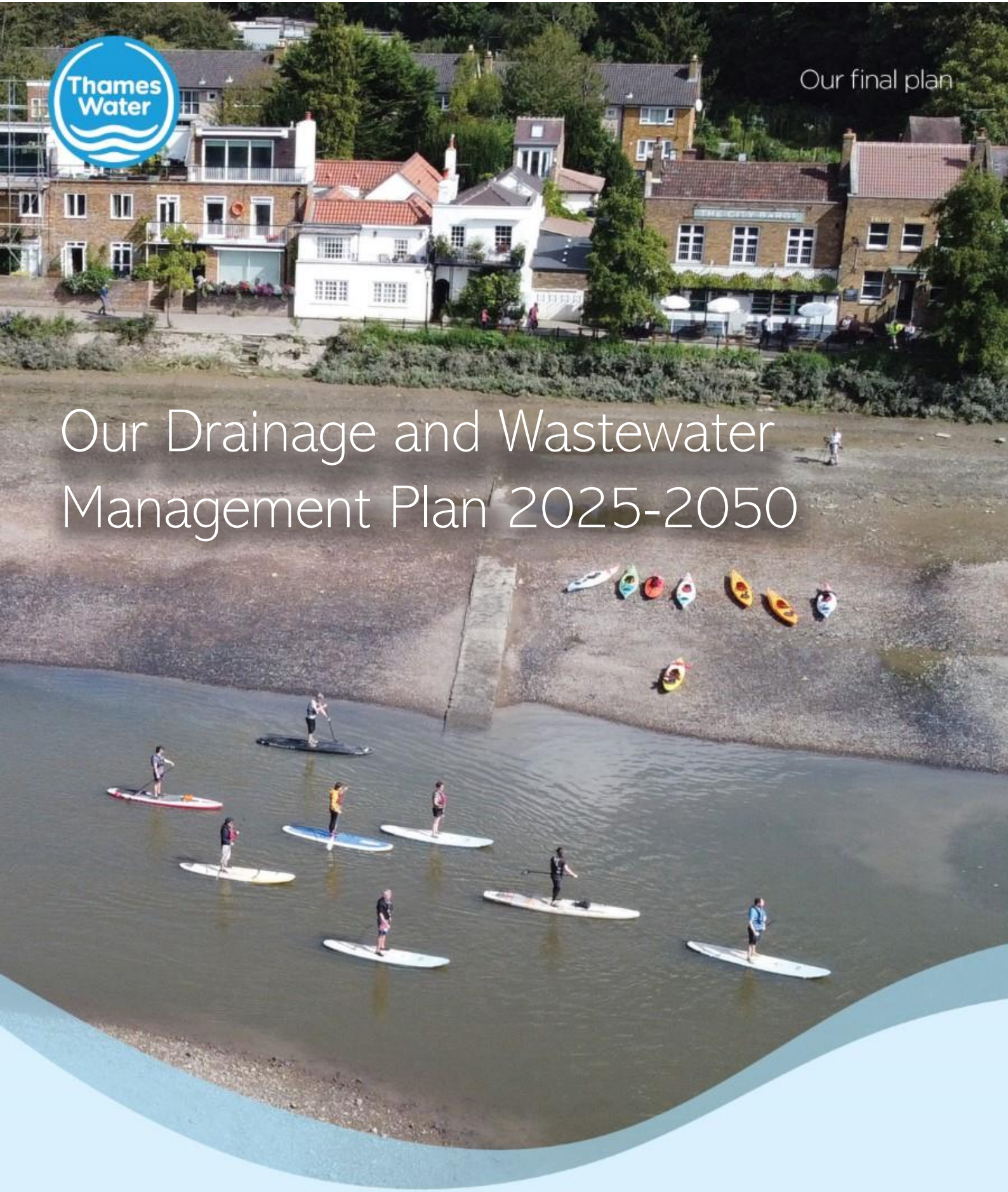


Our final plan

Our Drainage and Wastewater Management Plan 2025-2050

Technical Appendices
Appendix R – Sustainable Drainage Systems

May 2023

Contents

Preface 4
Executive Summary 6
1 Sustainable drainage systems and nature-based solutions 8
What are they? 8
2 The size of the challenge 10
The need for SuDS 10
Stakeholder engagement feedback 12
3 Refining our SuDS delivery programme 13
4 Current SuDS delivery 17
Thames Regional Flood and Coastal Committee (TRFCC) 17
Greater London Authority (GLA) 19
Flood and Coastal Resilience Innovation programme 20
Transport for London (TfL) 21
Thames Water 22
AMP7 SWMP: Strategic Partnership Workstream 22
AMP7 SWMP - Third Party Projects Workstream 24
Planning and development 27
Partnership working 28
5 Accelerating delivery to meet our ambition 29
Working in partnership 30
Alignment of plans and programmes 30
Collaboration with other utilities and street works 31
Dynamic project pipeline 32
Partnership opportunity database 32
Environmental Partners Opportunities 32
Planning 33
Planning Process and Implementation of Schedule 3 33
Impermeable paving and parking 34
Improved greenfield run-off rates 35
Evidence 36
Improved modelling 36
Data Sharing 37
Learning from best practice 37
Funding and financial incentives 38

Upskilling, training and guidance 38
Engagement and communication 40
Ofwat Innovation Fund 41
Water Butts 41
6 Next steps 43
7 Conclusion 44
Glossary 45
Navigating our DWMP 49

Figures

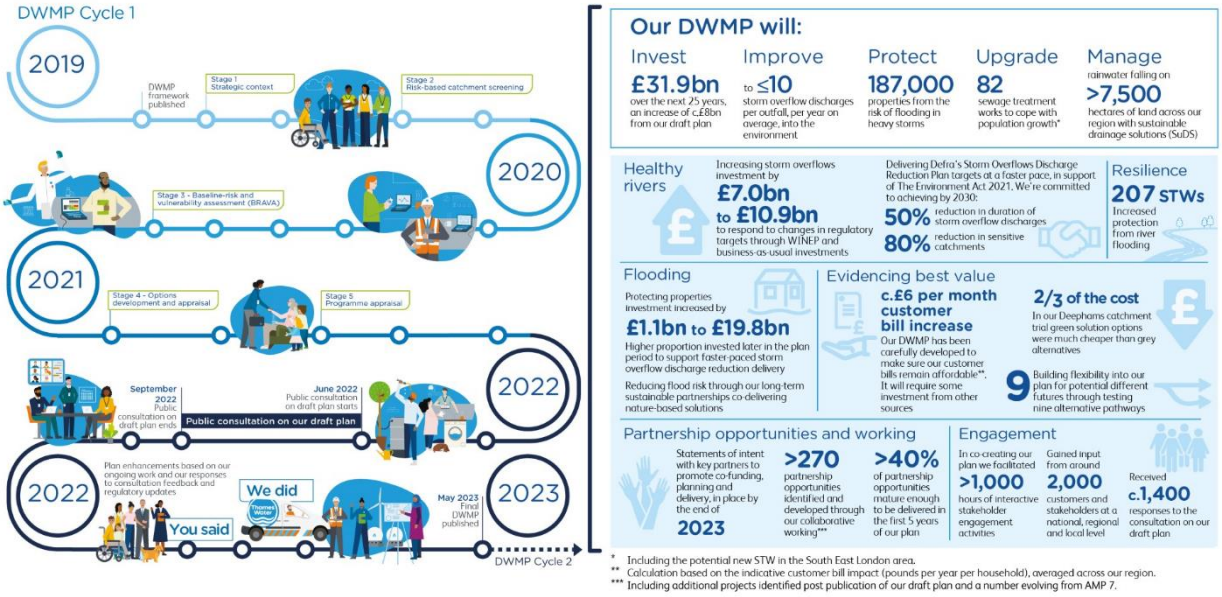
Figure 1-1 The benefits of SuDS and nature-based solutions 9
Figure 2-1 DWMP targets and their alignment with the Corporate Vision 2050 12
Figure 3-1 Our SuDS plan for the region 14
Figure 3-2 Our SuDS plan in numbers 15
Figure 4-1 The benefits of distributed SuDS (source: Susdrain and Arcadis) 18
Figure 4-2 Old Street station artist impression (source: TfL) 21
Figure 4-3 Lambeth Archbishop Sumner planters 23
Figure 4-4 Tulse Hill Lambeth concept design sketch plan (source: London Borough of Lambeth and Project Centre) 23
Figure 4-5 Muswell Hill flood alleviation scheme in Barnet (source: London Borough of Barnet) 25
Figure 4-6 Worcester Park masterplan in Sutton (source: Sutton Council and BDP) 26
Figure 4-7 Windus Road raingardens in Hackney 26
Figure 4-8 Haggeston Road and Lee Street raingardens in Hackney 27
Figure 5-1 Headstone Manor in Harrow (source: London Borough of Harrow) 33
Figure 5-2 Thames Water planter 42

Tables

Table 2-1 Detailed BRAVA results 11
Table 4-1 Breakdown of funding in the Third-Party Projects Workstream according to sewer type 24

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.

For documents newly created for the fDWMP, we've provided a progress summary table upfront, to demonstrate what type of information the document provides.

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: Appendix R – SuDS	Progress updated	More detail or new content	Number(s) updated	Delivery timeframe updated	Informing DWMP cycle 2
1 SuDS & NbS					
2 The size of the challenge					
3 Refining our SuDS delivery programme					
4 Current SuDS delivery					
5 Accelerating delivery to meet our ambition					
6 Next steps					
7 Conclusion					

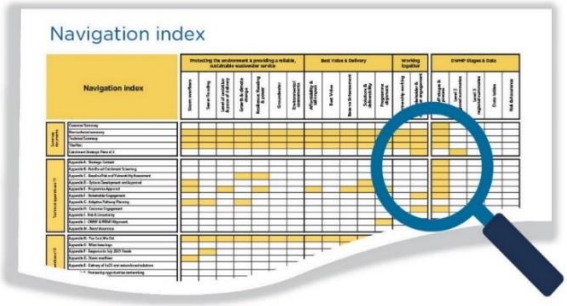
Key DWMP content

This document specifically includes the following key DWMP content:

- Protecting the environment and providing a reliable, sustainable wastewater service:
  - Storm overflows
  - Sewer flooding
  - Level of ambition & pace of delivery
  - Growth & climate change
  - Resilience: flooding & power
- Best Value and Delivery:
  - Affordability & bill impact
  - Best Value
  - Solutions & deliverability
  - Programme alignment
- Working together:
  - Partnership working
  - Stakeholder & customer engagement

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.



Executive Summary

Our DWMP is a 25-year plan for drainage and wastewater to implement changes to benefit our customers, communities and the environment. It's designed to look after the health of our rivers and ensure that we are resilient to the risks of flooding. Our DWMP gives us a roadmap to make sure future generations have a wastewater service that meets their needs and is kind to the environment.

Climate change will have an impact on the frequency and intensity of extreme storm events and winter rainfall. Population growth could mean further losses of permeable land cover and more people and property in areas of flood risk. Together, this means that both the probability and consequences of flood risk will increase if we don't plan for this now. Our DWMP identifies the need for a range of measures to tackle flood risk, as well as the solutions to address it.

Sustainable drainage systems ('SuDS') are features that help reduce flooding from heavy rainfall. Through absorbing and delaying rainwater running off buildings and hardstanding, they reduce the total volume, flow and rate of surface water entering drains and sewers, helping manage flood risk. SuDS is an umbrella term covering both 'green' SuDS, such as raingardens, swales and tree pits, and 'grey' SuDS, which includes traditional solutions such as storm tanks and rainwater butts. SuDS can also be referred to as 'nature-based solutions' (NbS) where an approach that mimics natural processes is used.

There are many benefits to including SuDS as an integral part of infrastructure projects; they reduce the impact of urbanisation on flooding, enhance water quality and protect the natural flow of water. Green SuDS can also improve the quality of the local environment, reducing air pollution, offsetting the urban heat island effect by providing shade and increasing evapotranspiration, attracting wildlife, and providing more green spaces for communities. The increased use of SuDS in our communities will create better places to live, work and play.

Our DWMP takes a 'SuDS-first' approach to prioritising the options to manage flood risk. This means that we will consider a SuDS solution first. It also sets out the need to drain 7,598 hectares (ha) of impermeable land to SuDS by 2050, making SuDS the biggest set of interventions in our plan. This area equates to 50 Hyde Parks or 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.

The purpose of this appendix is to provide an overview of our approach to working in collaboration with partners to increase the amount of SuDS delivered across London and Thames Valley. We've also looked at where we can learn and deliver better outcomes from future projects and ensure that SuDS are prioritised and maximised in every opportunity.

This appendix outlines the work that is currently being done by ourselves and our partner organisations to deliver SuDS within the current frameworks. It reviews how different factors can influence the delivery of SuDS including the planning process, policy, legislation, modelling, data sharing, funding and financial incentives, collaboration with others, upskilling and training, engagement and communication. We also provide information on case studies in the UK and

internationally, specifically New York and Copenhagen, that have experienced similar flooding to London and have integrated SuDS as part of the solution to mitigate their flood risk.

We believe that this ambition is achievable, but we cannot deliver it in isolation. In the conclusion we set out the key activities that we believe are necessary to build the capacity and capability to achieve our SuDS target.

1 Sustainable drainage systems and nature-based solutions

What are they?

1.1 The London Plan[1] describes SuDS as "Using sustainable drainage techniques and managing surface water run-off from buildings and hardstanding in a way that reduces the total volume, flow and rate of surface water that runs directly into drains and sewers".

1.2 SuDS work in several ways; allowing water to soak into the ground, directing water flow into a watercourse, or sewer, storing water on site or slowing down the flow. The Susdrain website[2] (a community that provides resources for organisations involved in the delivery of SuDS) provides an overview of the wide variety of SuDS components. They vary in type of solution, from 'green' infrastructure solutions, which includes, swales, 'raingardens' and tree pits, to 'grey' infrastructure approaches, which include engineered solutions like stormwater storage tanks and water butts. SuDS are a suite of components working in different ways, that can be used to drain a variety of sites. When selecting SuDS components, the site opportunities and constraints need to be fully considered. Often SuDS schemes that use a combination of approaches, provide the best results.

1.3 The terms 'nature-based solutions' (NbS) and 'green infrastructure' relates to the use of natural processes to address societal challenges, such as reducing flood risk[3]. Examples of NbS include daylighting rivers, where culverted watercourses are uncovered and restored to natural channels, wetlands restoration, dune protection and others. For the purposes of this document, we will use the term SuDS but it also includes NbS.

1.4 Susdrain[4] explains that SuDS are considered more sustainable than traditional drainage methods through:

- Managing run-off volumes and flow rates from hard surfaces, reducing the impact of urbanisation on flooding
- Providing opportunities for using run-off where it falls
- Protecting or enhancing water quality (reducing pollution from runoff)
- Protecting natural flow regimes in watercourses
- Being sympathetic to the environment and the needs of the local community
- Providing an attractive habitat for wildlife in urban watercourses
- Providing opportunities for evapotranspiration from vegetation and surface water
- Encouraging natural groundwater/aquifer recharge (where appropriate)
- Creating better places to live, work and play

[1] https://www.london.gov.uk/sites/default/files/the_london_plan_2021.pdf
[2] https://www.susdrain.org/delivering-suds/using-suds/suds-components/suds-components.html
[3] https://www.worldwildlife.org/stories/what-are-nature-based-solutions-and-how-can-they-help-us-address-the-climate-crisis#:~:text=Nature-based%20solutions%20refer%20to%20a%20suite%20of%20actions,security%2C%20rising%20risk%20of%20disasters%2C%20or%20climate%20change.
[4] https://www.susdrain.org/delivering-suds/using-suds/background/sustainable-drainage.html

1.5 SuDS can also provide shade, reducing urban heat island effect, where urban areas are hotter than surrounding rural areas. They can also trap air pollutants, improving air quality and have further positive effect on the health and wellbeing of our customers. Figure 1-1 is a visual representation of some of the benefits that SuDS provide.

Figure 1-1 The benefits of SuDS and nature-based solutions

2 The size of the challenge

The need for SuDS

2.1 In our DWMP, we assess the impacts of population growth and climate change on our wastewater and drainage services and how through the solutions we plan to deliver, we can provide a wider benefit to our customers and the environment. The amount of permeable/green areas being lost to new development, property extensions and installation of impermeable surfaces is an important challenge to address. These changes in land cover increase run-off, leading to more rainwater entering our sewer network faster which can cause flooding and poor river water quality. We also need to consider the problem of surface water drains misconnected into foul sewers which take up capacity within our foul sewer network.

2.2 Our network is designed to cope with 'normal' storms and prolonged rain. Very intense, localised storms can lead to flash flooding. There are two reasons why this can happen:

- Firstly, rainwater can't enter our network as the inlets aren't big enough to admit the volume of water trying to enter
- Secondly, there isn't enough capacity within the network to contain all the runoff from the storm, so the rainwater backs up in the sewers and either surcharges to the surface through manholes, where it may cause further flooding, or enters properties via their sewer connection.

2.3 The results from our Baseline Risk and Vulnerability Assessment (BRAVA) show the number of properties at risk of internal and external sewer flooding today and how this number will increase by 2050 – see Table 2-1. These figures underline the scale of the challenge and how, unless action is taken, the number of properties at risk will increase by approximately 4,000 properties per year.

Planning Objective	Unit	Region	Threshold Description	Value
Properties at risk of internal sewer flooding for a 1:30 year rainfall return period	Number of properties	London	2025 value	87,119
			2050 value	133,852
			Increase	46,733
			% Change	**54**
		Thames Valley	2025 value	3,091
			2050 value	4,969
			Increase	1,778
			% Change	**61**
		Thames Water	2025 value	90,310
			2050 value	138,821
			Increase	48,511
			% Change	**54**
Properties at risk of internal and external sewer flooding for a	Number of properties	London	2025 value	300,771
			2050 value	391,468
			Increase	90,697
			% Change	**30**
			2025 value	14,827

1:50 year rainfall return period[5]		Thames Valley	2050 value	22,863
			Increase	8,036
			% Change	**54**
		Thames Water	2025 value	315,598
			2050 value	414,331
			Increase	98,733
			% Change	**31**

Table 2-1 Detailed BRAVA results

2.4 Our SuDS-first plan will implement solutions to absorb, hold and delay rainfall, reducing the flow, rate and volume of rainwater trying to enter our networks, so reducing the demand on them. This means implementing an unprecedented programme of SuDS to dissipate the storm flow, combined with correcting surface water misconnections and traditional sewer upsizing and network retention tanks.

2.5 Our DWMP clarifies the importance we place on SuDS and the value of these projects to our stakeholders, our customers, and the environment. The Options Development Appraisal Technical Appendix[6] shows the difference in value between green and grey engineering solutions. It includes the work we have undertaken to understand the difference in outcomes and costs between implementing green and grey solutions in the Deephams catchment.

2.6 The delivery of SuDS aligns with our long-term vision (known as 'Vision 2050'). It will build resilience against flooding, lead to the improvement of the environment and a balanced land use strategy. It also aligns with the following DWMP framework principles:

- Look for opportunities to enhance the local environment, economy, and wellbeing.
- Strive to deliver resilient systems
- Consider the impact of drainage systems on immediate and wider environmental outcomes including habitats and in developing options for mitigation to include consideration of environmental net gain and enhancement.
- Be collaborative
- Show leadership
- Engage customers

2.7 Figure 2-1 demonstrates the alignment between our corporate Vision 2050 and our DWMP planning objectives.

[5] This planning objective is not included in the national results as it is a bespoke objective for us
[6] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-d-options-development-and-appraisal.pdf

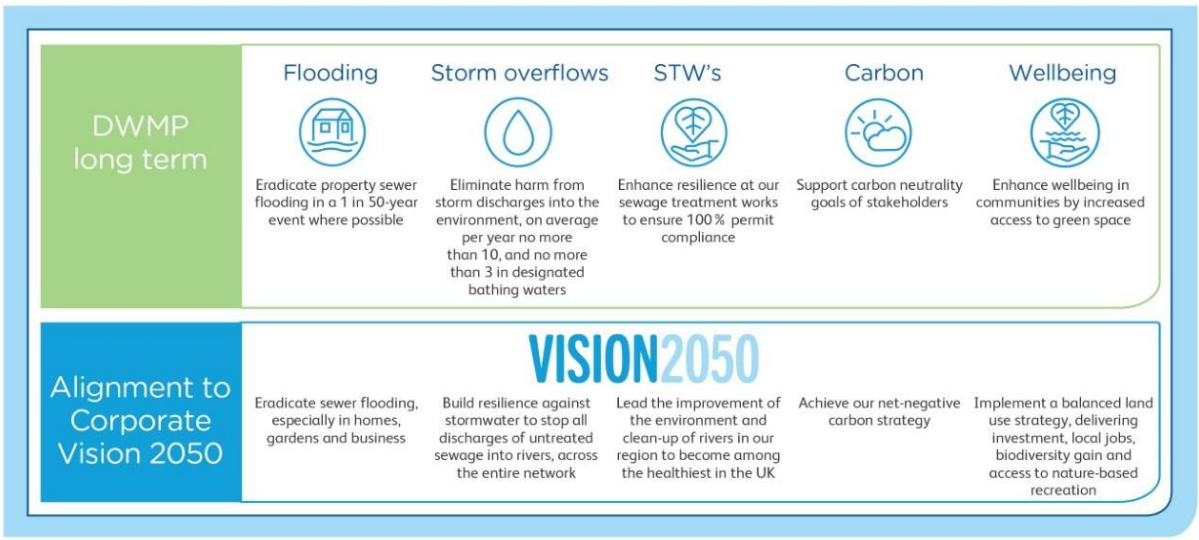


Figure 2-1 DWMP targets and their alignment with the Corporate Vision 2050

Stakeholder engagement feedback

2.8 Whilst the public consultation on our draft DWMP showed strong support for SuDS, with nearly 7 out of 10 consultation responses supporting our target for increasing the use of SuDS, concerns were raised around the practicality of implementing our SuDS plan. Our stakeholders and customers gave us valuable input and feedback on the deliverability of the plan and timescales for implementation. Some of the challenges that our stakeholders raised included:

- Space and opportunities for retrofitting in London where land availability may be limited due to the streetscape and housing
- Ownership and maintenance of SuDS were flagged as a potential issue for future management of a network which includes more SuDS
- The need for increased investment and alignment of funding cycles to maximise collaboration between programmes and organisations
- Uncertainty in modelling the effect of SuDS due to the varying nature of infiltration by the SuDS feature
- Limited capacity and resources of stakeholder organisations to support a significant amount of SuDS partnership schemes alongside statutory responsibilities.

2.9 For more detail on the stakeholder feedback and our response to their suggestions for new solutions received during the consultation, please see our 'You said, We did' Technical Appendix[7].

[7] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-n-you-said-we-did.pdf

3 Refining our SuDS delivery programme

3.1 The impact of extreme rainfall, such as caused the extensive flooding in London in July 2021, has also been experienced in other cities internationally. Rainfall of this intensity was previously thought of as being exceptional, but these events are now taking place more frequently across the globe. This gives us the need and opportunity to learn from international best practice. We have engaged with city officials from leading cities, including New York, Copenhagen, Amsterdam, and Rotterdam. Examples from different cities can be found in the 'C40 Cities Climate Leadership Group guidance: Climate change adaptation in delta cities'[8].

3.2 The 'New York City Stormwater Resilience Plan (2021)[9] includes clear actions, setting out the lead agency and completion dates. Its goals, supported by different initiatives, include communication of the risk, prioritisation of response in vulnerable areas, policies, research, investment, and a call for extensive greening, which led to over 10,000 green infrastructure projects being implemented and planned.

3.3 Rainproof New York City[10] was produced by a range of NGOs which advocate for solutions to address flood risk. It includes three main principles:

- Start with the most socially and physically vulnerable communities
- Create a large investment in multi-benefit green and blue solutions
- Where they cannot go fully green, prioritize co-benefit solutions.

3.4 The Copenhagen Cloudburst Management Plan (2012)[11], includes priorities and measures to adapt to extreme rainfall events. Action is prioritised in areas with a high flood risk where measures are easy to implement and will achieve good synergistic effects with urban planning. The plan identifies about 300 projects to be implemented, around 15 projects a year in the next 20-30 years. Partnership working with the water utility led to the restructuring of the Copenhagen drainage system. The streetscape was used to turn roads into rivers during extreme rainfall, directing water to outlets and retention basins. This is supported by green infrastructure and SuDS, using gardens, green roofs and bioswales to reduce the rate of rainwater entering the sewers.

3.5 The Amsterdam Rainproof programme (2014)[12] emphasizes the importance of 'rainproofing' the city by encouraging the widespread use of SuDS in the public and private realms and providing communications and engagement, including maps of priority areas to address. It breaks down approaches by different scales (neighbourhood, buildings, gardens) and actors, creating a movement of citizens, public servants and entrepreneurs to build a more resilient city. It looks beyond the expansion of underground drainage, to

[8] https://www.c40.org/wp-content/uploads/2022/02/C40-Good-Practice-Guide-Climate-Change-Adaptation-in-Delta-Cities.pdf
[9] https://climate.cityofnewyork.us/reports/nyc-stormwater-resiliency-plan/
[10] https://rebuildbydesign.org/rainproof-nyc/
[11] https://en.klimatilpasning.dk/media/665626/cph_-_cloudburst_management_plan.pdf
[12] https://www.rainproof.nl/English

design smarter outdoor urban spaces which retain and store rainwater where it falls. It also includes a guide on how to 'rainproof' homes.

3.6 Working in partnership and looking at a combination of solutions are critical to delivering the improvements required. As demonstrated by Copenhagen's experience, there is always the possibility that a storm will be bigger than the improvements we can deliver, so we need to 'design for exceedance'. This means we will need to consider measures that provide resilience to storms with an intensity well beyond current design standards.

3.7 In 2008, we commissioned research into impermeable land cover in the London boroughs of Camden, Brent, Ealing, Hammersmith and Fulham, and Kensington and Chelsea. The results showed a 17% increase in impermeability since 1971[13]. This loss of green and permeable surfaces has happened mainly through permitted installation of impermeable surfaces. Our approach to mainstream SuDS delivery will support a better management and even a reduction of impermeable surfaces.

3.8 Our DWMP SuDS programme will be one of the most ambitious urban re-greening programmes in the world. Cumulatively, we will go from disconnecting 20 ha of impermeable area to SuDS during AMP6, to over 200 ha by 2030, rising to a total of 7,598 ha by 2050. From these, 7,013 ha will be in London and 585 in the Thames Valley – see Figure 3-1. This area is equivalent to 50 Hyde Parks or almost 5% of London's surface area – see Figure 3-2.

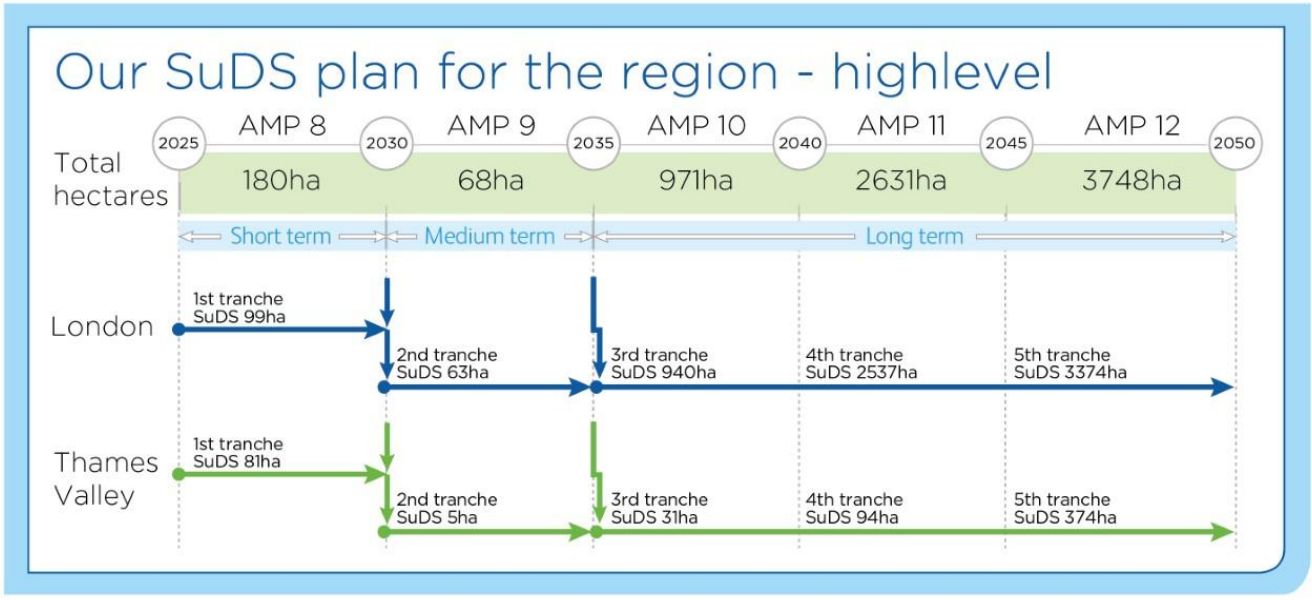


Figure 3-1 Our SuDS plan for the region

3.9 The situation in the Thames Valley is different, with over 50% of our systems having only foul drainage, with surface water drained to soakaways. Our intent here is to reduce unwanted flows, made up of groundwater and surface water, getting into our 'foul only' sewerage system which will restore capacity in these sewers and reduce storm discharges.

[13] Thames Water Permeability Project, Ambiental Technical Solutions Ltd, 2008.

To achieve this, our priorities will be to:

- deliver targeted network enhancements
- reline sewers to reduce groundwater infiltration
- seal manholes
- replumb surface water misconnections

3.10 We will also seek to reduce surface water flows into the surface water system to support growth by freeing space in the sewer system which can accommodate flows from new development. In addition, we will map and model our surface water networks and work with our stakeholder partners to evolve systems that champion green infrastructure.

3.11 It's difficult to imagine what 7,598 ha of impermeable areas draining into SuDS would look like. Figure 3-2 is a schematic to help visualise the scale of the proposal.

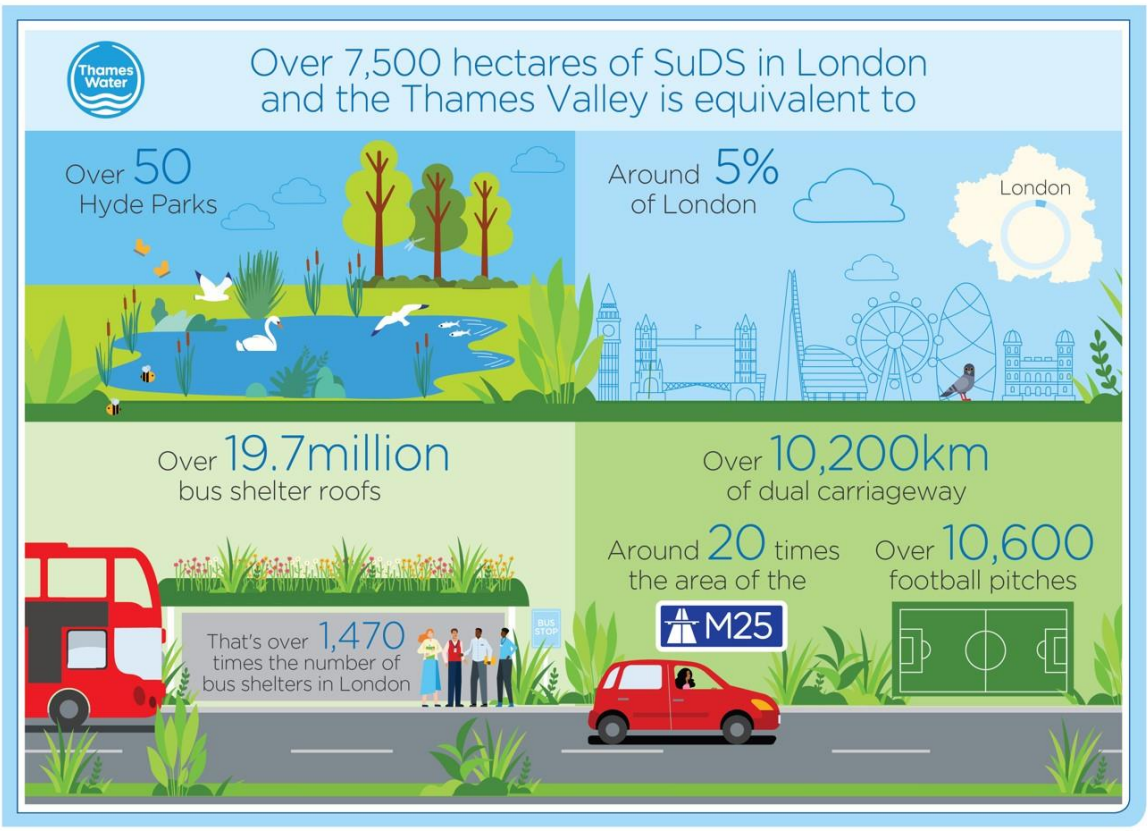


Figure 3-2 Our SuDS plan in numbers

3.12 To assess the feasibility and the scale of our target, we used a number of tools including a bespoke SuDS opportunity mapping tool (Atkins SuDS Studio)[14]. Our estimates show that the average cost of implementing SuDS will be about £1.25m per hectare, bringing the total investment to over £9bn over the duration of the programme.

3.13 As with other international cities, we will deliver a range of measures to manage the increasing risk of sewer flooding. This includes 4,362,608m^3 of network storage (the equivalent of 1,745 Olympic swimming pools[15]) and upsizing and creating 953km of sewer

[14] https://data.london.gov.uk/dataset/SuDS-opportunity-mapping-tool
[15] The volume of an Olympic swimming pool is 2,500m^3

to reduce the pressure in the London sewer network. As a result of our programme, we plan to introduce 138 ha of green space in areas where there is currently little or none.

3.14 Our stakeholders' key requirements for long-term planning is to work collaboratively to deliver future resilience through nature-based solution[16]. Our ambitious SuDS programme will involve a step-change in partnership working, as we cannot deliver the scale of change required alone. We'll develop and deliver our plan in collaboration with other Risk Management Authorities (RMAs) and partners, working together on their strategic policies, as our priorities align with their declarations of climate emergency and adaptation plans.

3.15 The partners we'll work with include the Environment Agency (EA), Lead Local Flood Authorities (LLFAs), Thames Regional Flood and Coastal Committee, the forthcoming SuDS Approval Bodies, Greater London Authority, Transport for London, River Catchment Partnerships and local interest groups.

3.16 A better understanding of surface water flow will be key to support partnership working. It will enable us to make better decisions on where the SuDS are best placed so that they make the most impact. To help our understanding we've committed to enhancing our surface water modelling. Increasing our understanding, alongside established partnerships, innovation and lessons learned during delivery, will support us to scale up the deployment of SuDS.

3.17 Long-term deliverability is a current concern and an issue that will need future development. The delivery profile will change at each cycle of the DWMP as more accurate information becomes available and the planning horizon is extended.

[16] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-n-you-said-we-did.pdf

4 Current SuDS delivery

4.1 Our customer and stakeholder feedback highlighted some of the challenges we need to overcome to deliver the scale of SuDS required. From aligning our strategic plans, programmes and funding with our partners, pooling our collective resources, and understanding where SuDS should be implemented, to the need of technical expertise to design, build, manage and overcome delivery constraints. There are already many promising trials and projects underway that aim to break down these barriers to delivery. This is supported by all our partners acknowledging that SuDS is the way forward, along with government support to formalise their implementation and adoption.

Thames Regional Flood and Coastal Committee (TRFCC)

4.2 SuDS are currently delivered through different mechanisms, with some initial trials and projects completed and more underway. One example is the London Strategic SuDS pilot (LSSP)[17] which was supported by the TRFCC levy funding. The TRFCC identified that the current approach to grant funding was not delivering enough surface water flood mitigation schemes and decided to test a distributed approach to SuDS delivery through the LSSP.

4.3 The objectives of the LSSP pilot[17] were to:

- Determine the flood risk benefits of strategic SuDS within an urban environment using hydraulic modelling
- Identify and evaluate the wider social and health benefits of green infrastructure SuDS delivery
- Demonstrate the feasibility and benefits of strategic SuDS through delivery in six pilot London boroughs: Camden, Enfield, Southwark and Hillingdon, City of Westminster and Royal Borough of Kingston
- Monitor the delivery of strategic SuDS measures within the pilot
- Develop a long-term strategy and programme for SuDS retrofitting, aligning them with other public works programmes to drive efficiency

4.4 The project demonstrated that retrofitting small SuDS features can deliver greater benefits when using hydraulic modelling to target key locations. This was applied with small-scale SuDS dispersed across a catchment, called ‘distributed’ SuDS, or when integrating SuDS measures into wider public works. It identified that 65% of the flood damage reduction benefit could be achieved by delivering SuDS in the 5% most effective locations and nearly 90% of the benefit if 30% of the most effective locations were addressed. The summary of outcomes and benefits are shown in Figure 4-1.

[17] Evidence: https://www.susdrain.org/resources/evidence.html

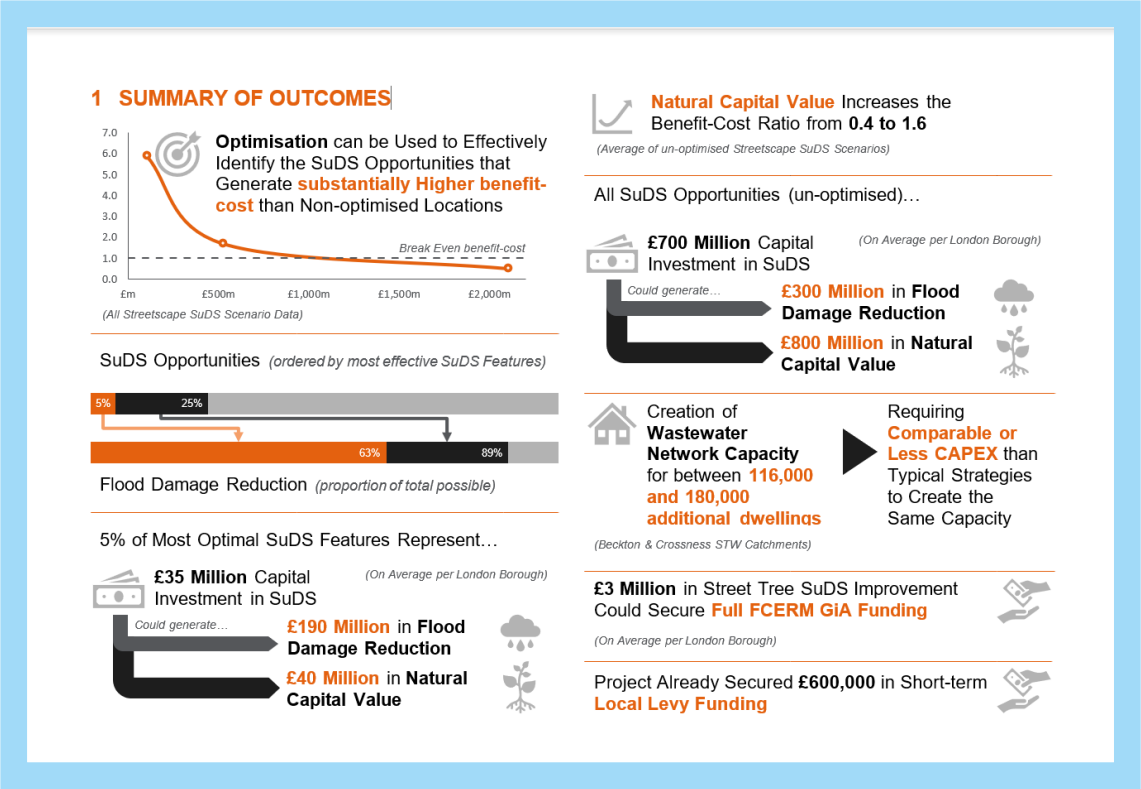


Figure 4-1 The benefits of distributed SuDS (source: Susdrain and Arcadis)

4.5 The outcome of this project allows boroughs to estimate potential costs of installing SuDS in optimised locations, ensuring they deliver the greatest benefit. Demonstrating these benefits reinforces the case for national funding. So far, the project has helped to unlock £1m from the TRFCC Local Levy funding to deliver SuDS in London over the next six years. The project provides a successful proof of concept which supports the case for rolling out the approach widely.

4.6 The LSSP modelling was done for six boroughs, either totally or partially. Our ambition, shared with others across London, is to extend this modelling to cover the whole of London and potentially go beyond to other urban areas within the TRFCC area. Once the modelling is finalised, the information can be used as evidence to make strategic decisions on SuDS implementation. The other benefit will be to justify small and localised interventions for specific flooding hotspots. We need to ensure that the SuDS we implement have the highest impact. To do this, we're working with the EA and other partners to extend this modelling approach. We're also supporting the monitoring of the SuDS installed which will provide valuable information on their performance.

4.7 Following the successful outcomes of this project, the TRFCC developed a new £1m programme known as 'PROSPER' (Protecting People, Property and Environment) to further support the identification and delivery of SuDS projects. The overall aim of the project is to promote the adoption and delivery of SuDS, streamlining the assurance process, providing evidence to inform alternative funding mechanisms, and demonstrating good value for money. The project looks to engage with Lead Local Flood Authorities (LLFAs), RMAs and delivery partners who are developing SuDS schemes. By including SuDS features in their projects they may have access to further funding.

4.8 The learnings from the LSSP project can be applied in the TRFCC six-year funding programme. The number of SuDS projects in the programme has increased from 218 in the period from 2015-2021 to 290 in the current programme. These figures only account for schemes that are spending grant in aid or levy funding. Local authority or Thames Water funded schemes or those funded from development opportunities are not included in these figures. We're pleased to co-fund many TRFCC projects and will continue to build upon this support to deliver more SuDS.

4.9 The TRFCC also established two Thames Flood Advisor teams to support LLFAs develop and progress projects in their six-year programme. These teams are partially funded by Thames Water.

Greater London Authority (GLA)

4.10 The GLA published the London Environment Strategy in 2018[18], setting out its vision to make London the greenest global city. This strategy includes objectives to ensure an efficient, secure, resilient, and affordable water supply for London.

4.11 The GLA's New Deal programmes[19] 'Greener City'[20,] 'Grow Back Greener' and 'Green and Resilient Spaces'[21] have contributed over £20m since 2016 to help London adapt to climate change. Some examples of projects to address surface water flood risk include:

- Capturing rainwater, Camley Street Natural Park in Camden
- Installations of SuDS features in Acklam Road in North Kensington's Swinbrook Estate
- Creating swales and ponds in Streatham Common in Lambeth

4.12 In 2021, we co-funded the 'Grow Back Greener'[22] programme which awarded £1.4m to 45 community projects to create and enhance green spaces and increase climate resilience. Projects in areas of deprivation, high climate risk and poor access to green space were prioritised.

4.13 The London Sustainable Drainage Action Plan (2016)[23] promotes the awareness and retrofitting of SuDS, setting out actions to increase their uptake. It focusses on how SuDS can be delivered as part of other redevelopment, maintenance or street works schemes. The plan has also produced SuDS guidance and training for practitioners across sectors including retail, education, and healthcare.

[18] https://www.london.gov.uk/programmes-and-strategies/environment-and-climate-change/london-environment-strategy
[19] https://www.london.gov.uk/coronavirus/londons-recovery-coronavirus-crisis/recovery-context/green-new-deal
[20] https://glagrants.org.uk/home/greener-city-fund/
[21] https://www.london.gov.uk/publications/green-and-resilient-spaces-fund
[22] https://www.london.gov.uk/programmes-and-strategies/environment-and-climate-change/parks-green-spaces-and-biodiversity/green-space-funding/grow-back-greener-fund-2021
[23] https://www.london.gov.uk/programmes-and-strategies/environment-and-climate-change/climate-change/surface-water/london-sustainable-drainage-action-plan

4.14 We supported the GLA and the Department for Education with the project 'Climate resilience schools'[24]. The aim of this project is to make up to 100 London schools more resilient to the impacts of climate change. Measures taken include improving water efficiency, reducing surface water flood risk, creating climate adaptation plans and teaching children the importance of adapting to climate change.

4.15 The GLA have recently been granted funding from the Department for Business, Energy & Industrial Strategy's Regulators' Pioneer Fund[25]. This funding will be used to develop a market-based approach to delivering SuDS through utility company infrastructure renewal projects in streets. The project is being led by the GLA's Infrastructure Coordination Service. A recent pilot project delivered by a collaboration with Cadent Gas and Enfield Council demonstrated a 25% cost saving in SuDS delivery. This was done through coordination of gas main renewal project work and SuDS installation. The pilot has been a success and have identified a number of challenges that need to be addressed. The aim of the new project is to understand these challenges further and provide viable solutions.

Flood and Coastal Resilience Innovation programme

4.16 The Government's Flood and Coastal Resilience Innovation programme[26] is funding two projects in London boroughs, the Silk Stream flood resilience innovation project in Barnet and flood resilience in the Beverley Brook catchment in Richmond. These projects are natural flood management schemes that will address flooding in urban areas, make properties more resilient and raise community awareness so they are more prepared for future events. As part of our DWMP, we're supporting the Silk Stream flood resilience innovation project and we're working in partnership with the following organisations: the London Borough Councils of Barnet and Harrow, DEFRA, Thames21, EA, GLA, Canal and River Trust, Brent Catchment Partnership, Friends of the Silk Stream Resident Group, Silk Stream Flood Action Group as well as other community groups.

4.17 Other innovation programme funded schemes across the country are looking at projects to increase flood warning and informing the communities affected as well as improvements for surface water schemes. The learning from these projects will help inform future surface water project delivery work in London.

[24] https://www.london.gov.uk/programmes-strategies/environment-and-climate-change/climate-change/climate-adaptation/climate-resilient-schools
[25] https://www.gov.uk/government/publications/projects-selected-for-the-regulators-pioneer-fund/projects-selected-for-the-regulators-pioneer-fund-2022
[26] https://www.gov.uk/guidance/flood-and-coastal-resilience-innovation-programme

Transport for London (TfL)

4.19 TfL has published their climate change adaptation plan 2023[27]. They explain that adaptation must be considered early and throughout the project development process. This is because many of their assets have long lifespans that will need to be resilient to future weather changes. TfL are focusing on this by:

- Using their climate risk assessment to identify the type and location of projects to prioritise action to deal with climate risk and adaptation
- Setting out which climate projection scenarios will inform the design of the project
- Updating their standards to make SuDS the default approach in projects

4.20 TfL have set a target of draining 5,000m^2 of their highways to SuDS every year. This is a very positive step forward and will support achieving our SuDS target for London.

4.21 We have collaborated with TfL in innovative SuDS projects which contain different features. So far, we have contributed over £0.5m towards these projects. Some examples include:

- Edgware Road - Westminster: due start at the end of 2023, this project will turn disused subways into raingardens. This will give a new life to a redundant asset where antisocial behaviour is currently taking place. This is part of the LSSP project and could be easily replicated across London.
- Old Street roundabout - Islington: a transport improvement scheme which include SuDS in the transformation of the junction and station.
- Tolworth junction improvements – Kingston: this project will include SuDS in both the carriageway and green space within the roundabout.
- Nine Elms lane - Wandsworth: this project includes porous surfacing on the cycle lane along with tree pits. The project has also used attenuation storage to provide temporary surface water storage

Figure 4-2 Old Street station artist impression (source: TfL)

[27] https://tfl.gov.uk/corporate/about-tfl/adapting-to-climate-change

Thames Water

4.22 We are implementing a range of SuDS projects in London and the Thames Valley. From including SuDS supporting storm alleviation schemes such as the Counters Creek and SuDS projects with different scales. In AMP7, through our Surface Water Management Programme (SWMP), we've invested over £11m on SuDS projects. With this programme, we've sought to understand how to mainstream SuDS with local authorities and other partners, following the three principles:

- Need for capacity in our sewers
- Collaboration
- Generating public value

AMP7 SWMP: Strategic Partnership Workstream

4.23 The Strategic Partnership workstream consists of working closely with three partnerships, involving the London Boroughs of Lambeth, the London Borough of Hounslow and a Tri-Authority Partnership of Oxfordshire County Council, Vale of White Horse District Council and Cherwell District Council. The aim of this workstream is to understand how Local Authorities can identify and deliver SuDS more effectively through integrating them into the management of assets that they are responsible for. We allocated £5.6m of funding for this workstream.

4.24 In Lambeth, the Council have leveraged the £2.45m of our funding to commit £3.55m of the Council's capital funds to create a £6m SuDS programme[28]. This partnership enabled Lambeth to develop a varied programme of more than 30 projects to be delivered by March 2025. The projects are grouped into sub-programmes looking at SuDS in schools, highways, housing estates and parks.

4.25 Lambeth is testing different delivery models through different Council project management approaches, designers and external contractors, as well as the Council's Direct Labour Organisation (DLO) for construction of simple SuDS interventions. Engagement of the DLO and other teams within the Council aims to develop skills within the organisation, which might be utilised in future projects and develops awareness of how surface water management can be incorporated into 'business as usual'.

[28] https://love.lambeth.gov.uk/sustainable-drainage/ https://love.lambeth.gov.uk/sustainable-drainage/ https://love.lambeth.gov.uk/sustainable-drainage/

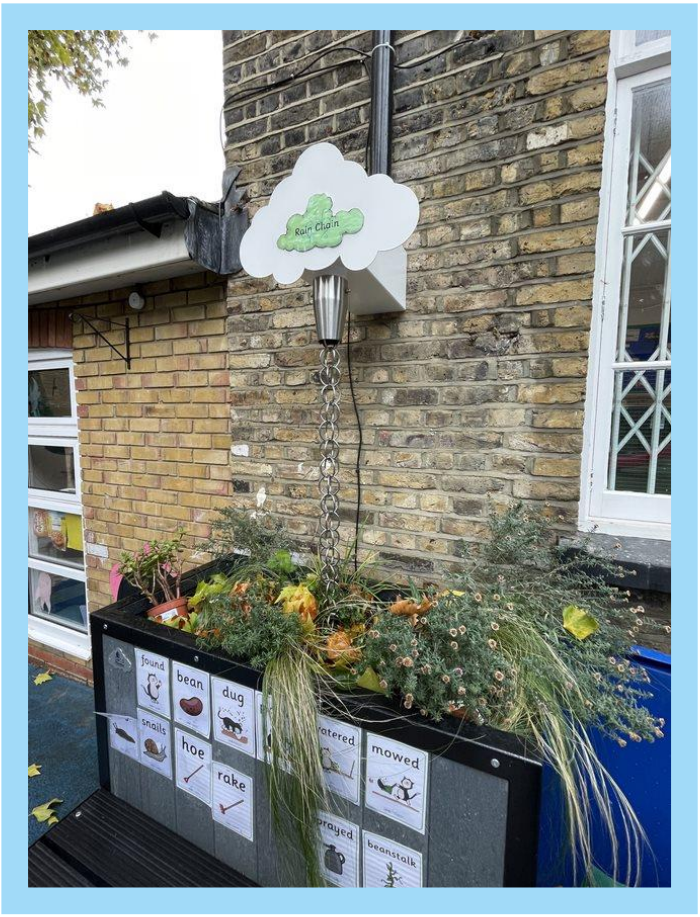


Figure 4-3 Lambeth Archbishop Sumner planters

Figure 4-4 Tulse Hill Lambeth concept design sketch plan (source: London Borough of Lambeth and Project Centre)

4.26 The SWMP funding allocation to the London borough of Hounslow is £2.45m. Currently the feasibility studies are completed and approximately £1.4m of funding has been allocated to projects. Delivery is focused on large, open attenuation projects, complemented by a range of smaller interventions like highway raingardens or SuDS at schools.

4.27 The allocation for Oxfordshire CC/Vale DC/Cherwell DC is £0.71m. We've undertaken a significant amount of work and liaison to understand relationship between the parties within the Tri-Authority and how to deliver the Strategic Partnership goals in complex arrangement of tiered local authorities. This partnership allows all partners to learn and better understand challenges and limitations in implementation of SuDS projects in two-tiered local authorities and how to overcome them.

4.28 There are six projects identified in Oxfordshire that are progressing through design. The projects include car park remodelling schemes, sewer diversions and property level planters.

AMP7 SWMP - Third Party Projects Workstream

4.29 This workstream has been allocated £5 million and to date is funding 57 projects, 46 in London and 11 outside London. The funding allocations per scheme type is:

- Highway raingardens and 'pocket parks' - 23 projects
- Flood storage in parks and woodland – 12 projects
- SuDS at Schools – 10 projects
- Housing estates improvements / community gardens – 9 projects
- Rainwater butts – 3 projects

4.30 In order to identify third party projects, in 2021 and 2022 we invited local authorities to bid for over £3 million out of the overall £5 million funding. The aim was to create SuDS schemes to address local flooding challenges and put in place more green spaces. The projects will collectively replace more than 17 ha (170,000 m^2) of impermeable paving (effective area), the equivalent of 24 football pitches. For these projects, we are working with more than 30 local authorities and stakeholders such as TfL, NGO's - Farming and Wildlife Advisor Group, Action for the River Kennet, and Schools including Heathbrook and John Burns Primary School. See figures below for some project examples in Barnet, Sutton and Hackney.

Sewer Type	No of projects	Funding allocation
Surface water sewer	28	£2,530k
Combined sewer	20	£1,725k
Foul sewer	7	£485k
Multiple sewers	2	£270k
Total	57	£5.01m

Table 4-1 Breakdown of funding in the Third-Party Projects Workstream according to sewer type

Figure 4-5 Muswell Hill flood alleviation scheme in Barnet (source: London Borough of Barnet)

Figure 4-6 Worcester Park masterplan in Sutton (source: Sutton Council and BDP)

Figure 4-7 Windus Road raingardens in Hackney

Figure 4-8 Haggeston Road and Lee Street raingardens in Hackney

Planning and development

4.31 Another way of delivering SuDS is through the planning process. SuDS have been implemented in major development projects since 2014 as required through the National Planning Policy Framework[29]. The London Plan has a specific policy encouraging the implementation of SuDS[30] through a hierarchy of drainage options that prioritises green over grey features. Local planning authorities normally have their own SuDS policies, these explain when and how to implement them as part of new and re-development projects come forward.

4.32 However, new development represents a small proportion of all development. In London there are a large amount of retrofitting and refurbishment projects which may not trigger the need for planning permission or the implementation of SuDS because they are small scale projects. This is an area where we need to find opportunities to include SuDS delivery on these projects. We also need to tackle the incremental loss of permeable space arising from permitted development and uncontrolled activities (see section 5).

4.33 One of the recommendations of the National Infrastructure Commission's report 'Reducing the risk of surface water flooding'[31] is to implement Schedule 3 of the Flood and Water Management Act 2010. This would require developments to have sustainable drainage systems (SuDS). The government have recently completed a review into Schedule 3 and agreed to implement it during 2024, which means that SuDS implementation will become mandatory for new developments. The details of implementation, including the size of the development which will require SuDS has not been confirmed so the impact of Schedule 3

[29] https://www.gov.uk/guidance/national-planning-policy-framework/14-meeting-the-challenge-of-climate-change-flooding-and-coastal-change
[30] https://www.london.gov.uk/sites/default/files/the_london_plan_2021.pdf
[31] https://nic.org.uk/studies-reports/reducing-the-risks-of-surface-water-flooding/surface-water-flooding-final-report/#tab-summary

is not clear yet. However, we welcome the government decision and believe this will assist with the delivery, ownership and maintenance of SuDS.

Partnership working

4.34 Partnership working is critical to delivering SuDS. It provides the expertise needed to identify opportunities, design, build, maintain and monitor SuDS and can also provide joint funding and better support to communities during implementation. We recognise the value of partnership working to deliver the DWMP and we have created a new Partnership Opportunities and Working Technical Appendix[32].

4.35 We need to work with other organisations who manage surface water, whether or not this is through their statutory responsibility. Our partners include, the LLFAs, EA, Highway authorities, the GLA, TfL, other transport agencies, Housing trusts, Catchment Partnerships, and other local organisations. Our customers and the public in general are also key partners in the delivery of our DWMP.

4.36 There have been several reviews into the causes and solutions to the flooding in London in July 2021 and they all highlighted the need for closer partnership working. A report by London Councils identified the importance of appropriate governance, funding, understanding the problem and communications are to address surface water issues and respond to flooding events. The Mayor's Roundtable[33] into the London 2021 floods set up a 'task and finish group' to examine the long-term barriers to surface water flood risk management across London. This group found that the issues stemmed from lack of a strategic vision and plan alongside a formal body tasked with its development and implementation.

4.37 The London Flood Review[34] also identified a lack of strategic co-ordination and collaboration between risk management agencies and the need for a strategic-level plan to co-ordinate activity at supra-borough level. Collectively, these led to the formation of the London Surface Water Strategic Group ('LSWSG'), which met for the first time in December 2022. The aim of the LSWSG is to ensure the collaboration of the key flood risk management organisations and drive the development and delivery of a London-level surface water management strategy and action plan. We are members of the LSWSG and co-funding the development of the strategy, which should be complete in early 2024.

[32] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-s-partnership-working-and-opportunities.pdf
[33] https://www.london.gov.uk/sites/default/files/flooding_progress_report_final_1.pdf
[34] https://www.thameswater.co.uk/about-us/investing-in-our-region/london-flooding-response

5 Accelerating delivery to meet our ambition

5.1 In Section 2 we explained the scale of the surface water challenge and we why are proposing a 'SuDS-first' plan. In Section 3 we set out our ambitious target to deliver 7,598ha of impermeable area managed by SuDS, and in Section 4 we showed how SuDS are currently being delivered by different partners and partnerships and the steady progress already underway.

5.2 Whilst the current rate of delivery is improving, it is not enough to secure the scale of change needed. To achieve the SuDS target we need a step-charge in almost every aspect of the way we plan, design, fund, deliver and manage SuDS. In this section we explain the different delivery constraints that we and our partners will need to overcome to achieve our ambition.

5.3 The SuDS delivery profile in our plan is not uniform, with a reduction in the quantity we propose to deliver in 2030-2035 from the previous 5 years. There are two transitions required in SuDS delivery over the next 10 years that explain this profile.

5.4 The first transition is before the start of the DWMP planning period (i.e., up to 2025) and so not shown in Figure 3-1. The transition is to make a step change increase in area of SuDS delivered with a wide range of partners. We will do this using the partnership opportunities database we initiated as part of this DWMP. With the 180 ha proposed between 2025 and 2030 we propose to co-deliver circa 100 ha of projects already identified in or to be added to our partnership database. This will strengthen SuDS delivery by existing partners. During this period, we also plan to:

- Develop the London Strategic SuDS Pilot (LSSP) style modelling to a much larger area to give us the understanding of where SuDS can provide the largest benefit
- Integrate the LSSP style modelling with a wider range of partners
- Mainstream the inclusion of SuDS in utility streets works within areas identified as beneficial in the LSSP style modelling

5.5 Once all the approaches mentioned above are embedded, we expect their use to yield a mature delivery process. In AMP9, we propose to maximise the benefit from that mature process, implementing it robustly and efficiently in key areas. Initial indications from cycle 1 modelling are that the following risk zones provide the largest benefit and should be our focus:

- Beckton Risk Zone 2
- Beddington Risk Zone 1
- Deephams
- Mogden Risk Zones 2, 3, 4 and 7
- Riverside Risk Zones 4 and 5

5.6 Delivering the LSSP style modelling as well as BRAVA analysis in future cycles of the DWMP may amend the list of risk zones. It should also allow us so clearly articulate which upstream interventions (potentially in adjacent Local Authority areas) are needed to address known areas of flood risk.

5.7 Our DWMP scheduler (a Decision Support Tool or 'DST', used to profile the DWMP programme) phases these risk zones upfront in AMP9 but cannot replicate this efficiency in subsequent AMPs as multiple schemes are required to meet our goal of reducing flood risk by 95% by 2050. As DWMP transitions to a delivery plan this uneven profile will be smoothed. For this first cycle we retain the original DST output as it flags the potential efficiency opportunities as mainstreaming SuDS ramps up in AMP9.

Working in partnership

Alignment of plans and programmes

5.8 The Mayor's Surface Water Flooding Roundtable and the London Flood Review found a lack of a strategic vision to address surface water flooding in London, with local level Flood Risk Management Plans not co-ordinated to address shared flood risk.

5.9 DEFRA's local plan reform[35] is looking into local flood and coastal erosion risk planning to provide a more strategic and comprehensive approach by 2026. This will support long-term local action and investment. We'll work with Defra to understand how the DWMP process can be aligned with other plans and programmes, outside water companies.

5.10 We recognise the importance of aligning our plan with other strategic policy and programme planning tools to support the delivery of our SuDS targets. These plans include: the Water Resource Management Plans, River Basin Management Plans, Flood Risk Management Plans, Local Flood Risk Management Strategies, Strategic Flood Risk Assessments, Local Plans, TRFCC programme and the developing London-level surface water management strategy and action plan.

5.11 We believe that the formation of the LSWSG with its aim to provide strategic co-ordination and drive collaboration between the key partners on managing surface water is a potential game changer. The LSWSG has committed to develop and deliver a London-level surface water management strategy and action plan which will provide a framework for the borough's surface water management plans. The strategy will be published in 2024.

5.12 Alignment of plans should follow a proactive approach by all partners to understand where the hotspots are, and how they can be alleviated through SuDS opportunities. We encourage all local authorities to audit potential sites for SuDS, to understand the potential opportunities in roads, parks, railway land, infrastructure such as schools, libraries, museums, public realm, and housing. The GLA already started this process with a series of green infrastructure maps and tools[36] which helps target implementation.

5.13 The identification of SuDS opportunity areas will provide evidence for the creation of targets for SuDS. We encourage local authorities to have a SuDS target in their Local Flood Risk

[35] https://www.gov.uk/government/publications/local-flood-risk-management-planning-reform-advisory-group
[36] https://www.london.gov.uk/programmes-and-strategies/environment-and-climate-change/parks-green-spaces-and-biodiversity/green-infrastructure-maps-and-tools

Management Strategies, Local Plans and Climate Change Programmes, which will also support carbon reduction targets.

5.14 Both, the EA, as part of their strategic surface water role, and the TRFCC should also have clear targets to develop SuDS projects in their 6-year programme and Flood Risk Management Plans. We'll continue to support and fund SuDS projects in the programme that meet the strategic objectives of the DWMP.

5.15 In October 2021, the government asked the National Infrastructure Commission ('NIC') to undertake an assessment of how responsible bodies can better manage and reduce the risk of surface water flooding. The NIC published their report[37] in November 2022 and recommended[38] that:

- government acts to mitigate the impact of urban development on surface water flooding
- the EA should improve identification of the highest risk areas, drawing on local maps and models
- government should set a long-term target for a reduction in the number of properties at high and medium risk of surface water flooding
- government should clarify in its strategic priorities that Ofwat should enable water and sewerage companies to invest in solutions to manage surface water flooding, including nature-based solutions where appropriate
- in high-risk areas, local authorities, water and sewerage companies and, where relevant, internal drainage boards, should be required to develop costed, long term, joint plans to manage surface water flooding, including local targets for risk reduction, assured by the Environment Agency with input from Ofwat
- government should devolve public funding to upper tier local authorities in the new flood risk areas based on their level of risk
- for properties remaining at high risk of flooding, government should explore options for funding property level measures".

5.16 The government has yet to formally respond to the NIC's report, but we expect that the NIC's recommendations will at least further raise the debate about the planning and delivery of SuDS.

Collaboration with other utilities and street works

5.17 Partnership working with other utilities when implementing street works, is another opportunity to introduce SuDS. In 2022-23, utility companies submitted 25,819 permits for 'major' works in highways. Even if a small percentage of these led to SuDS, over time this could accumulate to a significant contribution towards the SuDS target. A great case study is the work Enfield Council did with Cadent Gas and the GLA. The scheme was part of the wider Moore Brook Green Link project, which aimed to use rain gardens along a walking route to reduce surface water flood risk, improve water quality, reduce traffic speeds and encourage more active travel. The Park Lane rain gardens were part of many rain garden interventions in the area. Cadent Gas were carrying upgrades to their infrastructure in the

[37] https://nic.org.uk/studies-reports/reducing-the-risks-of-surface-water-flooding/#tab-summary
[38] https://www.nic.org.uk/studies-reports/reducing-the-risks-of-surface-water-flooding/surface-water-flooding-final-report/#tab-summary

area, and with support from the GLA, agreed to trial a collaborative project. Cadent Gas would assist by reinstating an excavated area with rain gardens (totalling 49m^2) and using council land for their site compound. If this approach were streamlined for all street works in hotspot areas, we will be able to make SuDS delivery much more cost effective and less disruptive.

Dynamic project pipeline

5.18 In order for our partners to have the confidence to commit resources to develop a stream of SuDS projects, they need a long-term commitment to the provision of co-funding and clarity on how to secure it. To support this, we have created the Partnership Opportunities Database (see below) to support the co-funding of projects. This dynamic project pipeline will make it easier for funders and delivery partners to track projects, identify gaps and opportunities, and enable the large-scale delivery of SuDS. In London this could be supported by the GLA's Infrastructure Mapping Application[39] (IMA) which is an interactive web-based mapping tool displaying growth and development data, future infrastructure investment data, and contextual information relating to growth and infrastructure.

Partnership opportunity database

5.19 Based on the number of projects submitted in response to our SWMP calls for projects, there is already a strong foundation to expand from. We currently have 271 opportunities on our DWMP Partnership Opportunities Database[40], 152 of these were derived from stakeholder engagement events and include 57 opportunities that have a SuDS element. In addition, 119 schemes were submitted to our SWMP application process, but were not awarded funding in AMP7.

Environmental Partners Opportunities

5.20 Opportunities to deliver SuDS could come from partners as explained earlier with excellent projects implemented in Harrow and planned in Hillingdon as part for the Smarter Water Catchment. Another great example is Firs Farm Wetlands[41] which mitigates the impact of surface water flooding and diffuse urban pollution by providing storage during extreme rainfall events and filtering water through the wetlands. We are proud to have supported this project which also improves the local environment.

5.21 Street tree replacement could also provide opportunities to disconnect and/or reduce impermeable areas draining into the sewer system by providing tree pits with attenuation. The GLA is aiming to increase the tree canopy coverage[42] by 10% in 2025 to reach 31% This increase could be targeted with outputs from detailed modelling (such as LSSP) to enhance their effect.

[39] https://www.london.gov.uk/programmes-strategies/better-infrastructure/data-and-innovation-tools/infrastructure-mapping-application
[40] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-s-partnership-working-and-opportunities.pdf
[41] https://www.susdrain.org/case-studies/case_studies/firs_farm_wetlands_london.html
[42] https://www.london.gov.uk/programmes-and-strategies/environment-and-climate-change/parks-green-spaces-and-biodiversity/trees-and-woodlands/tree-canopy-cover-map

5.22 Our Smarter Water Catchments programme is based on the catchments of the rivers Crane, Evenlode, and Chess. It works with catchment partnerships to identify and deliver schemes that address shared priorities, including reducing flooding and pollution, conserving biodiversity, and improving amenity. Financial contributions range from small grants to larger investments. The programme has already supported a major wetland stream restoration and flood defence scheme at Headstone Manor in Harrow (2021). The programme is also supporting a scheme at the Pinkwells Estate in Hillingdon, introducing swales and rain gardens into this area of social housing.

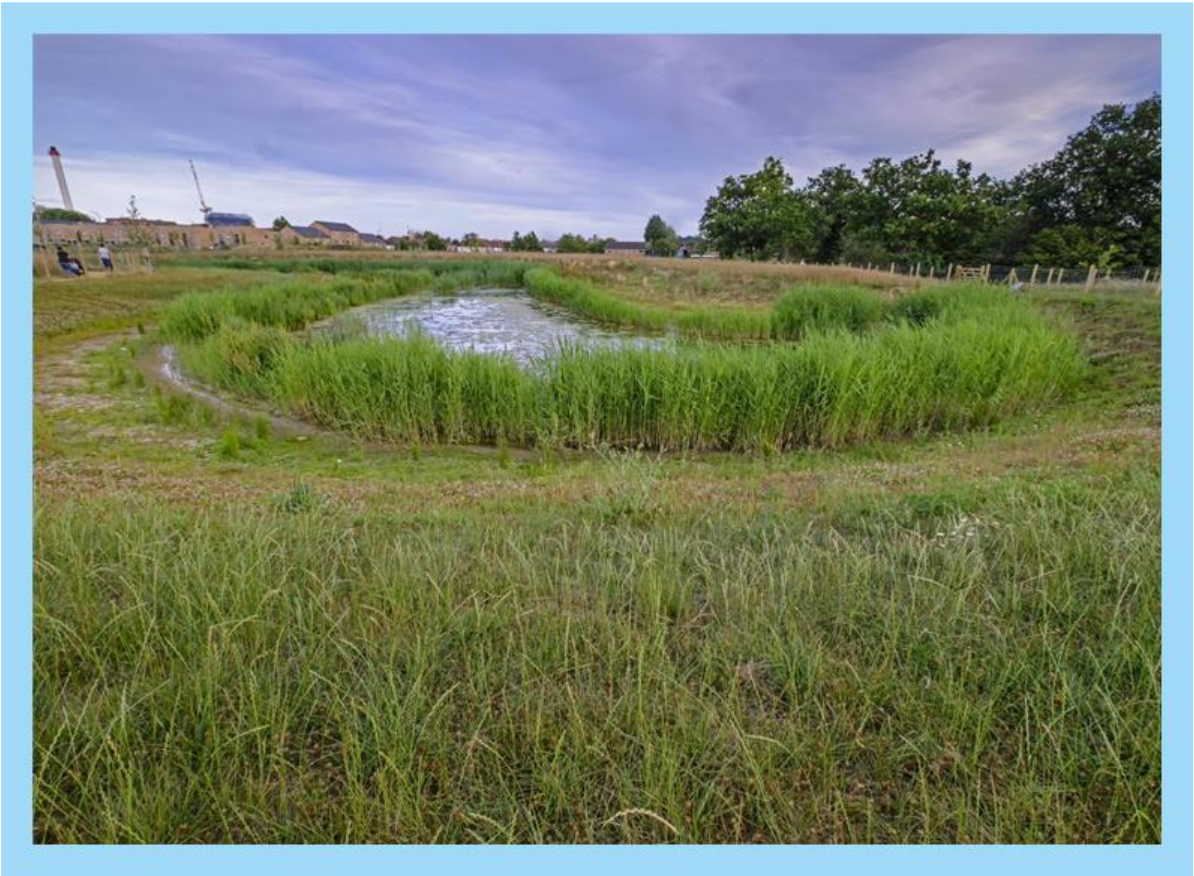


Figure 5-1 Headstone Manor in Harrow (source: London Borough of Harrow)

Planning

Planning Process and Implementation of Schedule 3

5.23 Our DWMP assumes that new development is built to current planning policy standards, so the requirement for SuDS is already built into our modelling assumptions. This means to contribute towards our 2050 SuDS target, new development must deliver SuDS beyond existing planning policy requirements. The implementation of Schedule 3 of the Flood and Water Management Act 2010[43] is likely to increase the amount of SuDS delivered and formalise the adoption and maintenance process, as well as removing developers' automatic right to connect to our sewers. At this stage it is not possible to forecast the

[43] https://www.legislation.gov.uk/ukpga/2010/29/schedule/3

amount of additional SuDS it will enable, but we anticipate it will be helpful in meeting our target.

5.24 However, new development represents a small proportion of all development. In London there are a large amount of property retrofitting and refurbishment projects which may not trigger the need for planning permission because they are too small scale. This is an area where we need to find opportunities to include SuDS. We also need to tackle the incremental loss of permeable space arising from permitted development and uncontrolled activities (see section 4).

5.25 We've been working with the GLA and relevant boroughs on developing Integrated Water Management Strategies (IWMS) for high growth areas in London. These seek to encourage an integrated approach to managing the demand for potable water, the disposal of wastewater and flood risk from the outset of the master planning process. In the Battersea - Nine Elms development, this led to the implementation of a strategic surface water network, instead of draining rainwater to the combined sewer. In the Old Kent Rd Opportunity Area IWMS[44] it led to the proposal for an 'offsetting' policy, which would enable developers unable to achieve a greenfield run-off rate on a development over a certain size to deliver their unmet attenuation requirement elsewhere.

Impermeable paving and parking

5.26 The desire for private off-street parking, incentivised by reduced car insurance premiums, has led to a massive increase in the paving over of front gardens. The installation of impermeable paving in front gardens requires planning permission if the paved area is over 5m^2. However, Local Authorities have insufficient resources to monitor, let alone enforce, this policy. We would like to support Local Authorities in stopping and then reversing the loss of permeable areas for off-street parking. Dropping kerbs to facilitate off-street parking also increases flood risk through reducing the containment of any floodwater in the road space, so the effect of new proposals needs to be understood before permission is given.

5.27 The cumulative impact of off-street parking is now being appreciated by Local Authorities. The LB Waltham Forest is working to address this issue through reducing the number of kerbs being dropped and enforcing planning rules to ensure permeable paving is implemented in off-street parking. Last year they introduced a new soft landscaping requirement for 50% of the front area of the property[45] so rainfall can soak into the ground. They work with their Neighbourhood Teams who carry out Highway enforcement activities, however they recognise that there are limits of what can be enforced against through the Highways Act.

5.28 Another example is the Royal Borough of Kensington and Chelsea which has specific policies resisting the use of impermeable surfaces in gardens in their Local Plan[46] and

[44] https://www.southwark.gov.uk/assets/attach/8174/OKR-IWMS-FinalReport-2018.pdf
[45] https://www.walthamforest.gov.uk/sites/default/files/2023-01/Vehicle Crossover Policy March 2022 AA.pdf
[46] https://www.rbkc.gov.uk/planning-and-building-control/planning-policy/local-plan

Neighbourhood Plan[47]. The London Plan also discourages development proposals that include impermeable surfaces and the GLA has published a guide to community-led depaving projects 'Grey to Green'[48] which contains useful, practical, information.

5.29 Reversing impermeable surfaces will play a crucial role in our SuDS programme and for that we need to work with others and lobby government to change the current rules and ensure local authorities have enough resources to enforce them.

Improved greenfield run-off rates

5.30 UKWIR published their report in 2021 "Surface water drainage from new development"[49], which looks at the current standards and how they can be improved to meet the water industry needs.

5.31 They explain that there is a strong international move towards managing and retaining the volume of rainfall from ordinary storms, those of normal intensity, with less focus on the management of extreme events. These approaches promote green infrastructure solutions delivering other benefits, rather than underground attenuation storage tanks, seen more often in the UK. The main change is focused on taking into account the characteristics of the receiving system, whether it is a sewer or river. They conclude that there should be a focus on the characteristics of the receiving system and a limit to the current options to assess greenfield run-off rates. They proposed different criterion for development located in greenfield sites, previously developed sites and small sites, trying to limit run-off as much as possible.

5.32 We are keen for the GLA and Local Planning Authorities to reflect on the learning obtained through this study to strengthen the evidence base of their planning policy regarding surface water management. We'd like a statement in the next London Plan regarding the need to deliver 7,000 ha of impermeable areas draining into SuDS to improve the resilience of the capital to surface water flooding, supported by a tightening of the greenfield run-off rate policy and a more strenuous application of drainage hierarchy policy.

5.33 We'd also like these new criteria to be considered in the non-statutory SuDS standards[50]. This is even more relevant now as the SuDS Approval Body (SAB) in England is likely to be in place to review, approve and adopt SuDS from next year.

[47] https://www.rbkc.gov.uk/planning-and-building-control/neighbourhood-planning/st-quintin-and-woodlands
[48] https://www.london.gov.uk/sites/default/files/grey_to_green_guide.pdf
[49] https://ukwir.org/topic-catalogues-1?object=66374
[50] https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards

Evidence

Improved modelling

5.34 We used our BRAVA to assess the impact of climate change and growth on eight key metrics[51]. The modelling used for BRAVA assumes that all new development is built in line with the current planning policy standards, including following the drainage hierarchy and meeting greenfield run-off rates which will lead to a net reduction in run-off compared to previous development.

5.35 We acknowledge that the models used in BRAVA can be improved regarding its capability to replicate the impact observed during extreme weather events. We also recognise that the meteorological assessment to better predict high intensity convective summer storms across a wide geographical area is very challenging. Our modelling is also not equally comprehensive across our operational region, as surface water sewers are not mapped and modelled everywhere. We've invested continuously in our modelling stock, making the models simulate rainfall every day. This aids our day-to-day management of the system and improved accuracy in predicting the impact rainfall will have on the system. We propose to further develop the sewer models to include unmapped and unmodelled sewer as well as extend their application to include two-dimensional overland flow paths. We will also capture and analyse future extreme rainfall events as we did in the London 2021 storms.

5.36 We acknowledge that it will be evolutionary in terms of development due to the large area our model stock covers. This will allow us to observe how our models perform and target improvements such as how we model overland flooding in combined systems or how flow is routing into surface water systems such as road gullies. We believe these enhancements will help build valuable insight into flood risk and afford greater opportunity for partnership working with other RMAs.

5.37 The need for improved modelling and information available regarding surface water flood risk has also been raised by the GLA in their 'Surface Water Flooding in London Roundtable progress report'[52]. Amongst the recommendations of the Task and Finish group to improve the evidence resources were:

- Review what models are required to support the development of the London surface water strategy and plan, and how these should be achieved.
- Put together a bid for Thames RFCC and Thames Water to fund modelling to inform Drainage and Wastewater Management Plans and Local Flood Risk Management Strategies.
- The strategic SuDS identification work carried out for the LSSP project should continue, focusing on priority hotspots. Secure government/Thames RFCC funding to extend the approach to the rest of London.

[51] 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
[52] https://www.london.gov.uk/programmes-and-strategies/environment-and-climate-change/environment-publications/surface-water-flooding-london

5.38 The London Flood Review[53] recommended to "develop existing modelling specifications, or create new ones, which provide clear guidance on the use of rainfall, boundary conditions and complex flow mechanisms. Ensure that a common model environment is used so that shared risks between LLFAs and Thames Water are well understood".

5.39 We support these recommendations and would like to encourage LLFAs and other RMAs to improve their local flood risk modelling to achieve similar outputs of the LSSP project. The interaction between the above ground flooding hotspots and surcharge from sewers and culverted watercourses should be studied to understand if these create new or amplify existing flood risk hotspots. The Section 19[54] flooding reports done by LLFAs after the London 2021 floods will provide valuable information for this.

5.40 Once this information is factored into models similar to the LSSP project, it will support the identification and ranking of the most effective SuDS and the flooding hotspots that each SuDS project will benefit. This will align with the strategic work that is being done in London. The outputs of further detailed modelling should identify the best location for delivery.

Data Sharing

5.41 Data sharing is fundamental to address flood risk and enable a greater scale of SuDS delivery. Data sharing is also one of the recommendations of the London Flood Review[55]. In the process of data sharing, we will always be compliant with the Data Protection Act. We have a template for confidential data sharing agreements for RMAs to allow them to fulfil their statutory responsibilities under the act.

5.42 We need to work in collaboration with our partners to improve data sharing and partnership working. This will lead to increased efficiencies, reduction in disruption and costs and it will support the strategic approach needed to implement our approach.

5.43 Data sharing will also allow us to track the delivery of SuDS. Currently, there is no mechanism to capture all the SuDS projects implemented. The GLA SuDS retrofit map[56] has examples of SuDS in highways, parks, and other areas across London, but not all locations have been mapped.

Learning from best practice

5.44 Susdrain[57], the community for sustainable drainage has many examples of SuDS projects within the UK, with very detailed information. We have worked with many local authorities and others in our area to deliver SuDS. For example, SuDS projects in the Counters Creek Area (London Borough of Hammersmith and Fulham and the Royal Borough of Kensington and Chelsea) and other projects mentioned in previous sections.

[53] https://www.thameswater.co.uk/about-us/investing-in-our-region/london-flooding-response
[54] https://www.legislation.gov.uk/ukpga/2010/29/section/19
[55] https://www.thameswater.co.uk/about-us/newsroom/latest-news/2022/jul/london-flood-review-conclusion
[56] https://www.london.gov.uk/programmes-and-strategies/environment-and-climate-change/climate-change/surface-water/sustainable-drainage-london
[57] https://www.susdrain.org/case-studies/

5.45 There are also plenty of examples internationally. In New York there are currently over 10,000 green infrastructure projects constructed or underway. The Amsterdam's Climateproof programme aims to make the city resilient to severe storm events by identifying bottlenecks, creating rainproof solution maps and implementing a series of green and grey projects. Other international examples include the Cloudburst Management Plan (Copenhagen), Philadelphia's Green Stormwater Infrastructure Strategic Framework, Climate Ready DC (Washington) and Rotterdam's Resilience Strategy.

Funding and financial incentives

5.46 Given the number of properties currently at risk of surface water flooding and the further increase we forecast, we anticipate that our DWMP will provoke a discussion as to what is an acceptable level of flood risk and how achieving it should be paid for. We believe that a market-based mechanism is needed to fund the scale of SuDS interventions required to manage this risk and we will work with partners to develop this. Options being considered include:

- Stormwater trading - allows landowners who can store extra stormwater on their property through green infrastructure to sell their capacity to developers.
- Private drive depaving incentives - the rate of these incentives could be related to the location of the paving, supported by enhanced modelling to identify hotspots.
- Green financing– they are generally investments, such as 'green bonds', that are used to encourage the development of green projects or minimize the impact on the climate of more regular projects.
- Regulated volumetric surface water charging – could be used to incentivise customers to manage surface water in their property. The charge per customer will depend on the impermeable area and whether they have SuDS or rainwater harvesting devices. Pilot schemes in future AMPs will look to understand the issues and how disconnection can be achieved. These projects will not change water company income but re-apportion the money the company gets.

5.47 As explained in Section 4, our SWMP provided £10.61m funding to Local Authorities and other third parties to deliver SuDS. As these projects are delivered, we will reflect on lessons learnt to make future funding programmes more efficient. We're also preparing our PR24 submission to Ofwat with final decisions received at the end of 2024. This will reflect our investment for AMP8.

Upskilling, training and guidance

5.48 The delivery of SuDS requires the knowledge of many specialist staff such as planners, modellers, ecologists, designers, engineers, contractors and suppliers. It's also important that all practitioners, from LLFAs and wider local authority officers to contractors have an understanding of flood risk and how their actions and projects can support the reduction of this risk.

5.49 The need for training and upskilling has been raised on several occasions by the National Infrastructure Commission, the Chartered Institute of Water and Environmental Management, the London Drainage Engineers Group, the Association of SuDS Authorities and the industry in general. Several surveys aimed at local authority staff, consultants,

supply chain and practitioners have been undertaken. The most recent one is the DEFRA's survey in relation to the implementation of Schedule 3 (SAB). The LSWSG, formed after the London 2021 floods, should be looking at green skills and what the GLA can do to boost them.

5.50 The findings reveal that there is a general shortage of skilled staff in the flood risk and the SuDS industry, this is likely to be a more acute problem now that the SAB will be in place next year. In order to deliver our SuDS, ambition we need the appropriate skills and supply chain, which is currently not available. The supply chain will need to adjust to meet the market demand and step up to the challenge. There also needs to be a shift of designing bespoke projects for each location to standard "off the shelf" template solutions. We need to find a way forward, to upskill existing staff and train new staff to be able to face the challenge.

5.51 There is currently a divide in how well resourced LLFAs are to implement their duties[58]. Unitary authorities, especially central London boroughs, have one officer working on LLFA issues and they also have other Council duties. County councils and outer London boroughs may have teams dedicated to implement LLFA duties and flood risk projects. This impacts on capacity to bid for external funding and to deliver SuDS and flood risk projects.

5.52 There is already a wealth of information and guidance available online. The CIRIA SuDS manual[59] is a key document for all SuDS practitioners. CIRIA also provides training courses on different aspects of SuDS delivery[60]. The non-statutory SuDS standards[61] set out technical standards regarding peak flow and volume controls, flood risk inside and outside the development, structural integrity and maintenance. These standards may be reviewed as part of the implementation of Schedule 3.

5.53 Some LLFAs have also produced their own SuDS guidance. Either through the planning policy process, local policy, supplementary planning guidance, or separate documents to explain to developers and residents how to implement SuDS. TfL SuDS guidance[62] and Urban Design Learning guidance: 'Designing Raingardens, a practical guide'[63] are best practice examples of guidance. They outline a standardised approach to delivery small features and include case examples.

5.54 As part of the London Sustainable Drainage Action Plan, the GLA has produced a series of sector-specific SuDS guidance including schools, social housing, parks and green spaces, hospitals, commercial and retail[64]. Other bodies such as the Association of SuDS Authorities[65],Association of Directors of Environment, Economic, Planning and Transport

[58] https://www.ciwem.org/news/ciwem-report-on-surface-water-management
[59] https://www.ciria.org/ItemDetail?iProductCode=C753F&Category=FREEPUBS
[60] https://www.ciria.org/CIRIA/Training/Training_overview.aspx
[61] https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards
[62] https://tfl.gov.uk/corporate/publications-and-reports/streets-toolkit#on-this-page-1
[63] https://urbandesignlondon.com/library/publications/designing-rain-gardens-practical-guide/
[64] https://www.london.gov.uk/programmes-and-strategies/environment-and-climate-change/climate-change/surface-water/suds-sector-guidance
[65] https://www.suds-authority.org.uk/

(ADEPT)[66] and the London Drainage Engineer Group[67] provide information, resources and case studies on their websites.

5.55 We've also produced and delivered training events. We ran a series of well attended online events in February - April 2022 and heard from a variety of organisations including local authorities implementing different types of SuDS features:

- Constructed Wetlands[68] - Enfield
- SuDS in Schools[69] - John Burns primary school
- SuDS in London[70] - GLA
- Highway SuDS[71] - Hackney
- Housing Estates[72] - Groundwork

5.56 As more projects supported by the AMP 7 SWMP are completed, we'll run further sessions to share experiences and lessons learnt between the partners.

5.57 A local example of training is that delivered as part of the project Great Green Bedwyn by Action for River Kennet[73]. They train the local community on surface water management and construction and maintenance of raingardens.

Engagement and communication

5.58 Engagement and communication will be crucial for the delivery of our ambition. We will build on our positive stakeholder engagement to reach all delivery partners and the public. Projects in the current Ofwat Innovation Fund will also help us to raise awareness, engage and communicate better with customers and partners in future SuDS projects.

5.59 Many people are unaware of the flood risk they live at and their contribution to increasing it through the loss of permeable spaces. We are working with key partners in London to develop the scope for a flagship community-led SuDS retrofitting scheme that would be designed to raise awareness of flood risk, the benefits of SuDS and fund the delivery of a number of projects. We anticipate that this will generate more projects that can be funded by this programme, but these could be also be added to the wider project pipeline.

5.60 Another example of public engagement project is the Water Neutral Garden Calculator[74] which is being developed with Imperial College London and the British Geological Survey.

[66] https://www.adeptnet.org.uk/
[67] https://www.lotag.co.uk/lodeg
[68] https://www.thameswater.co.uk/media-library/home/about-us/responsibility/surface-water-management-programme/constructed-wetlands-in-enfield.pdf
[69] https://www.thameswater.co.uk/media-library/home/about-us/responsibility/surface-water-management-programme/suds-at-schools-webinar.pdf
[70] https://www.thameswater.co.uk/media-library/home/about-us/responsibility/surface-water-management-programme/suds-in-london-gla.pdf
[71] https://www.thameswater.co.uk/media-library/home/about-us/responsibility/surface-water-management-programme/suds-rain-gardens-at-highways-webinar.pdf
[72] https://www.thameswater.co.uk/media-library/home/about-us/responsibility/surface-water-management-programme/suds-at-housing-estates-webinar.pdf
[73] https://www.greatgreenbedwyn.org.uk/flooding-and-water-pollution
[74] https://camellia-metadata.bgs.ac.uk/geonetwork/srv/api/records/3c58abcc-e6de-4c05-94ee-ebe9ac977e62

It is an online tool to help people who own gardens understand how they can use their gardens to alleviate flooding and use rainwater for watering. It will be available later in 2023.

Ofwat Innovation Fund

5.61 Innovation is very important to challenge current practice. The Ofwat Innovation Fund[75] is a pioneering £200m programme to unleash a wave of innovation in the water sector and tackle some of the major challenges of our time, delivering transformative benefits for consumers, society, and the environment.

5.62 We partnered with other water companies and organisations to encourage communities in our regions to adopt rainwater harvesting solutions, which will help prevent or slow the rate of rainwater entering the sewer network. We'll test a combination of incentives and physical implementation of solutions to reduce rainwater reaching our sewers, demonstrating it can be achieved at a better cost and a large scale. The aims are twofold, to progress SuDS retrofitting, encouraging the widespread adoption of rainwater capture methods to offset the effect of impermeable areas, and to trial and develop the engagement approach.

5.63 The objectives are to:

- Synthesise a range of innovative frameworks to develop a smart and community-led resilience strategy
- Test and measure how communities can be incentivised to take up these measures
- Explore installation opportunities and challenges
- Provide a framework for building participation for future solutions

Water Butts

5.64 As part of the Ofwat Innovation Fund, we organised a water butt and planters trial, contributing to the costs of purchasing and installing the planter units. We tested different engagement approaches and messages to see what the resulting take up would be. The first order of 180 Thames Water planters units has been placed and their locations include Waltham Forest (50 planters), Lambeth (120 planters), and Cherwell, Cirencester & Fairford.

[75] https://waterinnovation.challenges.org/ofwat-innovation-fund/

Figure 5-2 Thames Water planter

5.65 CAMELLIA Smart Water Butt[76] is another example of water butt project which aims to develop and demonstrate an integrated water management system for community and private gardens. It uses smart water tanks for runoff collection and water supply based on an open-source modular platform that can be adapted for existing water butts.

5.66 The project includes the creation of user-friendly tools to assess the environmental, economic and timesaving effects of a smart water butt system and the development of a prototype. It enables smart irrigation that considers past and future weather conditions to maximise plant growth, minimise water use and could potentially be used to attenuate storm water.

5.67 We see water butts as an important element of our SuDS programme as they could contribute to providing a 'decentralised' storage capacity system. They are relatively cheap to deliver and maintain and act a physical reminder to customers that we all have a role to play in managing flood risk and saving water.

[76] https://www.camelliawater.org/swb

6 Next steps

6.1 In terms of the requirements to deliver our SuDS plan, our next steps will be to continue developing a dynamic pipeline of projects. We are finishing some flagship projects and closely monitoring the output from completed projects to ensure that we have updated information and lessons learnt to implement into the next projects. One of the key next steps is to continue to work collaboratively with our partners and stakeholders to see how we can streamline the delivery of SuDS within their asset management portfolios. We envisage that this process will improve over time, but we'll continue to engage with them and highlight the need to consider SuDS in every development opportunity.

6.2 We'll continue to review and understand the financial requirements of our SuDS plan. This will develop over time, and we'll monitor closely the investment required and how we can share that with partner organisations. We will continue to deliver our plan to achieve an incremental increase of SuDS reaching the objective we've set by 2050.

7 Conclusion

7.1 This document explains why we believe SuDS should be the basis of our response to manage the increasing risk of surface water flooding, especially in London. It sets out an ambitious target to drain 7,598 ha of impermeable land to SuDS, but stresses that this can only be realised if all the key partners are committed and work collaboratively to achieve it.

7.2 Whilst the delivery of SuDS is increasing and there is a solid foundation to build on, we believe that there are a set of core activities that will need to be developed and delivered over the next couple of AMPs to build the necessary capacity and capability to achieve our target. We will work with our partners on these activities which include:

- The publication of the London-level surface water management strategy providing a framework for strategic co-ordination
- A process that integrates above and below ground flood modelling to better understand flood risk hotspots
- A SuDS opportunity map that identifies and prioritises where SuDS need to go and highlights synergies to achieve improved co-benefits. This would link to the Partnership Opportunities Database that supports the development of a dynamic project pipeline to enable the public, stakeholders, and project funders to identify, co-create and co-deliver project opportunities
- A clear, target-based approach to delivering SuDS, drawn from a catchment-level assessment of the volume of stormwater that needs to be managed to achieve and maintain an acceptable level of flood risk and the contribution expected from SuDS per year
- A commitment by utility companies, Local Authorities, and Highways Agencies to maximise the opportunities to integrate SuDS into street works in SuDS opportunity areas
- A market-based mechanism that funds the development, delivery, and maintenance of SuDS projects. This should lever funding from other sources on the basis of the quantified co-benefits (e.g., improving air quality)
- The trialling and then phased introduction of charging for stormwater run-off based on impermeable area
- A simplified typology of, and standardised design for SuDS schemes, together with agreed performance outcomes for different measures in different locations
- A clear plan to significantly increase the skills and jobs to design, plan, install and maintain SuDS
- A public awareness raising campaign that fundamentally changes the perception of the causes and solutions to surface water flood risk and empowers people and communities to engage in stopping and reversing the use of impermeable surfaces
- A statement in the next London Plan on the need to deliver 7,000 ha of impermeable areas draining into SuDS to improve the resilience of the capital to surface water flooding, supported by a tightening of the greenfield run-off rate policy and a more strenuous application of drainage hierarchy policy.

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.
fDWMP	The final version of the Drainage and Wastewater Management Plan, to be published in May 2023.
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[77]. 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.

[77] 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.