such as expanding storm tanks and increasing hydraulic capacity of sewage treatment works. The benefit of this is that we will be implementing proven

[18] Due to the change in cost base, this value is does not match that reported in our draft plan. It has been adjusted to be in the same cost base as the final plan.

solutions which will enable us to meet the challenging targets set out in the WINEP guidance. We'll still have the opportunity to review these solutions as the plan develops and progresses and look at the potential for using new technology where possible within the confines of the regulatory recommendations.

A plan for sewer flooding

6.14 From the BRAVA modelling, we know that the impact of climate change and population growth will increase the number of properties at risk of sewer flooding in a 1:50 year storm event from 90,310 in 2025 to 138,821 by 2050. Our target is for 100% of properties in the Thames Valley and 95% of properties in London not to be at risk of sewer flooding in up to a 1:50-year storm event. These targets have remained the same as those in our draft DWMP. We estimate that it will cost £19.8bn over the 25-year plan period to achieve these targets in the draft DWMP the estimated cost was £18.8bn[19].

6.15 Our plan for reducing the risk of sewer flooding is outlined in Table 6-4. Our sewer flooding plan adopts a 'SuDS-first' approach to prioritising the options for managing flood risk. We set out the need to drain 7,598[20] hectares of impermeable land to SuDS, making this the biggest set of interventions in our plan. This area equates to over 50 times the size of Hyde Park or over 10,000 football pitches. We believe that this makes it one of the most ambitious re-greening plans in the UK, possibly in the world. In promoting SuDS at this scale, we are building on the 'sponge city' approach developed in China and being led by cities such as Copenhagen, Rotterdam, New York and Portland. Between 2025 to 2030 and 2030 to 2035 we will transition from traditional approaches to scaling up SuDs delivery and in this change, we see a significant shift in cost versus benefit, as indicated in Table 6-4.

fDWMP	Unit	2025 - 2030	2030 - 2035	2035 – 2040	2040 - 2045	2045 – 2050	Total
Capex	£m	483	354	2,323	6,072	10,564	19,797
Properties protected in a 1:50	No.	2,472	16,502	15,737	26,180	126,128	187,019
Properties protected internally in a 1:30	No.	1,227	6,107	6,066	9,441	48,658	71,500
Properties protected externally in a 1:30	No.	960	7,595	7,170	11,883	60,522	88,129

Table 6-4: Cost and benefit profile on sewer flood risk reduction

6.16 In the near term (2025 to 2030) our sewer flooding plans have been constrained between draft and final versions of DWMP by implementing our regulatory WINEP requirements. This means we need to accelerate flood risk reduction later in our plan to achieve ambitious 25-year goals. This reprofiled delivery in our 25-year plan is unconstrained and takes us beyond our current delivery experiences in this sector. We cannot achieve these targets alone. As the DWMP matures through subsequent cycles we will gain more experience of partnership

[19] Due to the change in cost base, this value is does not match that reported in our draft plan. It has been adjusted to be in the same cost base as the final plan.
[20] This SuDS implementation provides both flooding and storm overflow discharge benefit

delivery. We have written a technical appendix specifically dedicated to SuDS and nature-based solutions[21].

6.17 On 12 July 2021, very intense rainfall fell over a swathe of west London from a convective storm. On 25 July 2021, a similar event occurred, but this time the rain fell over a larger part of London and Essex. The events resulted in the flooding of many homes and businesses and London's transport, education, and health infrastructure. Over 1,500 properties have reported some internal flooding, either from sewers backing up inside the properties, or overland flows reaching sufficient depth to penetrate properties through air bricks, door, and window frames. On 12 July more than a month's worth of rain fell in under an hour and some areas received nearly 80mm of rain (170% of July's average rainfall) over the course of the storm, with Kensington, Westminster, and Hammersmith the most affected. The Met Office later confirmed return periods of up to 179 years for the rain that fell in one hour.

6.18 This flooding led to the realisation of the need for an urgent and strategically co-ordinated approach to tackle surface water flood risk on an unprecedented scale. The DWMP supports the findings of the independent review[22] on the flooding with a dedicated technical appendix[23] detailing activities underway by many of the leading organisations as well as how solutions within this DWMP support reducing the risk of flooding.

Regional plans

6.19 Our plans are articulated at different levels: region wide, sub-regional and catchment level. This recognises the uniqueness of our systems and the communities they serve. We summarise plans for London and the Thames Valley: This ensures the capital city's unique assets and needs are met, alongside those of our more rural communities served by small, separated systems that support areas of global ecological importance, such as chalk streams.

6.20 For London Table 6-5 outlines the costs and benefits, Figure 6-4 a schematic of the plan followed by Table 6-6 with the activities proposed by catchment.

	2025 - 2030	2030 - 2035	2035 - 2040	2040 - 2045	2045 - 2050	Total
Capex (£m)	439	2,314	4,547	6,723	8,898	22,922
Properties protected in a 1:50	1,406	15,001	15,003	22,977	110,319	164,706
% London Storm overflow locations resolved	10	43	75	100	100	n/a

Table 6-5: Costs and benefits for London

[21] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-r-delivery-of-suds-and-nature-based-solutions.pdf
[22] https://www.thameswater.co.uk/about-us/investing-in-our-region/london-flooding-response
[23] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-p-response-to-july-2021-floods.pdf

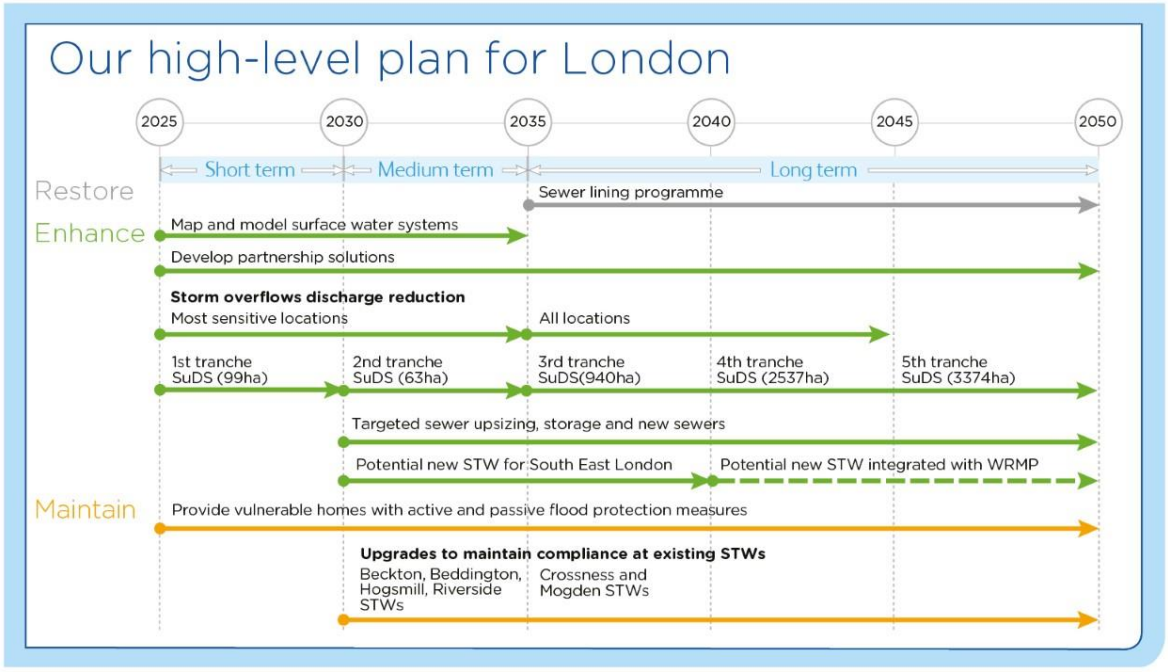


Figure 6-4: Schematic of the plan for London

Catchment	SuDS (ha.)	Sewer lining (km)	Sewer upsizing (km)	Storage (m^3)	Property Protection*
Beckton	1,104	0	165	950,061	31
Beddington	157	32	21	35,079	0
Crossness	2,412	0	33	565,188	11
Deephams	613	0	1	602,737	0
Hogsmill	357	0	582	495,218	0
Long Reach	306	423	115	413,662	0
Mogden	1,885	0	36	2,008,204	310
Riverside	79	201	2	199,572	0
Total	6,914[#]	656	953	5,269,721	352

* Property level protection is a term for a collection of devices that can be installed at property level to protect the property from flooding.

[#] 99 ha are not allocated to any catchment and will be delivered through partnership opportunities

Table 6-6: Catchment level activity for London

6.21 For the Thames Valley Table 6-7 outlines the costs and benefits, Figure 6-5 a schematic of the plan followed by Table 6-8 with the activities proposed by TRFCC partnerships.

	2025 - 2030	2030 - 2035	2035 - 2040	2040 - 2045	2045 - 2050	Total
Capex (£m)	1,055	900	1,549	2,339	3,177	9,020
Properties protected in a 1:50	1,066	1,501	734	3,203	15,809	22,313
% Thames Valley Storm overflow locations resolved	26	56	97	100	100	n/a

Table 6-7: Costs for Thames Valley

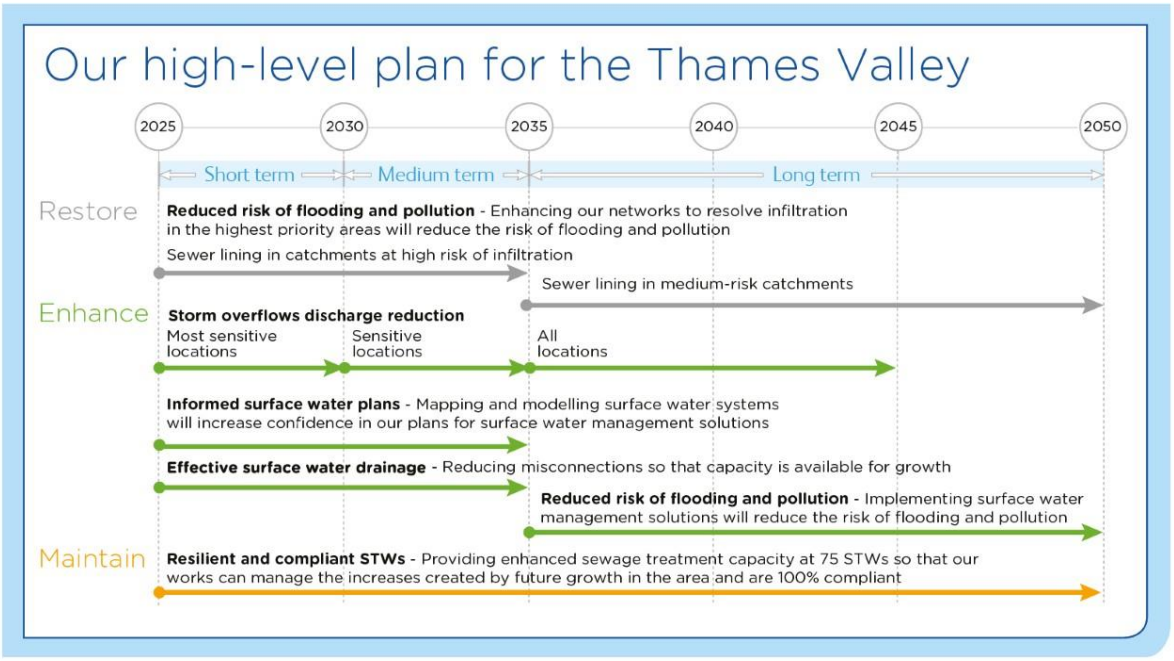


Figure 6-5: Schematic of the plan for Thames Valley

L2	Surface water management (ha.)	Sewer lining (km)	Treatment works upgrades
Hertfordshire	116	125	5
Central Bedfordshire, Buckinghamshire, Slough and Luton	75	107	6
West Berkshire, Reading, Wokingham, Bracknell Forest, Windsor and Maidenhead, Hampshire and West Sussex	81	337	20
Surrey	115	23	7
Essex & Thurrock	19	17	5
Oxfordshire, Swindon, Wiltshire, Gloucestershire and Warwickshire	179	588	32
Total	585*	1,197	75
* 99 ha are not allocated to any L2 area and will be delivered through partnership opportunities			

Table 6-8: TRFCC partnership level activity for Thames Valley

The role of maintenance activities

6.22 Maintenance activities ensure that our systems are working to their operating capacity. They are an integral part, in the hierarchy of options outlined in Figure 6-6 of how we mitigate the impact of climate change and population growth.

6.23 Hydraulic flooding performance is firstly managed through maintenance activities (including silt removal). This allows our sewers to flow freely. We also optimise existing capacity in our network using flow control devices. Once these are implemented and hydraulic flooding still occurs, we manage flood risk through additional activities to increase the effective capacity of the assets. These activities are the focus of DWMP.

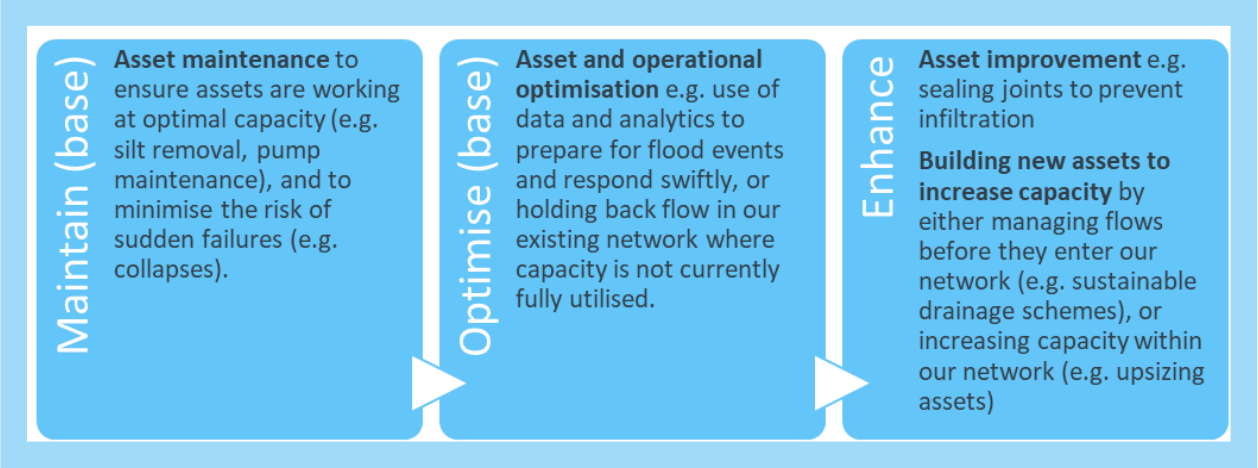


Figure 6-6: Base and enhancement activity

6.24 We have risk-assessed the impact of maintenance activities in terms of impact of additional hydraulic capacity requirements. Based on this assessment, silt removal and predictive analytics are key tactical measures impacting on incident prevention. Our DWMP modelling assumes that continuing these activities is necessary to maintain current levels of hydraulic risk, and that further risk reduction requires expenditure as outlined in the DWMP. The modelling approach used in BRAVA assumes that sewers are already generally silt-free (other than a minimal amount of ~20mm or where a specific flow monitor has picked up the need to include some) and that the opportunity for improving performance through increased silt removal is therefore negligible.

Partnership opportunities

6.25 Our aim has been to create a partnership-led shared plan. We are not going to be able to achieve our shared ambitious DWMP goals affordably without working together. Our DWMP journey has resulted in a partnership database with 271 opportunities, of which 80 are being considered in greater detail at a result of a screening process. These are listed in a separate Technical Appendix on Partnership Opportunities[24].

6.26 Most schemes are focused on addressing sewer flooding risk. We have mapped our sewer flooding schemes and assessed their proximity to other surface water schemes, e.g., within 50 metres of an Environment Agency surface water flood location. For London we have

[24] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-s-partnership-working-and-opportunities.pdf

found that on average the overlap is 64% of schemes, highlighting the potential for partnership solutions.

6.27 We anticipate that over time partnership projects will mature, so we can define the proportion of the flooding investment that can be met by co-funding. In cycle 1 we have developed partnership working to a "proof of concept" stage. In cycle 2, we aspire that the continuing focus and greater definition of schemes will result in further co-funding.

Adaptive planning

6.28 In our final DWMP we have extended adaptive planning from focusing on London's large STWs to including all DWMP requirements. The approach follows the guidance published by Ofwat on Long Term Delivery Strategies (LTDS)[25], where the impact of climate change, population growth and technology (defined as common reference scenarios) are specifically tested.

6.29 We found that our preferred plan is most sensitive to different climate change scenarios, particularly our storm overflows plan (see Figure 6-7). A high global emissions climate change scenario may require 29% more investment in the longer-term (up to 2050) to achieve our ambition of reducing storm overflow discharges compared to our preferred plan. This is because high climate change scenarios may lead to storms of a far greater intensity and with the consequent need for our networks and STWs to handle much higher flows of surface water, leading to higher storm overflow discharge volumes.

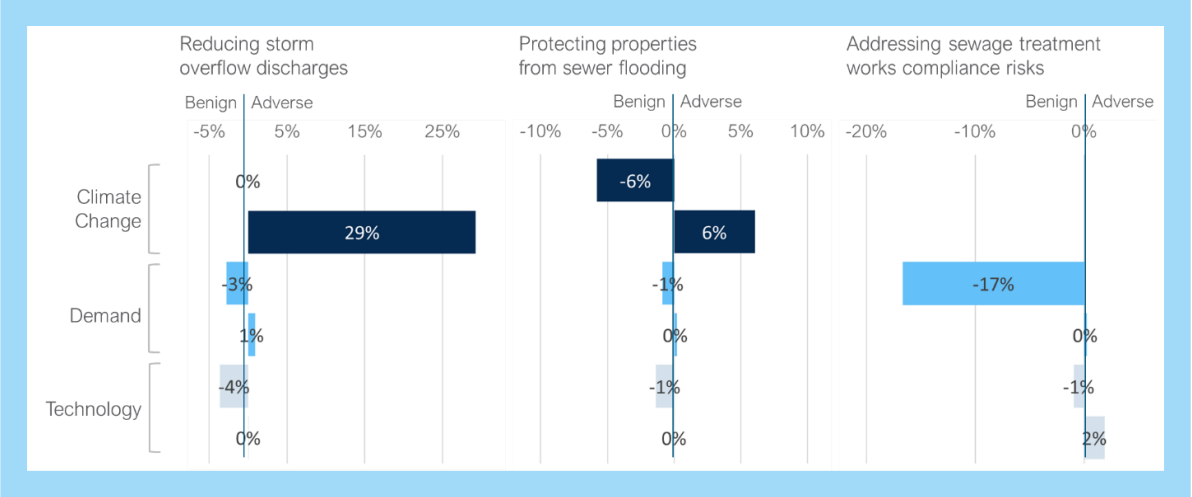


Figure 6-7: Percentage change in costs due to uncertainty using the common reference scenarios

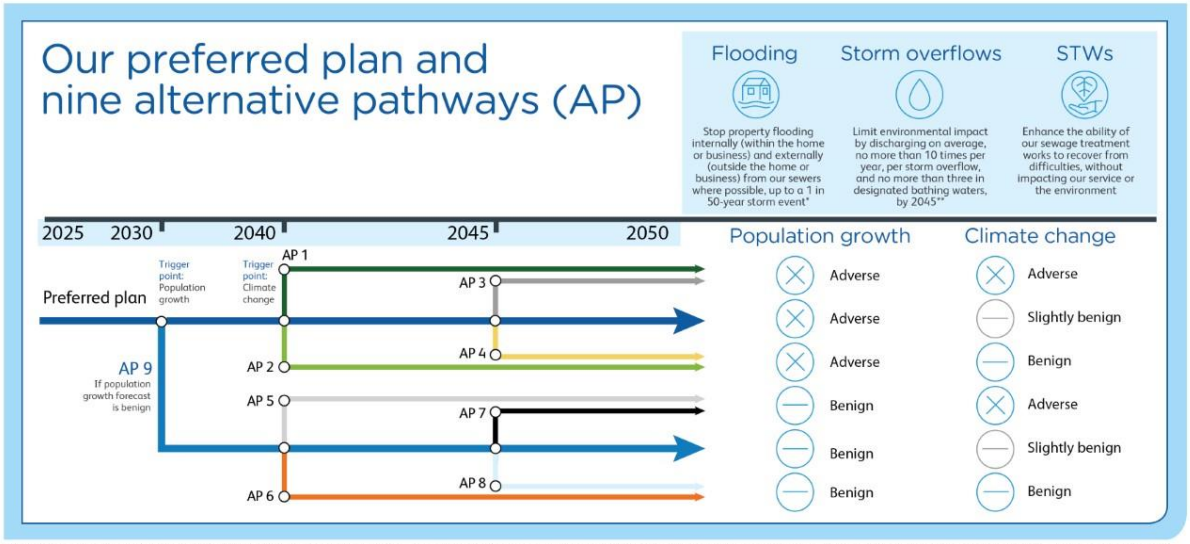
6.30 Following Ofwat's LTDS framework, we combined climate change, population growth and technology scenarios to generate plausible futures that drove different plans or pathways. We then compared our preferred plan to the subsequent "core" and "adverse" pathways.

6.31 We found that in the medium term different combined forecasts (climate change, population growth and technology) do not have an impact on driving different plans, as meeting ambitious environmental targets dictate the spend trajectory. As a result, our preferred plan is aligned to a no- and low-regret (core) pathway up to 2040 in terms of overall investment.

[25] https://www.ofwat.gov.uk/publication/pr24-and-beyond-final-guidance-on-long-term-delivery-strategies

Beyond 2040, divergent climate change forecasts drive different pathways. Our preferred plan tracks a position between the core and adverse pathways.

6.32 We combined different forecasts to create nine different plausible futures as outlined in Figure 6-8. The main trigger to change direction onto a different pathway was climate change with changing forecasts triggering a pathway change review.



* This is a measure of how well our drainage systems can cope in extremely wet weather. The risk of sewer flooding in a 1 in 50-year storm is defined as the likelihood that flooding will occur as a result of rainfall in a storm that has a 1 in 50 (or 2%) probability of happening in any given year.
** Our sewers are designed to overflow to the environment to prevent homes and businesses from flooding. However, storm discharges that happen too often, or for too long, can impact the environment.

Figure 6-8: Adaptive plan pathways for our DWMP

7 Plan development

7.1 This is the first cycle of the DWMP, and we've developed our plan in accordance with the DWMP Guiding Principles and the DWMP industry framework[26]. Between the draft and final plans, we have ensured alignment to the requirements set out in Defra's Storm Overflow Discharge Reduction Plan[27] as well as incorporated responses received from stakeholders and regulators during the public consultation and detailed in our Technical Appendix called 'You Said We Did'[28].

Screening catchments

7.2 Once the planning objectives were set at the Strategic Context stage, we moved on to screening out catchments at low risk. This enables us to focus on catchments with risks and vulnerabilities that need long-term planning to ensure continuity of service and avoid adverse environmental impacts.

7.3 Seventeen agreed key indicator measures were used to provide a high-level review of existing issues, using published data and catchment knowledge. The metrics included historical pollution incidents, sewer flooding incidents, treatment works compliance, sewer collapses, sewer blockages and population growth.

7.4 Screening allowed progression to stage 3 of the framework while 89 catchments were screened out. That is 77% of catchments progressing, but 99.8% of our population equivalent[29]. Only 32,730 p.e. was excluded at this stage. Figure 7-1 shows the percentage of catchments that breach each of the indicators.

[26] https://www.water.org.uk/policy-topics/managing-sewage-and-drainage/drainage-and-wastewater-management-plans/
[27] https://www.gov.uk/government/publications/storm-overflows-discharge-reduction-plan
[28] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-n-you-said-we-did.pdf
[29] Population Equivalent (p.e.) represents a measure of the equivalent people a treatment works or part of the network serves. Commuters, tourists, as well as trade flows are converted into an equivalent person.

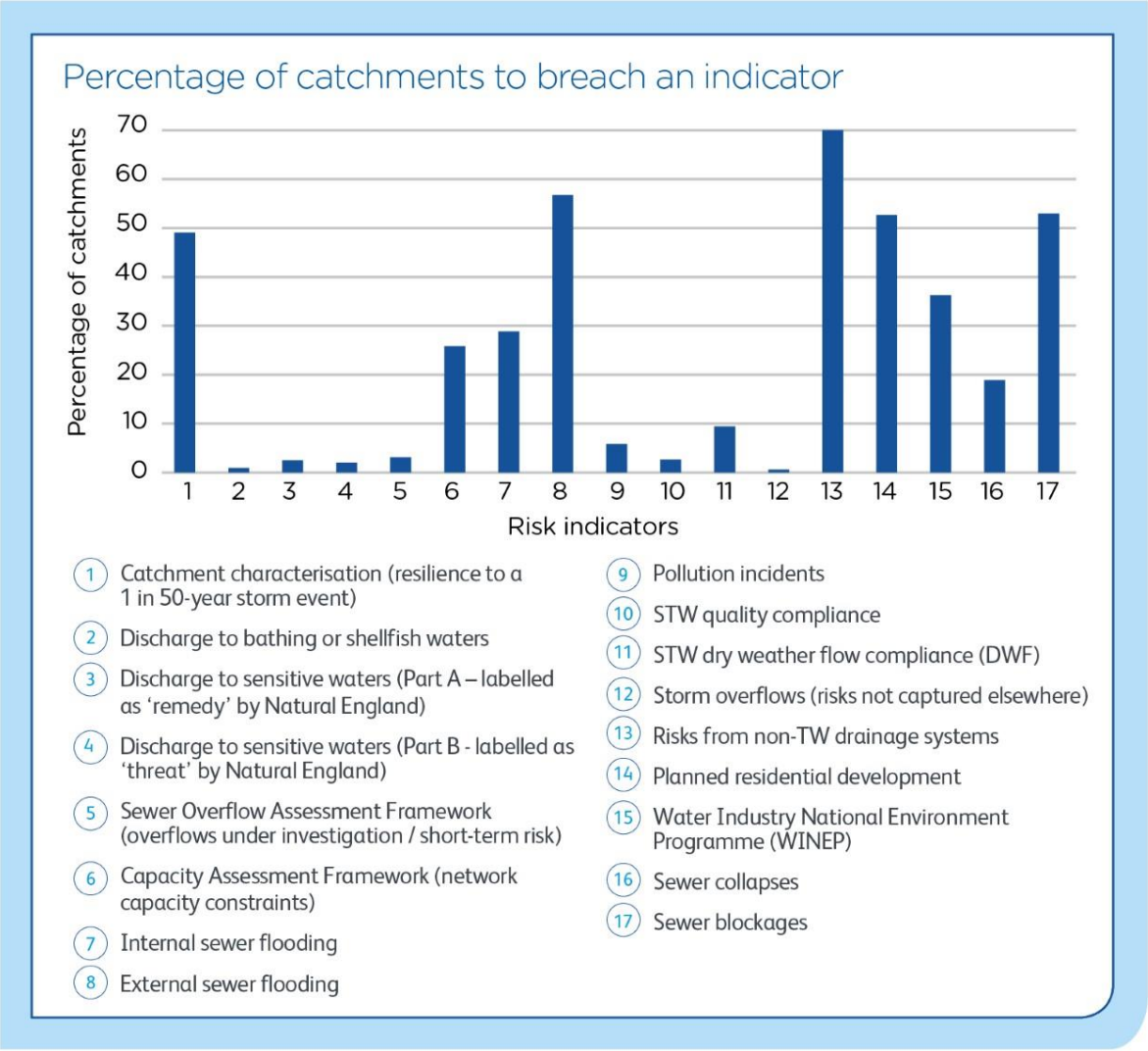


Figure 7-1: Percentage of catchments breaching each indicator to demonstrate the significant differences between the indicators[30]

7.5 For a detailed understanding of risk-based catchment screening and to view which risk indicators each catchment passed or failed, please refer to the Technical Appendix on Risk based catchment screening[31].

Baseline Risk and Vulnerability Assessment (BRAVA)

7.6 The Baseline Risk and Vulnerability Assessment (BRAVA) stage is aimed at understanding the current (or baseline) performance of the planning objectives, before predicting how they will change in the future due to population growth and climate change. The size of the gap is then addressed in Options Development Appraisal. Only catchments that have passed through RBCS are analysed in BRAVA.

7.7 We summarised our BRAVA data and collated into a national assessment, published through Water UK in December 2020. Thames Water results for the 2020 baseline and

[30] SOAF: Storm overflow assessment framework, CAF: capacity assessment framework, WINEP: Water Industry National Environment Programme
[31] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-b-risk-based-catchment-screening.pdf

2050 positions of the national picture can be found in Figure 7-2 for treatment works, Figure 7-3 for storm overflows and Figure 7-4 for 1:50 flood risk mapped to L2.

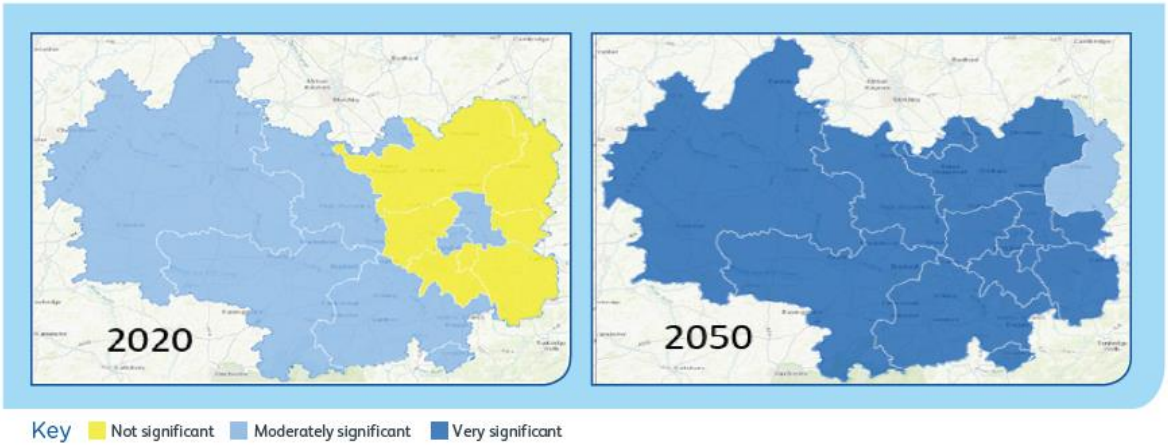


Figure 7-2 : Change in risk position on STW compliance with permit conditions by 2050

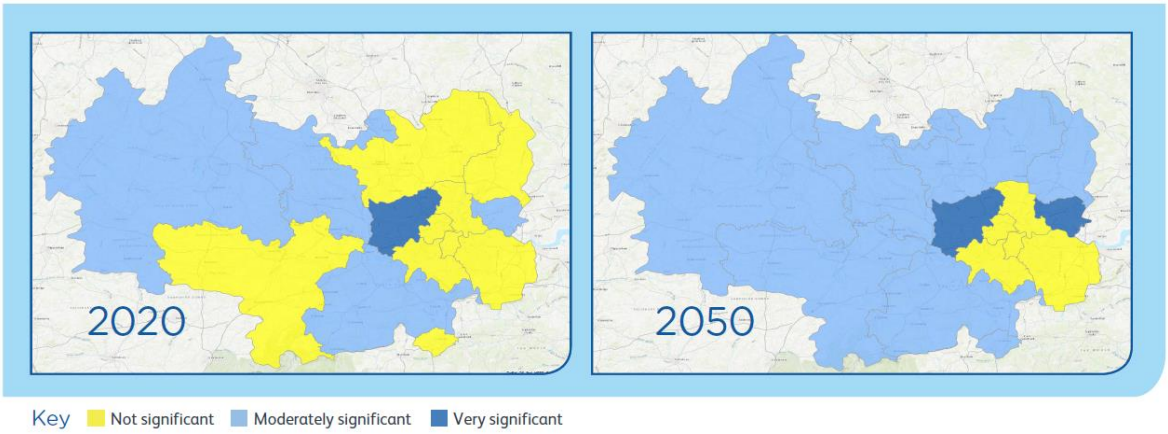


Figure 7-3 : Projected increasing risk of storm overflow performance by 2050

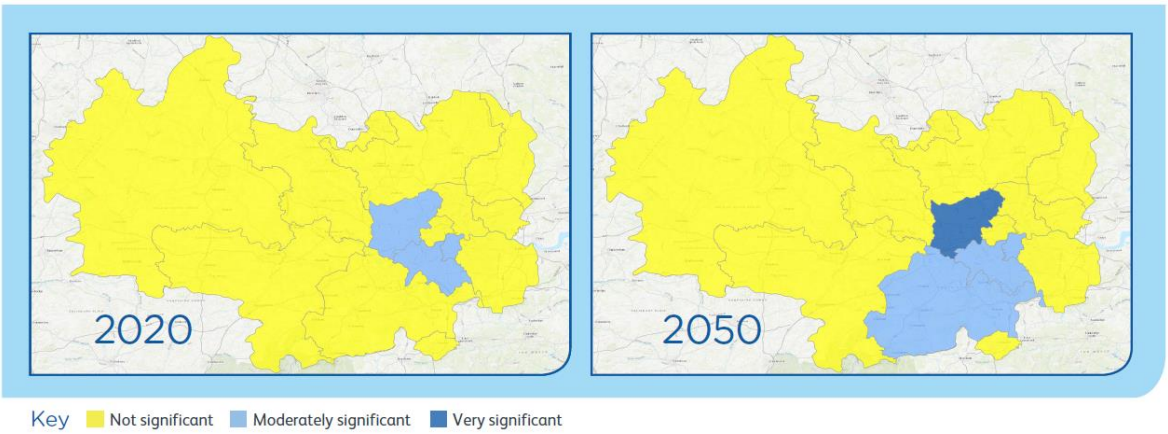


Figure 7-4 : Projected risk of property flooding by 2050

7.8 To facilitate engagement with BRAVA for our stakeholders an external GIS portal was provided. The portal also holds the risk-based catchment screening data and stakeholder engagement opportunities. BRAVA datasets are presented as heatmaps to ensure individual property level risk is not identifiable. We released the data on the portal following

a series of stakeholder engagement workshops explaining the BRAVA data and walking stakeholders through how the data is visualised.

7.9 The final element of BRAVA is Problem Characterisation. We assessed each Level 3 catchment where BRAVA was undertaken against a strategic needs score and complexity factor on a 4 by 3 matrix. The Problem Characterisation stage is used to determine the level of complexity required in Options Development Appraisal.

7.10 For a detailed understanding of BRAVA and problem characterisation, please refer to the Technical Appendix on BRAVA[32].

Options development appraisal

7.11 Options development in the DWMP is focussed on delivering a 'best value' set of solutions for a catchment that mitigate the impact identified at BRAVA. Solution options were developed by the industry, informed by customer research, and created with stakeholders. Our focus was to ensure that solutions provide wider benefits than just resolving a single issue. This meets stakeholder expectations, especially for the outcome measures identified in our Strategic Context.

7.12 Our approach is outlined in Figure 7-5 and comprises four phases. They are:

- Development of generic options (qualitative)
- Refinement of generic options to unconstrained options (qualitative)
- Refinement of unconstrained options to constrained options (qualitative)
- Refinement of constrained options to feasible options (quantitative)

7.13 Feasible options are then used in Programme Appraisal.

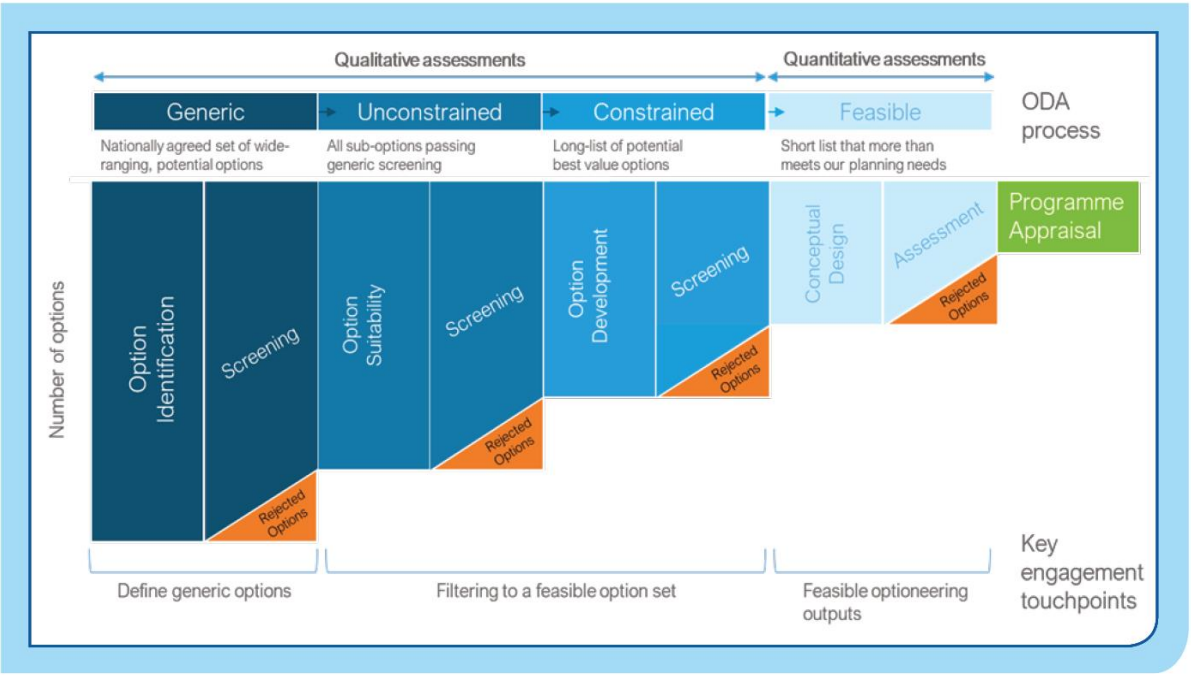


Figure 7-5: Overview of our optioneering framework for cycle 1 DWMP

[32] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-c-baseline-risk-and-vulnerability-assessment-and-problem-characterisation.pdf

7.14 During public consultation our stakeholders made a series of regional and location specific recommendations for use within the DWMP. Many of these focussed on solutions and included:

- Suggestions for solutions to implement
- Suggestions of additional wider benefits that may be calculated
- Support for some solution types (especially nature base solutions)

7.15 We have compiled all their feedback into our Statement of Response (called 'You Said, We Did')[33] that holds a section specifically on solutions.

7.16 The benefit of green versus grey engineering was also assessed through a more detailed case study in the Deephams[34] catchment. Using our feasible optioneering approach a green only solution was developed that met all the targets. We then developed and costed an alternative grey only solution that also meets the target. Following a costing exercise, the green solution was 66% of the cost of the grey solution. Additionally, the green solution provides a wide range of wider benefits that the grey one does not. For more details on the Deephams Case please refer to the Technical Appendix on Options Development Appraisal.[35].

7.17 Figure 7-6 and Figure 7-7 graph the percentage cost split by network solution option of London and Thames Valley respectively. In the London graphs we can clearly see the preference for green solutions with more traditional solutions and sewer lining being prominent in the Thames Valley.

[33] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-n-you-said-we-did.pdf
[34] Deephams is representative of large urban separately drained catchments in our area with challenges not as large as observed in central London.
[35] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-e-programme-appraisal.pdf

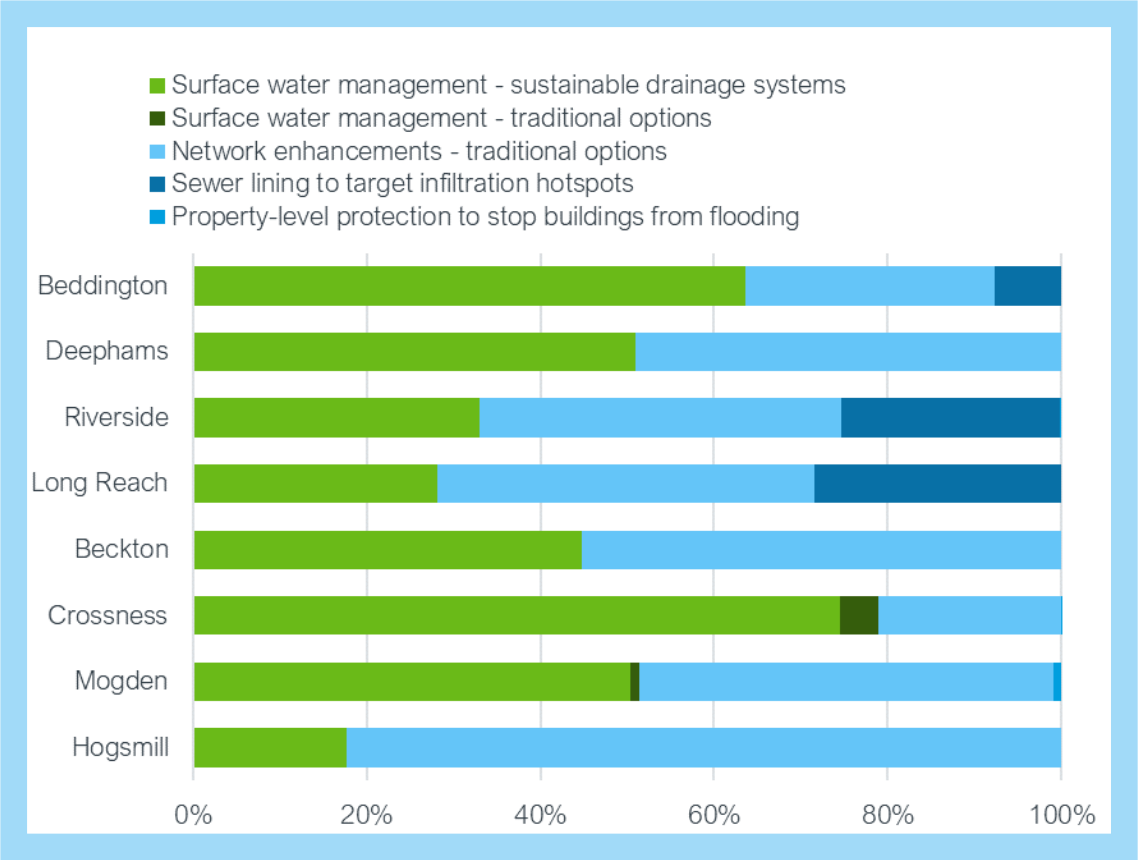


Figure 7-6: Network option types developed for London catchments as a proportion of total construction costs (to achieve planning objective targets by 2050)

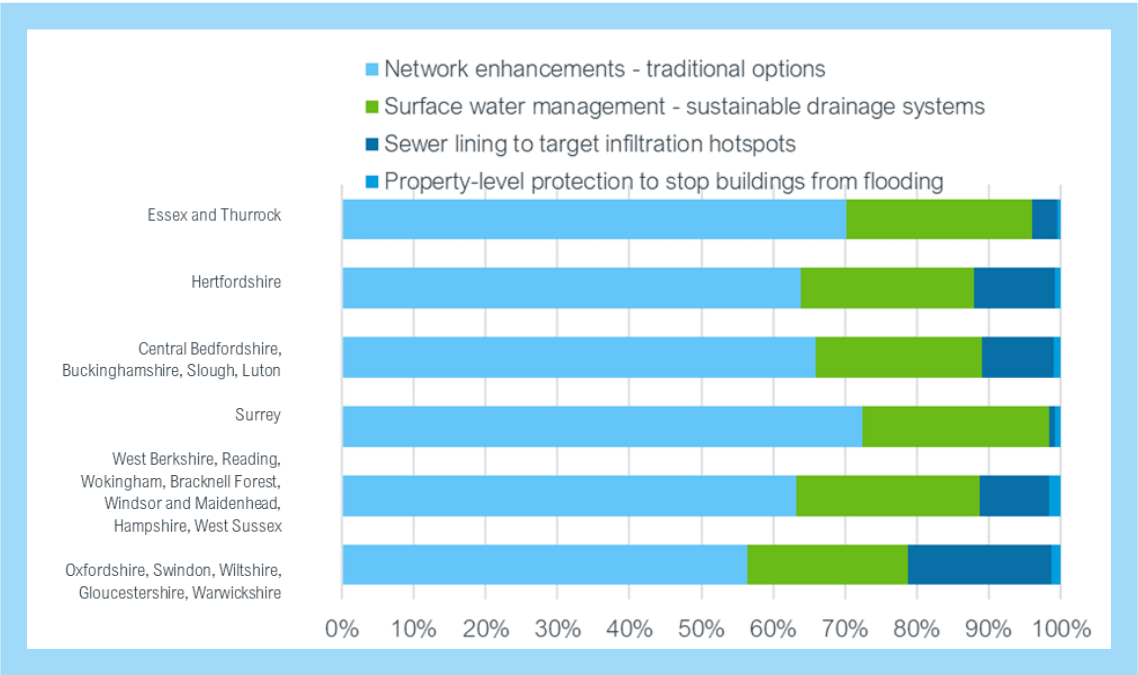


Figure 7-7 Network option types developed for L2 areas outside of London as a proportion of total construction costs (to address planning objective targets by 2050)

7.18 For more details on the Option Development Appraisal, refer to the Technical Appendix[36].

[36] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-e-programme-appraisal.pdf

Programme appraisal

7.19 Programme appraisal is the final step in the DMWP stages. It takes the outputs from the previous Option Development Appraisal stage and uses the solutions identified to build a 25-year programme of investment.

7.20 Additional data in terms of regulatory requirements, stakeholder expectations, and customer preferences are required. The wider benefits framework and value of the proposed plan is also developed.

7.21 Ofwat provided guidance on producing Long-Term Delivery Strategies (LTDS)[37] which are a mandatory requirement for PR24. We enhanced our Programme Appraisal to account for this guidance. We stress tested our plan using an Adaptive Planning approach. Details of how our approach aligns with the LTDS can be found in the Technical Appendix on Programme Appraisal[38].

7.22 We ran Programme Appraisal ahead of draft publication. We developed a series of plans and presented one of those as our plan of choice at public consultation. Due to the amount of stakeholder feedback and change in regulatory requirements on storm overflows we re-cast our plans, developing a new series of plans and selected a preferred one for the final DWMP.

7.23 The steps undertaken in programme appraisal as well as when stakeholder engagement was completed is outlined in Figure 7-8. This complies with the DWMP framework as it allows for different elements of the plan to be prioritised against each other, promotes an informed debate, and generated a best value programme.

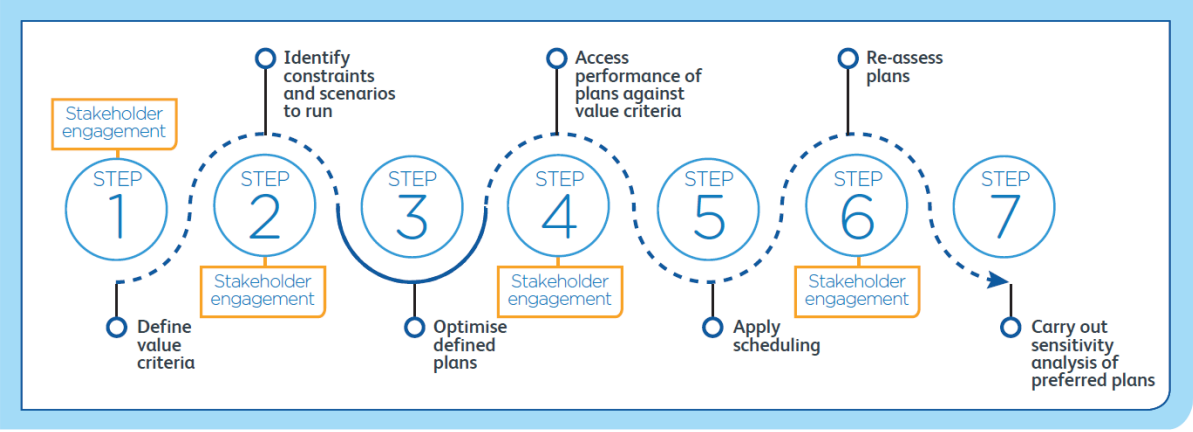


Figure 7-8: Overview of programme appraisal

7.24 Table 7-1 outlines the additional alternative plans that were developed between the draft DWMP and final DWMP.

[37] https://www.ofwat.gov.uk/publication/pr24-and-beyond-final-guidance-on-long-term-delivery-strategies/
[38] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-e-programme-appraisal.pdf

Plan Name	Plan Description
Maintain flooding resilience	This plan is similar to the draft plan in maintaining flooding performance but now prioritises delivery of our storm discharge reduction programme to meet legislative requirements and represents the minimum investment to achieve our current performance levels and regulatory requirements. The 'maintain flooding' plan has been assessed despite it being a low priority to stakeholders, as it provides a clear reference point against which more ambitious plans can be assessed.
Resilient – constrained	This plan prioritises delivery of our storm discharge reduction programme to meet legislative requirements and imposes a constrained/steady pace of investment on flooding performance in AMP8 and AMP9 to manage impact on customers' bills and deliverability. This follows the approach to flooding developed for the (preferred) resilient plan consulted on at draft DWMP.
Accelerated /deliver sooner	This plan prioritises delivery of our storm discharge reduction programme to meet legislative requirements by 2035 and delivery of our flooding targets sooner than the 'Maintain flooding resilience' plan
Maximum community benefit	This plan prioritises delivery of our storm discharge reduction programme to meet legislative requirements and, as with the 'maximum benefit' plan at draft, selects those options that meet our DWMP planning objectives which also create the most benefit to communities and the environment

Table 7-1: Plans considered between draft DWMP and final DWMP.

7.25 Variations in costs and benefits of the alternative plans are outlined in Table 7-2.

Impact	Area	Maintain flooding resilience	Resilient - constrained	Accelerated / deliver sooner	Maximum community benefit	Draft plan
Cost (£bn)	London	15.774	22.922	23.397	23.119	15.446
	Thames Valley	5.505	9.020	8.985	10.307	7.922
	Total	21.279	31.942	32.382	33.426	23.368
Bill Impact (£ pa per household)	London	**58.58**	**74.83**	**129.36**	**140.52**	**56.20**
	Thames Valley	**45.35**	**64.96**	**96.63**	**141.08**	**52.86**
No of properties no longer at risk of sewer flooding in a 1:50 year return period	London	116,968	164,706	166,698	165,337	155,018
	Thames Valley	8,101	22,313	22,313	22,313	20,651
	Total	125,169	187,019	189,011	187,650	175,669
No of properties no longer at risk of internal sewer flooding in a 1:30 year return period	London	47,429	66,559	67,775	67,410	65,331
	Thames Valley	1,892	4,941	4,915	4,982	4,382
	Total	49,321	71,500	72,690	72,392	69,713
No of properties no longer at risk of external sewer flooding in a 1:30 year return period	London	53,231	76,527	77,633	76,841	71,356
	Thames Valley	4,292	11,602	11,547	11,682	10,498
	Total	57,523	88,129	89,180	88,523	81,854

Table 7-2 Cost and benefit variances for the alternative plans

7.26 When considering the various plans and selecting the preferred plan we balanced the commitments and deliverables we needed to achieve with affordable bills. Figure 7-9 represents some of the challenges we faced.

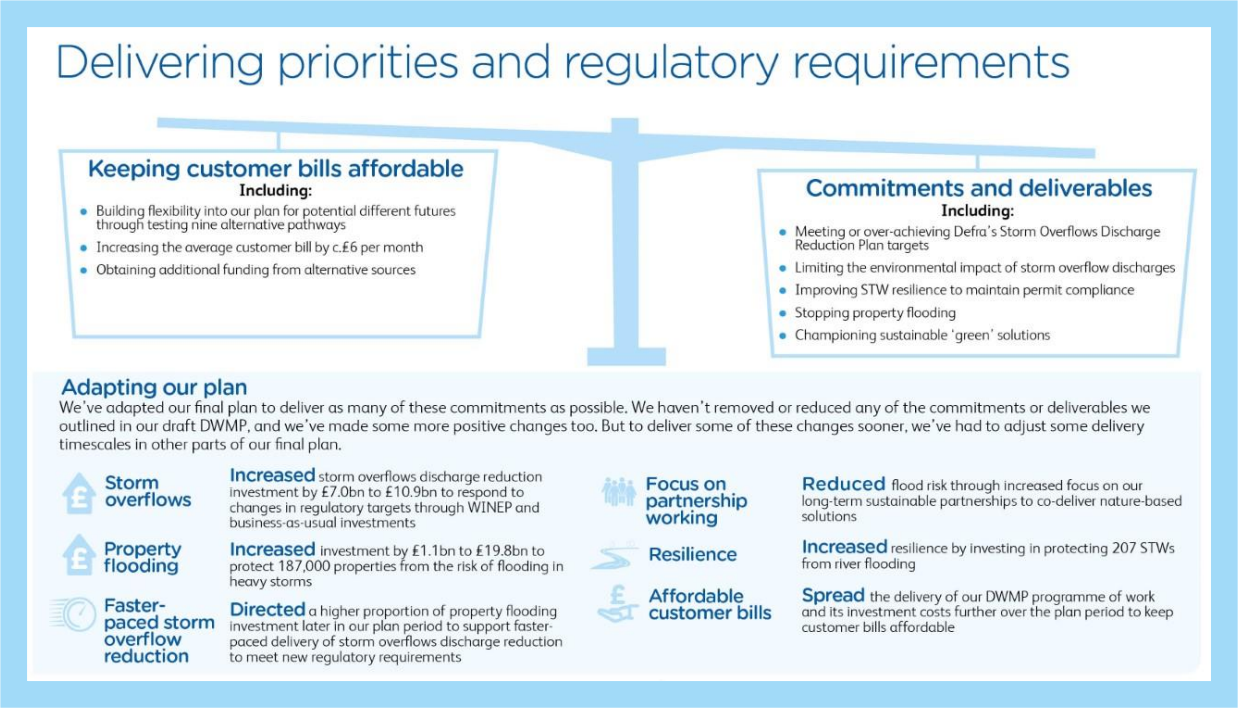


Figure 7-9: Priorities and regulatory requirements assessed in plan selection

7.27 We assessed these alternative plans under our best value framework to see which one performed best against the wider benefits described by the value criteria. The results are simplistically represented in the radar plot in Figure 7-10 and show that the plan that performed the best (i.e., largest area under the radar plot) was the "resilient constrained plan". The reason it performs well is because it achieves the same long-term outcome, but the more phased delivery profile means a smaller bill impact over the planning period.

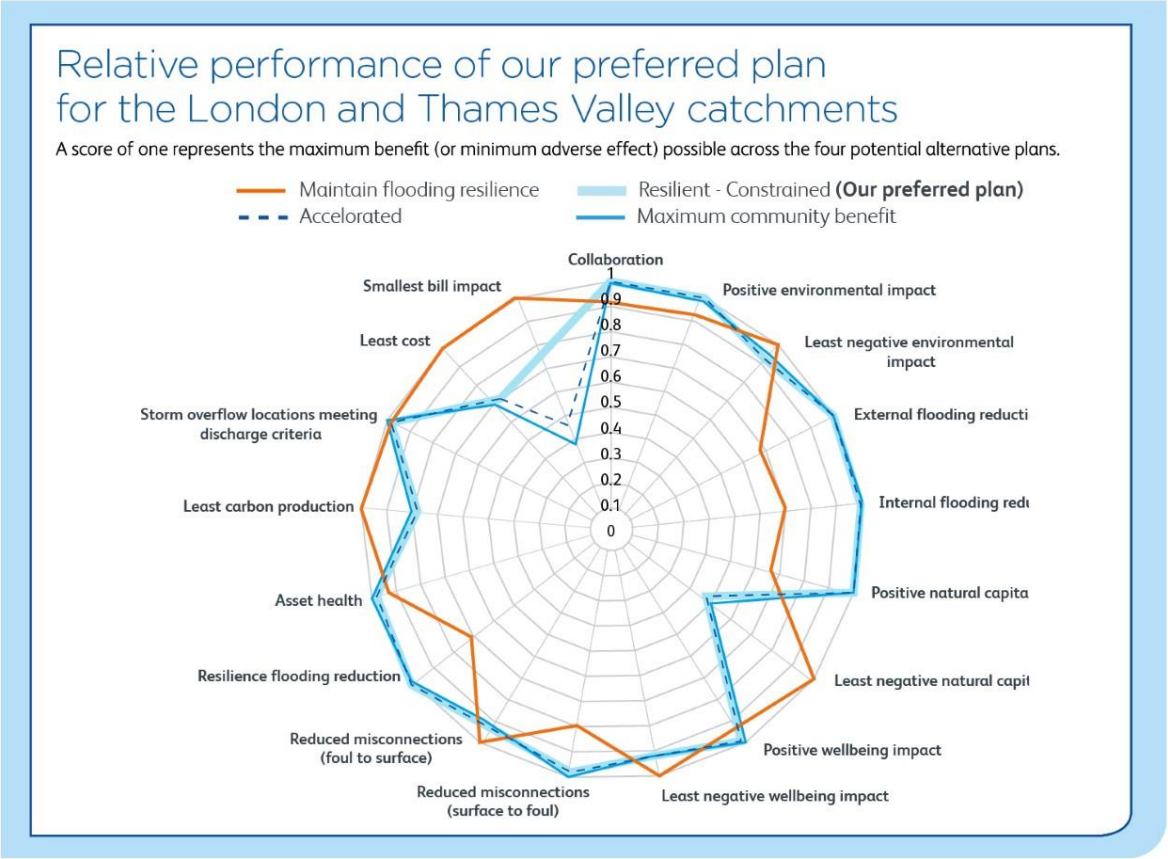


Figure 7-10: Radar plot to show how different plans performed under our best value framework

Note 1: Least cost relates to the construction cost of each plan. Smallest bill impact represents the household bill increase of each plan which considers the profiling of investment. Carbon is considered as part of the natural capital element
Note 2: The plan with the largest area under the radar plot indicates that plan provides the greatest value across all value criteria. The closer the line is to the outside of the graph, the better the outcome for any metric

7.28 For more details on plan alternatives please refer to Section 7 of the Technical Appendix on Programme Appraisal[39].

[39] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-e-programme-appraisal.pdf

Assurance

7.29 The Thames Water Utilities Board has responsibility for setting our strategy and assuring that all plans developed deliver that strategy. We have therefore obtained approval from our Board for this final DWMP.

7.30 Our regulators have defined a set of five criteria[40] that they expect all water company boards to assure for the DWMP. There were four of these at the draft stage and a fifth one has been added for the final DWMP. They are:

- The guiding principles and the DWMP technical framework have been followed and applied
- The planning objectives are being met (both common and bespoke)
- There are clear links and processes in place to ensure that the appropriate DWMP interventions, including partnership and co-funded schemes, will be put forward for investment in the PR24 business plan
- Measures are in place to achieve objectives set in the Government's Storm Overflows Discharge Reduction Plan (new criteria)
- It is a best value plan for customers and the environment, for managing and developing drainage and wastewater services, and is based on robust evidence and costing processes

7.31 Our plan has been externally assured against the DWMP set criteria to support the Board Assurance process. The audit of the DWMP was demonstrated by compliance with thirteen tests developed by the auditors independent of us.

7.32 The delivery of DWMP was also incentivised by a dedicated performance commitment set at the last price review (PR19) and we have separate external assurance as part of annual return reporting for this.

7.33 More details on assurance can be found in our Technical Appendix on Assurance[41].

[40] Letter to CEOs from Defra, Ofwat, EA on Expectations for assurance of cycle 1 draft and final drainage and wastewater management plans (DWMP's).
[41] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-m-board-assurance-statement.pdf

Glossary

Term	Description
1 in 30-year storm	A storm that has a 1 in 30 chance (3.33% probability) of being equalled or exceeded in any given year. This does not mean that a 30-year flood will happen regularly every 30 years, or only once in 30 years.
1 in 50-year storm	A storm that has a 1 in 50 chance (2% probability) of being equalled or exceeded in any given year. This does not mean that a 50-year flood will happen regularly every 50 years, or only once in 50 years.
Asset Management Plan (AMP)	A five-year planning cycle used by English and Welsh water industry regulators to set allowable price increases for privately owned water companies and for the assessment of performance indicators such as water quality and customer service.
Baseline Risk And Vulnerability Assessment (BRAVA)	Following Risk Based Catchment Screening (RBCS), more detailed risk assessments on those catchments where we believed there was an adverse risk to performance over time. We modelled their performance to 2020 (baseline), 2030, 2035 and 2050.
Business Plan	Business Plans are produced by water companies every 5 years. They set out their investment programme to ensure delivery of water and wastewater services to customers. These plans are drawn up through consultation with the regulators, stakeholders and customers and submitted to Ofwat for detailed scrutiny and review.
Catchment Strategic Plans (CSPs)	Summary reports to promote system thinking across large wastewater catchments. These provide early sight of our final plans enabling co-authoring opportunities for our stakeholders. Each document outlines the challenges that the catchment will face in the future and the long-term plans to address these issues.
Combined sewer	A sewer designed to receive both wastewater and surface water from domestic and industrial sources to a treatment works in a single pipe.
Customer Challenge Group (CCG)	An independent body that challenges both our current performance and our engagement with customers on building our future plans.
Cycle 1 and Cycle 2 DWMP	Our current DWMP is referred to as Cycle 1, it covers a planning period of 2025-2050. Our next plan will be published in five years' time and is referred to as our Cycle 2 DWMP, it will cover a planning period of 2030-2055.
Department for Environment, Food and Rural Affairs (Defra)	UK government department responsible for safeguarding the natural environment, food and farming industry, and the rural economy.
Drainage and Wastewater Management Plan (DWMP)	A Drainage and Wastewater Management Plan (DWMP) is '*a long-term strategic plan that sets out how wastewater systems, and the drainage networks that impact them, are to be extended, improved and maintained to ensure they are robust and resilient to future pressures*'. The planning period is 25 years, from 2025 to 2050. DWMP is iterated every five years; the first known as 'Cycle 1', published as a final plan in May 2023.
dDWMP	The draft version of the Drainage and Wastewater Management Plan, published in June 2022[42].
fDWMP	The final version of the Drainage and Wastewater Management Plan, to be published in May 2023.

[42] https://www.thameswater.co.uk/about-us/regulation/drainage-and-wastewater-management

Dry Weather Flow (DWF)	Dry Weather Flow is the average daily flow to a Sewage Treatment Works (STW) during a period without rain.
Environment Agency (EA)	UK government agency whose principal aim is to protect and enhance the environment in England and Wales.
EA Pollution Categories 1 to 3	Category 1 incidents have a serious, extensive or persistent impact on the environment, people or property. Category 2 incidents have a lesser, yet significant, impact. Category 3 incidents have a minor or minimal impact on the environment, people or property with only a limited or localised effect on water quality. Further Ofwat guidance available here: WatCoPerfEPAmethodology v3-Nov-2017-Final.pdf (ofwat.gov.uk)
Event Duration Monitoring (EDM)	Event duration monitoring (EDM) measures the frequency and duration of storm discharges to the environment from storm overflows.
External hydraulic sewer flooding	External flooding occurs within the curtilage of a property due to hydraulic sewer overload. Further Ofwat guidance available here: Reporting-guidance-sewer-flooding.pdf (ofwat.gov.uk)
Foul sewer	A foul sewer is designed to carry domestic or commercial wastewater to a sewage works for treatment. Typically, it takes wastewater from sources including toilets, baths, showers, kitchen sinks, washing machines and dishwashers from residential and commercial premises.
Grey infrastructure	New sewers, sewer upsizing and attenuation storage to provide additional capacity in the wastewater networks. Also covers new pumping stations, rising mains and/or civil structures at STWs.
Green infrastructure	Sustainable surface water management solutions, including sustainable drainage systems (SuDS), that are designed to mimic naturally draining surfaces. Typically applied to surface water or combined sewerage systems, but can also be applied to land, highway or other forms of surface drainage.
Historic England (HE)	A non-departmental public body of the government whose aim is to protect the historical environment of England by preserving and listing historic buildings, ancient monuments.
Hydraulic overload	Hydraulic overload occurs when a sewer or sewerage system is unable to cope with the receiving flow.
Internal hydraulic sewer flooding	Flooding which enters a building or passes below a suspended floor caused by flow from a sewer. Further Ofwat guidance available here: Reporting-guidance-sewer-flooding.pdf (ofwat.gov.uk)
L2 Area (Strategic Planning Area)	An aggregation of level 3 catchments (tactical planning units) into larger level 2 strategic planning areas. The level 2 strategic planning areas allow us to describe strategic drivers for change (relevant at the level 2 strategic planning area scale) as well as facilitating a more strategic level of planning above the detailed catchment assessments.
L3 Catchment (Tactical Planning Unit)	Geographical area in which a wastewater network drains to a single STW. Stakeholders may be specifically associated with this area. Includes for surface water sewerage that may exist which serves the wastewater geographical area but drains to a water course.
Lead Local Flood Authorities (LLFAs)	LLFAs are Risk Management Authorities as defined by the Flood and Water Management Act 2010. They have statutory duties with respect to flood risk management, investigating flooding and the compilation of surface water management plans.

Long-Term Delivery Strategy (LTDS)	A requirement by Ofwat on water companies, to ensure that short term expenditure meets long term objectives for customers, communities, and the environment. These will be submitted as part of the Price Review.
Misconnections	Misconnections are where either surface water drainage or foul water is connected to the wrong system e.g., surface water to foul only or foul to surface water systems.
Natural capital accounting	The process of calculating the total stocks and flows of natural resources in a given system, either in terms of monetary value or in physical terms.
Natural England (NE)	A non-departmental public body sponsored by the Department for Environment, Food and Rural Affairs to protect the natural environment in England, helping to protect England's nature and landscapes.
Non-governmental organisation (NGO)	An organisation that operates independently of any government, typically one whose purpose is to address a social or political issue.
Options Development and Appraisal (ODA)	A method to focus the level of planning effort, i.e., proportionate to the risks identified, with a view to providing a measure of consistency across the industry.
Ofwat	The regulatory body responsible for economic regulation of the privatised water and wastewater industry in England and Wales.
PR24	Every five years, water companies set out their plans for what they'll deliver and how much they'll charge customers[43]. Their plans over the next five years should include how they will: • Provide a safe and clean water supply • Provide efficient sewerage pumping and treatment services • Control leaks • Install meters • Maintain pipes and sewers • Maintain and improve environmental standards This process is known as the price review, and the next one will be in 2024, when Ofwat will make its final decisions. We call this PR24.
Risk-Based Catchments Screening (RBCS)	A first-pass screening exercise of catchment vulnerability against 17 different risk indicators. To understand which catchments are low risk catchments and those that are likely to be at risk in the future if not supported by our long-term plan.
Risk Management Authorities (RMAs)	Authorities responsible for Flood Risk as defined in the Flood and Water Management At 2010. These include, Lead Local Flood Authorities, Highway Authorities, Local Planning Authorities, Natural England and the Environment Agency.
Sewage Treatment Works (STW)	A sewage treatment works receives and treats wastewater to a standard legally agreed with the Environment Agency, before it is released back into the environment.
Specific, Measurable, Achievable, Relevant, and Time-Bound (SMART)	A framework for setting effective targets.
Storm overflow discharges	Storm overflows are used to manage excess flows, which typically occur as a result of heavy rainfall. Excess flow that may otherwise have caused flooding is released through a designated outfall to a water course, land area or alternative drainage system.

[43] https://www.ccwater.org.uk/priorities/price-review/

Strategic Environmental Assessment (SEA)	A systematic decision support process to ensure that environmental and other sustainability aspects are considered effectively in policy, plan and programme making.
Surface water sewer	A surface water sewer collects rainwater from domestic and commercial roofs, driveways, patios etc to a local watercourse or suitable surface water drainage system.
Sustainable Drainage systems (SuDS)	Drainage solutions that provide an alternative to the direct channelling of surface water through networks of pipes and sewers to nearby watercourses. SuDS aim to reduce surface water flooding, improve water quality, and enhance the amenity and biodiversity value of the environment. SuDS achieve this by lowering flow rates, increasing water storage capacity and reducing the transport of pollution to the water environment.
Thames Regional Flood and Coastal Committee (TRFCC) area	The TRFCC area was established by the Environment Agency under the Flood and Water Management Act 2010 that brings together members representing the Constituent Authority. Featured TRFCCs are listed here on our DWMP portal: Drainage and Wastewater Management Plan (arcgis.com)
Water Industry National Environmental Programme (WINEP)	The framework under which Defra and the EA require environmental improvements to be delivered by water companies. Guidance is released by regulators, which water companies interpret for their geographical area, and resubmit the outputs back to regulators for endorsement.

Navigating our DWMP

We've developed a comprehensive document suite to share our final DWMP. This includes five summary documents that contain increasing levels of detail. To help you to navigate around our document suite and to find key DWMP content, we provide a Navigation index below and on our DWMP webpage. The orange cells refer to where key DWMP content can be found across our final document suite.

Navigation index		Protecting the environment and providing a reliable, sustainable wastewater service							Best value and delivery					Working together		DWMP stages and data				
		Storm overflows	Sewer flooding	Level of ambition & pace of delivery	Growth & climate change	Resilience: flooding & power	Groundwater	Environmental assessments	Affordability & bill impact	Best Value	Base vs Enhancement	Solutions & deliverability	Programme alignment	Partnership working	Stakeholder & customer engagement	DWMP stages & process	Level 2 regional summaries	Level 3 regional summaries	Data tables	Risk & Assurance
Summary documents	Customer summary	■	■											■	■	■				
	Non-technical summary	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				
	Technical summary	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				
	The Plan	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				
	Catchment Strategic Plans x13	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		
Technical appendices x11	Appendix A - Strategic context												■			■				
	Appendix B - Risk-Based catchment screening															■				
	Appendix C - Baseline risk and Vulnerability assessment				■	■										■				
	Appendix D - Options development and appraisal	■										■				■				
	Appendix E - Programme appraisal	■		■		■			■	■	■	■	■			■				
	Appendix F - Stakeholder engagement														■	■				
	Appendix G - Adaptive pathway planning	■	■		■															
	Appendix H – Customer engagement Part A – Draft DWMP														■	■				
	Appendix I - Risk and uncertainty											■								■
	Appendix J - DWMP and WRMP alignment												■							
	Appendix M - Assurance																			■
New technical appendices x9	Appendix N - You Said, We Did (YSWD)	■	■	■	■	■	■	■	■	■	■	■	■	■	■					
	Appendix O - What base buys										■									
	Appendix P - Response to July 2021 Floods		■	■	■	■			■			■	■	■	■					
	Appendix Q - Storm overflows	■		■	■				■				■							
	Appendix R - Delivery of SuDS and nature-based solutions	■	■	■	■	■			■	■		■	■	■	■					
	Appendix S - Partnership opportunities and working			■								■		■	■					
	Appendix T - Groundwater quality						■													
	Appendix U - Resilience		■		■	■							■	■	■					
	Appendix V – Customer engagement Part B – Consultation Survey Report														■					
Environmental assessments	Appendix K - Strategic environmental assessment (SEA)							■												
	Appendix L - Habitats regulations assessment (HRA)							■												
Portals and data	Customer portal	■	■							■		■		■	■	■	■	■		
	Practitioner portal	■	■											■	■		■	■		
	Data tables			■							■								■	
	Data tables commentary																		■	

We welcome your views on our DWMP. Please share them with us by emailing: DWMP@thameswater.co.uk.

This document reflects our DWMP 2025-2050 as published in May 2023.