



# Water Resources Management Plan 2019 - Executive Summary

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## Foreword

Our Water Resources Management Plan 2019 (WRMP19) sets out how we plan to maintain the balance between water supply and demand, and provide our customers with safe, reliable water supplies, delivered efficiently. It explains how we will manage the pressures of a growing population and changing climate; respond to our customers' desire for a more resilient supply, and protect the environment we rely on.

We have prepared our WRMP19 to meet the preferences of customers, the requirements of our regulators, in consultation with our stakeholders, and under the scrutiny of our independent Customer Challenge Group. It has been developed in accordance with the *Water Resources Planning Guideline*, and to meet the more recent guidance set out by Government in its *Strategic Policy Statement*, Defra's *Guiding Principles* and the recommendations within the National Infrastructure Commission's *Preparing for a drier future*.

Our plan takes a long term view, going beyond the 25-year minimum statutory planning period to provide resilience for current and future generations, and meeting our customers' needs until the end of the century. This approach reflects the expectations of our stakeholders and customers.

As well as looking to the long term, we have considered needs and opportunities beyond our own boundaries to ensure the most effective and efficient plan for our wider region. This approach – developed through the Water Resources in the South East Group (WRSE Group) - has fundamentally influenced the make-up of our plan, which sets out a long-term vision for the region. We have also engaged United Utilities, Welsh Water and Severn Trent Water to develop inter-regional transfer options.

Throughout the development of our WRMP19 we have been guided by extensive customer involvement and ongoing engagement with key stakeholders and interested parties. We have carried out a comprehensive programme of research and engagement to understand their views and preferences, engaging over 20,000 customers and drawing on insights from 16 separate research activities to ensure our proposals reflect their views on issues including leakage, resilience, metering and our choice of supply options. It is clear that our customers' need for reliable water supplies is one of the essential ingredients to support a growing economy across the South East. Previous studies have shown that severe water restrictions in London alone could cost the economy up to £300 million per day.

We undertook 2 stages of public consultation. In spring 2018 we undertook an 11-week period of consultation. We received over 540 responses. We made a number of changes to our draft plan in response to the feedback from the public consultation, availability of new information, and ongoing discussions with our regulators and stakeholders. They include:

- A joint agreement with the Environment Agency to remove the Teddington Direct River Abstraction (DRA) water supply option
- Increased demand management programme and reductions in leakage
- A reduction in the forecast of longer-term population figures
- The movement of the South East Strategic Reservoir Option (SESRO) from 2043 to 2037/38 as a joint promotion with Affinity and ourselves.



In autumn 2018 we undertook a further 8-week period of consultation. This period of further consultation was designed to ensure stakeholders had an opportunity to comments on the changes we had made to our plan and ensures that our revised draft WRMP19 continues to properly account for the views of the wide range of organisations with a stake in our region's future water supply.

In the short term, the focus of our WRMP19 is to make the most effective use of the resources we already have, reflecting the strong preference of our customers, regulators and wider stakeholders, whilst ensuring the continued supply of wholesome water and protection of the environment.

We have made a commitment to reduce leakage by 15% (from our current regulatory 2020 target) by 2025 from our target of 606 Ml/d in 2020 and by 50% by 2050. In line with our stakeholders' expectations, we have made an additional commitment to further reduce water consumption, which we will deliver by the continued roll out of smart meters, working closely with commercial and domestic customers, and expanding our award-winning water efficiency programme.

While managing demand for water is the foundation of our plan, continued growth in the need for water means demand options alone will not be enough. Our Plan sets out how we will develop new supplies as part of a twin track approach that will both balance supply and demand and ensure sufficient water in the environment we rely on. In the medium term, we will develop a water transfer to bring supplies from the Midlands into our region via the Oxford Canal, and build an innovative water re-use plant in north of London.

These new supply options will assist in further increasing our resilience to drought, providing protection from a 1 in 200 year event by 2030, compared with a 1 in 100 year event today.

Working hand in hand with regional water companies as part of the Water Resources in the South East Group, we have considered the long-term needs of the wider region, and strategic water supply options that could provide better value for customers.

The South East Strategic Reservoir Option (SESRO) will improve the resilience of both the Thames Water and Affinity Water regions through the creation of a regional storage and transfer hub. This will capture and store water falling on the wetter west of our region to meet the growing needs of Swindon and Oxford, and using the River Thames as a natural, efficient water transfer system to supply customers in our Slough, Wycombe and Aylesbury area, customers served by Affinity Water, and our customers in London, up to 100 miles away.

Transfer options from the River Severn form part of our plan for the longer term. We continue to look at a number of transfer options that would bring water from the River Severn, and have entered a joint agreement with United Utilities, Severn Trent and the Environment Agency to continue to develop these options, along with further transfers from Welsh Water. We are committed to the development of regional transfers, which we believe will have an important role to play in the long-term.

Our WRMP19 takes an important step towards securing the more resilient water supply our region needs – but we still have work to do in key areas to develop our approach. They include:

- Assessing how best to provide a greater level of protection for the environment we rely on. The SESRO has the potential to make affordable water available all-year round, supporting our aspiration to cease abstraction from vulnerable chalk streams and water courses.
- Contributing to the evolution of regional co-ordination, within a national framework, which will play an increasingly important role in developing and efficiently using shared water resources and transfers to boost resilience. Our continued commitment to develop and fund the WRSE



Group will support this, and we welcome the support of Government and regulators in this area.<sup>1</sup>

- The National Infrastructure Commission's recommendations have helped shape our plan. We will work with them to explore in more detail the need highlighted in their assessment for new supply options totalling 1,300 million litres a day, and to ensure that the commitments in our revised draft plan reflect the needs they have identified for our region.

Our WRMP19 is well-evidenced and ambitious, both in what we ask of ourselves, and through reductions in consumption on the part of our customers. It is wide-ranging and innovative in the number and type of options we have considered; blending tried and tested options alongside new ways of working and innovative approaches to help achieve our longer term ambitions. We have also presented an adaptive plan to ensure we can accommodate future changes and new information and be confident that we can continue to provide a secure and sustainable supply of water whatever the future holds.

Our proposals reflect the needs of our customers and their willingness to pay for them; they meet the guidance of our regulators, and account for the wide-ranging views of our stakeholders. In proposing a long-term plan that considers the needs and opportunities in our service area and the wider region, we believe we are offering the best value approach for our customers and the environment.

*Note: This document reflects the WRMP19 as prepared in April 2019, with additional information included to respond to comments raised by Defra in October 2019, it may therefore not reflect fully other Thames Water documents that have been published since that time.*

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<sup>1</sup> 'Building resilient water supplies - a joint paper', Defra, Ofwat, DWI and EA, August 2018.



## Section 0: Executive summary

- 0.1 A secure water supply is essential for society, a prosperous economy and protection of the environment.
- 0.2 Every five years we are required to produce a Water Resources Management Plan (WRMP).<sup>2</sup> This is a strategic plan which sets out how we intend to maintain the balance between supply and demand for water, and provide our customers with safe, reliable water supplies both now and in the future. The WRMP forms part of our overall water resources strategy included within our business plan.<sup>3</sup>
- 0.3 Our studies show that future requirements for water in the south east of England are likely to be very much greater than they are today. Our plan must cater for an increasing population and continue to support economic growth. We must also take account of a changing climate, the need to protect the environment, and the need to strengthen our resilience to more severe drought. We also expect to play a pivotal role in ensuring water companies in the South East have sufficient and secure water supplies.
- 0.4 We have developed our plan in accordance with legal requirements and the Water Resources Planning Guideline. We have also taken account of government policy objectives and sought to align our plan with the recommendations of the National Infrastructure Commission<sup>4</sup> for the water industry.
- 0.5 We have engaged with our customers, stakeholders, regulators and other interested parties, and their feedback has helped to shape our plan.
- 0.6 We have taken a long term view to the end of the century, going beyond the 25-year minimum statutory period, to produce a plan that provides inter-generational resilience.
- 0.7 We have considered a wide range of options to both manage demand for water and to provide additional water, and we have considered opportunities beyond our geographic boundaries to achieve the most effective and efficient outcome for our customers.
- 0.8 Our priority is to make the most effective use of water resources and we have proposed ambitious targets to reduce the amount of water lost through leakage, and the promotion of the efficient use of water by our customers. This will help to achieve lower water consumption per person. However, demand management will not be sufficient on its own to meet future water resource challenges, and we are also proposing to develop new water resources.
- 0.9 We held 2 stages of public consultation – in spring and autumn 2018 to ensure stakeholders had an opportunity to review and comment on our developing plan. We have taken into account the feedback, as well as new information, in making changes and updates to our plan.
- 0.10 The significant changes in the inputs following the second stage of consultation and how these changed the preferred investment programme are summarised below and set out in the relevant sections of the plan:

<sup>2</sup> Water Industry Act 1991, Sections 37A to 37D (as amended by the Water Act 2003).

<sup>3</sup> Water Resources Strategy, Thames Water, PR19, CSD026, September 2018.

<sup>4</sup> "Preparing for a drier future", National Infrastructure Commission, April 2018.





- We have re-forecast population growth from 2045 using the latest information from ONS 2016 national forecasts. This has reduced our forecasts of population growth in the long term – Section 3.
- We have removed Teddington Direct River Abstraction (DRA) supply option from the preferred plan in response to environmental concerns – Section 7.
- We have extended our programme to reduce leakage including a target to reduce leakage by 15% by 2025 from our current regulatory target in 2020 and to halve leakage by 2050 – Section 8.
- We propose to develop new groundwater resources, transfer water via the Oxford Canal and develop the new Deepphams reuse scheme in North London to ensure security of supply and resilience to severe 1 in 200 year drought events by 2030 – Sections 10 and 11.
- We have brought forward the development of a new reservoir in Oxfordshire to 2037/38, called the South East Strategic Reservoir Option (SESRO), which addresses at an earlier date the requirement for raw water from Affinity Water. The reservoir will be jointly promoted by Thames Water and Affinity Water and will improve the resilience of water supply in the wider South East region – Sections 10 and 11.
- We have included increased protection to vulnerable chalk streams and watercourses once there is water to do so. The timing is facilitated by the delivery of the SESRO in 2037 – Sections 10 and 11.
- We have included the supported Severn Thames Transfer option towards the end of the planning period – Sections 10 and 11.

0.11 There are also a number of further changes to the plan including:

- Environment Agency confirmation of changes in our abstraction licences to ensure protection of the environment, called sustainability reductions – Section 4.
- Improvement to our Adaptive Pathway approach reviewing alternative options and clarity of our programme appraisal – Sections 10 and 11.
- A monitoring plan to provide improved clarity and further studies, focused on achieving the adaptive pathway decision point in 2022/23 – Section 11
- A continued commitment to work closely with the other water companies:
  - In the South East through the WRSE Group – Sections 10 and 11.
  - Through the continued joint development of the Severn Thames Transfer options working with United Utilities and Severn Trent Water – Sections 7 and 11
  - Development of the Strategic Regional Schemes tabled in Ofwat's Initial Assessment of Plans (IAP).
- Testing the resilience of our plan to a wider range of factors including scenarios of population growth, climate change and enhanced environmental protection – Section 10.
- Reviewing and updating our environmental assessments in response to feedback, including the Strategic Environmental Assessment, Habitats Regulation Assessment and assessments to ensure compliance with the Water Framework Directive – Sections 9 and 10.



- 0.12 We have also committed to continue studies to inform revisions to our plan, including further work to address environmental and navigational issues raised by the Environment Agency and the Port of London Authority in relation to the Teddington DRA scheme. This is detailed in Appendix L: Water Re-Use and Appendix XX: Programme of further studies 2019-2022.
- 0.13 We will continue to engage with regulators and stakeholders through the ongoing development of our plan and the programme of further studies. We have explained the consideration of comments received as part of the public consultations, and the updates that we have made to our plan.
- 0.14 Our plan is a technical document, comprising an Executive Summary, 11 sections and 28 appendices. The Executive Summary provides an overview of each of the 11 sections of the main technical report. It also includes information on the quality assurance processes that we have undertaken to provide confidence in the robustness of our WRMP19, and approval by our Board.
- 0.15 We are confident that we have an optimal plan to deliver the greatest value for our customers and those outside the region. We recognise the uncertainties around our forecasts, and will ensure our plan is agile enough to adapt to changes including population growth, and the costs and efficacy of different interventions.

## Section 1: Introduction and background

0.16 In Section 1 we set out the legal and policy framework to develop a WRMP and the approach we have followed to develop our WRMP19.

### ***What is a Water Resources Management Plan?***

0.17 A secure and sustainable supply of water is essential for public health, the economy and the environment. Water companies have a statutory duty to develop and maintain efficient and economical systems to provide water to their customers.<sup>5</sup> Every five years water companies are required<sup>6</sup> to produce a WRMP. Government, and its regulators, publish reference documents, namely the Guiding Principles<sup>7</sup> and Water Resources Planning Guideline<sup>8</sup> (WRPG), which provide a framework for the development of WRMPs.

0.18 The WRMP is a strategic plan which sets out how the company plans to maintain the balance between supply and demand for water for a minimum planning period of 25 years. Companies with particularly complex planning problems are encouraged to take a longer-term view, which is why we are planning over an 80-year period.

0.19 Our WRMP19 has been developed to answer a logical sequence of questions, which have also been used to structure this report:

- 1) How much water is available for public water supply now and how might this change over the planning period?
- 2) How much water do we need to meet the demand of our customers now and how might this change over the planning period?
- 3) Is there enough water to ensure a secure supply of water to our customers or will there be a shortfall?
- 4) If we do not have enough water to meet demand, what are the options to close this gap?
- 5) How do we decide on the longer-term, best value combination of options to ensure a secure supply of water over the planning period, and how robust is our programme of options to accommodate future uncertainties?

0.20 Pressure on our region's water resources is already significant and in the future we continue to face complex challenges. To ensure we can provide our customers with the best possible value over the long term we have designed our plan to satisfy three main objectives:

- To provide a secure supply of water for our customers, addressing the supply demand deficits that we forecast in our region;
- To improve our resilience to a severe drought of 1:200 years average frequency; and
- To look beyond the needs and opportunities of our region alone and take into account the growing needs of the wider south east of England. Our plan will allow for the

<sup>5</sup> Water Industry Act 1991, Section 37.

<sup>6</sup> Water Industry Act 1991, Sections 37A to 37D (as amended by the Water Act of 2003).

<sup>7</sup> Defra, Guiding principles for water resources planning for water companies operating wholly or mainly in England, May 2016.

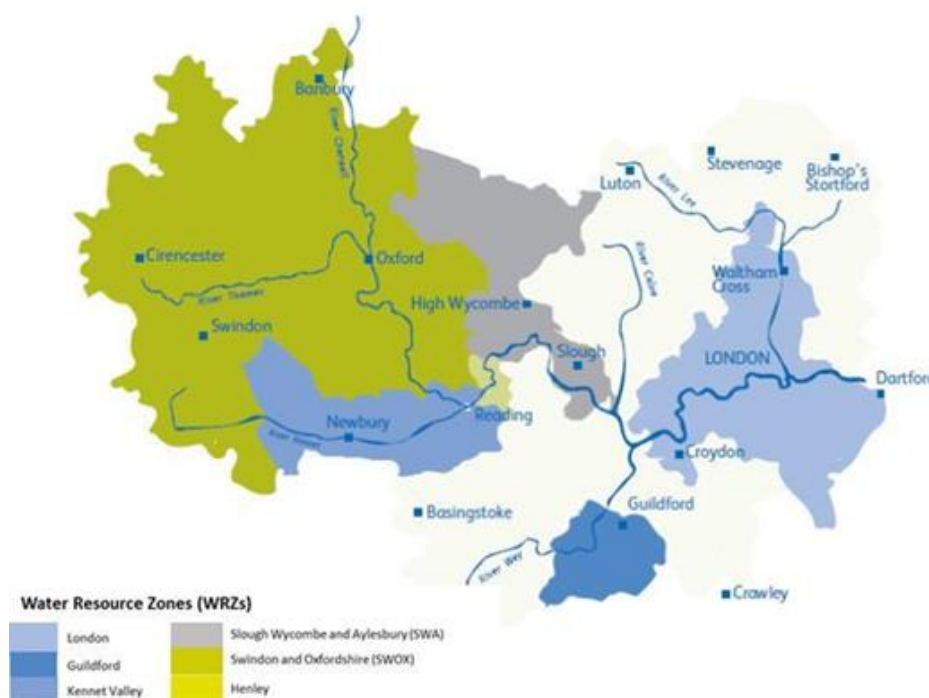
<sup>8</sup> Environment Agency and Natural Resources Wales, Water Resources Planning Guideline: July 2018.

potential transfers from and to other water companies to achieve the most effective and efficient outcome for customers in the South East.

### ***Our supply area***

- 0.21 Our supply area covers 13,000 square km, and extends from Cirencester in the west to Dartford in the east, and from Banbury in the north to Guildford in the south. Every day we supply approximately 2.6 billion litres of water to around 10 million people and 215,000 businesses.
- 0.22 We divide our area into six water resource zones (WRZs), as shown in Figure 0-1. London is our largest WRZ in terms of the number of customers served. Swindon and Oxfordshire (SWOX) WRZ is the next largest in terms of customers served, and the largest in terms of geographical area.

**Figure 0-1: Our supply area showing the six Water Resource Zones**



### ***The levels of service we provide to our customers***

- 0.23 As a water company, our duty is to provide sufficient water to meet our customers' needs every day. When we experience periods of prolonged dry weather, it may not be sustainable, or even possible, for us to do that. The frequency by which we provide a reduced standard of service to our customers, and expect them to take action to conserve water, is called our levels of service. We consulted our customers<sup>9</sup> on their preferences for the levels of service with respect to water use restrictions. Overall they were satisfied with the existing levels of service, with the exception of the most severe Level 4 restrictions, which involve phased cuts

<sup>9</sup> Revised draft WRMP19 Appendix T: Our customer priorities and preferences.

to water supply and/or very low pressure. Customers supported investments that would reduce the probability of these most severe restrictions being imposed.

- 0.24 The WRPG sets out Government and regulators' priorities for levels of service, with an aspiration to achieve a 1 in 200 annual probability of having to implement Level 4 restrictions. In our WRMP19 we set out the options that can achieve this level of resilience to drought over the next ten years. The lead time to enact this change will ensure it is deliverable and affordable for our customers. The current levels of service that we provide to our customers are set out in Table 0-1.

**Table 0-1: The levels of service we provide to our customers**

<b>Restriction level</b>	<b>Frequency of occurrence</b>	<b>Water use restrictions</b>
<b>Level 1</b>	1 year in 5 on average (20% annual average risk)	Intensive water saving media campaign
<b>Level 2</b>	1 year in 10 on average (10% annual average risk)	Sprinkler/unattended hosepipe ban, enhanced media campaign
<b>Level 3</b>	1 year in 20 on average (5% annual average risk)	Temporary Use Ban (formerly hosepipe ban), Drought Direction 2011 (formerly non-essential use bans) requiring the granting of an Ordinary Drought Order. N.B. Drought Permits are also part of Level 3 measures, but do not impinge directly on customers and so are not strictly relevant to customer service levels
<b>Level 4</b>	1 in 100 years (1% annual average risk)	Extreme restrictions such as standpipes and rota cuts in supply. If such measures were necessary their implementation would require the granting of an Emergency Drought Order

### ***The planning framework***

- 0.25 In 2015, following concern around the growing risk of drought in England and Wales, the Government asked the water industry to review the long-term resilience of water resources in England and Wales. A study<sup>10</sup> was commissioned by WaterUK together with water companies and regulators. The study considered the possible effects of climate change, population growth, environmental protection measures, and trends in water use to produce a wide range of potential future scenarios, looking 50 years ahead. The results of the study suggested that, in some scenarios, there is a more significant and growing risk of severe drought impacts than was previously thought. The findings were reported to Government for consideration in the development of government policy.
- 0.26 The Guiding Principles and WRPG provide a framework to guide companies in the preparation of WRMPs. These documents were reviewed and revised for this water resource planning period and included a number of significant changes to secure the long-term

<sup>10</sup> WaterUK, Water Resources long-term planning framework (2015-2065), 2016.

resilience of the water sector. Some of the main priorities presented in these documents which have shaped our approach are:

- A risk-based approach to planning that encourages companies facing more complex challenges to use more sophisticated methods to develop and test their plans
- A focus on developing a 'long-term, best-value' plan, rather than a 'least-cost' plan;
- A longer time horizon for the plan than the statutory minimum of 25 years
- Planning for a drought more severe than the worst drought in the historical record of rainfall and evaporation
- Working with neighbouring water companies and those further afield to investigate greater sharing of water resources
- Continuing to actively reduce leakage and per capita consumption (PCC)

0.27 We have also reviewed, and taken account of, recommendations arising from the public inquiry held in 2010 which focused on the options and the programme appraisals.

### ***The relationship between our WRMP19 and other plans***

0.28 Our WRMP19 has links to other plans, and is informed by them. The most important of these are:

- The Thames River Basin Management Plan<sup>11</sup>, which provides the environmental framework for the WRMP;
- Our own Business Plan for the period 2020-2025, which sets out the services that we plan to provide to our customers, and includes the funding requirements of the first five years of the WRMP19;
- Our Drought Plan<sup>12</sup>, which sets out the actions that we, and our customers, should take during periods of drought;
- The local authority Local Plans, which set out how much population and housing growth we should plan for;
- The 25-year Environmental Plan<sup>13</sup> from Defra which sets out the long-term approach to protecting and enhancing natural landscapes and habitats in England for the next generation;
- The NIC 'Preparing for a drier future'<sup>14</sup> report, which sets out a range of measures which the NIC believes Government, water companies and regulators should take to increase investment in supply infrastructure and encourage more efficient use of water;
- The London Plan published by the GLA for consultation, which sets out the long-term plan for London through to 2041.<sup>15</sup>

<sup>11</sup> Environment Agency, Thames River Basin District (RBMP) 2015.

<sup>12</sup> Thames Water, revised draft Drought Plan, 2018.

<sup>13</sup> 'A Green Future: Our 25 Year Plan to Improve the Environment', Defra, January 2018.

<sup>14</sup> National Infrastructure Commission, 'Preparing for a drier future', England's water infrastructure needs, April 2018.

<sup>15</sup> draft of the New London Plan, consultation, December 2017.

- Other water companies' plans, especially Affinity due to the joint need for a strategic option, and further companies to align with Ofwat's IAP action to develop regional strategic options.

### ***Engaging with customers, stakeholders and regulators***

- 0.29 We recognise that there is a wide interest in water resources and over the past four years we have worked extensively with customers, stakeholders and regulators to include their input into the development of the WRMP19.<sup>16</sup> In November 2014 we published a statement of Water Resources Stakeholder Engagement which set out how we planned to engage with interested parties during the preparation of our plan. Since January 2015 we have held over 30 forums and technical meetings. We have been open, innovative, collaborative and transparent in how we provide information throughout the development of our WRMP19, working as best we can to give opportunities for discussion and challenge. We aim to continue to engage with stakeholders as we finalise and deliver our plan.
- 0.30 UK Government has set out the importance it places on ensuring future water services are planned to deliver the services that customers want now, and in the future, in guidance<sup>17</sup> and more recently in a joint paper confirming the requirement for resilience.<sup>18</sup> Ofwat has also set out its expectations, promoting the need for water companies to engage directly with customers, using effective and innovative engagement strategies to build relationships and to use information gathered to drive decision-making and provide excellent levels of service.<sup>19</sup>
- 0.31 We have taken account of Ofwat's focus on customers' priorities and preferences reinforced in its approach to PR19<sup>20</sup> which is shaped around four inter-linked themes:
- Great customer service
  - Affordable bills
  - Resilience
  - Innovation
- 0.32 In Ofwat's Initial Assessment of Plans (IAP), we received an action to develop a number of strategic regional schemes, working jointly with other water companies. We welcome this, and the potential improved resilience this will achieve in protecting our customers' from severe droughts. The work undertaken has achieved alignment with the other water companies, with the added support of regional groups such as Water Resources South East (WRSE).
- 0.33 In developing our approach we have worked closely with our Customer Challenge Group (CCG), providing monthly progress updates on the engagement programme, seeking their guidance on the design and delivery of the research and engagement programme, and explaining how the output information will be used to shape our long-term plans. Members of the CCG have also frequently attended our forums and technical meetings.

<sup>16</sup> WRMP19 Appendix S: Stakeholder Engagement.

<sup>17</sup> Guiding principles for water resources planning for water companies operating wholly or mainly in England, Defra, May 2016

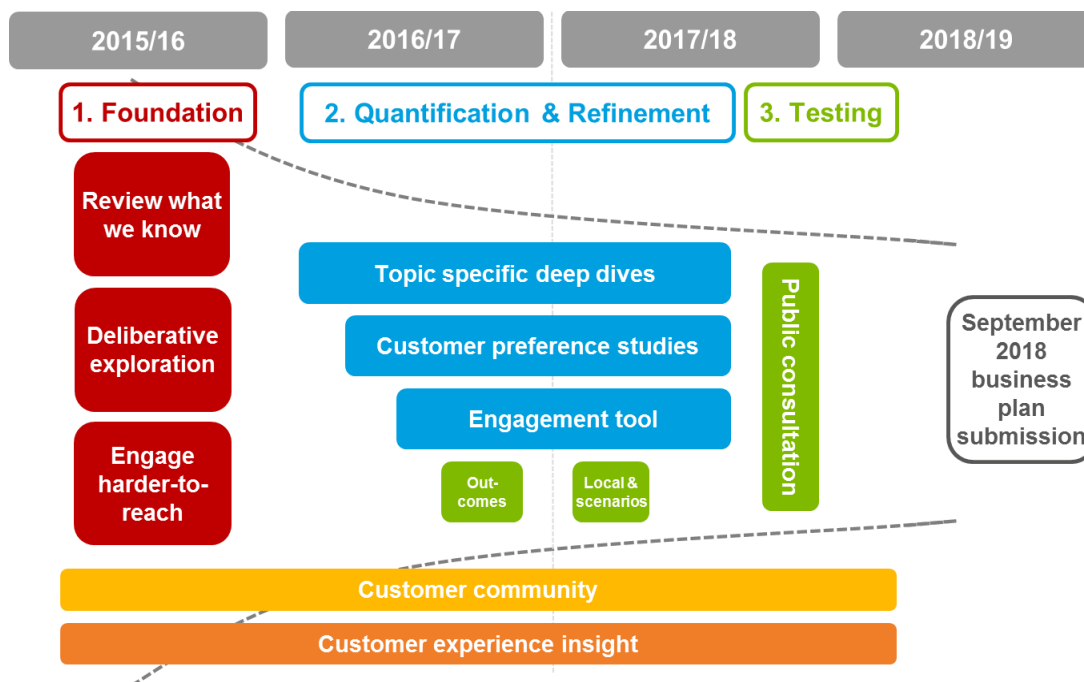
<sup>18</sup> 'Building resilient water supplies - a joint paper', Defra et al, August 2018.

<sup>19</sup> Ofwat, Customer engagement and policy statement and expectations for PR19, May 2016.

<sup>20</sup> Ofwat, Delivering Water 2020: Our final methodology for the 2019 price review, December 2017.

0.34 Our starting point for this plan is the needs of our customers. We have undertaken an extensive programme of research and engagement with our customers to make sure we understand and meet their needs and expectations. We have used a range of techniques and covered a wide range of topics: an overview of our approach is shown in Figure 0-2. This information, alongside information from day-to-day engagement with our customers, has been used to guide our decision making and shape our future plans. This is presented in detail in Appendix T: Our customer priorities and preferences.

**Figure 0-2: Overview of the research and engagement programme**



0.35 When we asked customers about planning for the future they told us we should plan for the long term and that they expect the cost of an affordable plan to be spread evenly over the generations, so everybody pays their fair share. They expected there would be no more service restrictions than there are today, and there was a willingness to protect services further against the effects of more extreme drought events. Customers were clear that they wanted us to make the most of the water we already have, before we developed new resources. They expected that leakage will decrease over time to around 15% of water put into supply. Customers supported programmes that improved the more efficient use of water. Customers recognised that demand and efficiency measures would deliver part of the additional water required in future, but that new water supplies would be needed. They reviewed the options and ranked them in terms of preference, with customers expressing a preference for the less complex, more tried and tested supply schemes.

0.36 We commissioned further research on national water transfers with United Utilities and Severn Trent Water to test customer views in all three regions on water transfers, to understand their support for transfers relative to other options, and to understand concerns that they may have. The initial feedback suggests that customers support trading of water but they do not rank it above other options presented, namely water re-use and reservoirs, and they expressed several concerns around the governance, reliability, security and



environmental impacts of such transfers that would need to be addressed if transfers were promoted.

- 0.37 In early 2019 we commissioned research to understand customer views on the protection of vulnerable chalk streams and investment to ensure protection against 1 in 500 year droughts. The findings of the research showed that customers supported investment on both these points, in principle.

### ***Public consultation***

- 0.38 We consulted publicly on our draft WRMP19 between 9 February and 29 April 2018. We received more than 540 responses from stakeholders and interested parties as well as feedback from customers. All of these responses are answered fully in our Statement of Response.<sup>21</sup>

- 0.39 The representations to the consultation, as well as new information, have been taken into account in revising our plan. There were a number of changes made to our draft plan. The main changes are set out below:

- Population forecasts have been reforecast from 2045 using the latest information from ONS 2016 national forecasts.
- Targets to reduce leakage by 15% (~100 MI/d) by 2025 from our target of 606 MI/d in 2020 and to halve leakage by 2050 are included in the plan.
- Teddington DRA scheme has been removed from the plan in response to environmental concerns raised by the Environment Agency. To compensate for the loss of this scheme the plan includes additional activity to manage demand and alternative resource schemes including Oxford Canal raw water transfer, innovative groundwater development and a reuse scheme at Deephams, Edmonton, North London.
- The timing of the South East Strategic Reservoir Option (SESRO) has moved forward from 2043 to 2037/38 to address an earlier requirement for raw water from Affinity Water; the scheme will be jointly promoted and will improve the resilience of water supply in the South East.
- Allowances have been included for reductions in existing groundwater and surface water abstractions which are perceived to have a detrimental environmental impact on vulnerable chalk streams and water courses. The timing is facilitated by the delivery of the South East strategic reservoir in 2037/38.
- Towards the end of the planning period, the supported Severn Thames Transfer option has been included.

- 0.40 In view of the changes made to our draft plan we carried out a further consultation in autumn 2018. We received over 750 representations. We have provided information on the further consultation, the comments made and our consideration of the points in our Statement of Response No. 2. This has provided five main updates to our plan:

- **Leakage** - We are committed to achieve 15% reduction in leakage by 2025 (from our current 2020 regulatory target) and to halve leakage by 2050. Currently our performance on leakage is behind where we expected to be, we have included an update on our

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<sup>21</sup> Draft Water Resources Management Plan 2019 Statement of Response, Thames Water, October 2018.

leakage performance and recovery plan to ensure we meet our 2025 leakage reduction target.

- **Decision-making process** - We have improved the explanation of the programme appraisal and decision making process to clearly present our rationale for the choice of our preferred programme.
- **Adaptive planning** - We have developed our adaptive planning approach, this sets out our preferred plan, as well as alternative pathways enabling us to take account of changes in future forecasts and new information.
- **Further studies** - We have committed to further work on strategic resource options which are included in our adaptive plan. These studies will be undertaken in collaboration with other water companies, regulators and interested stakeholders.
- **Monitoring plan** - We have developed a monitoring plan to provide transparency to stakeholders of the further work that is planned and how we will monitor and report progress.

0.41 We updated our plan to address these issues, as well as some minor updates to ensure our plan remains accurate and robust.

0.42 Defra requested further information on a number of aspects of our plan in October 2019, we responded in December 2019, and then, taking advice from the Environment Agency, Defra granted approval of our plan in March 2020. We then published our plan in April 2020.

## Section 2: Water resources programme 2015-2020

0.43 We are currently implementing our five-year programme of work, from 2015-2020, to manage water resources and ensure we can provide a secure water supply to our customers, in line with the details of the Ofwat Final Determination specific to Thames Water.<sup>22</sup> This provides the starting point for the development of the WRMP19. In Section 2, we set out our progress in delivering the programme, and the work that we plan to complete by the end of the five-year period (March 2020).

### ***Update on our five year programme***

0.44 The main focus of our current programme is to make the most effective use of the resources that we have available through reducing leakage, installing household water meters and improving the water efficiency of homes and businesses. An update on each of these components is provided below and summarised in Table 0-2.

#### ***Leakage***

0.45 We have committed to reduce leakage to 606 million litres a day (Ml/d) by 2020. In 2016/17 we missed our annual leakage target for the first time in 11 years and then missed it again in 2017/18. We have implemented a comprehensive leakage recovery plan to address the shortfall and ensure we do all we can to deliver our promise to customers. In August 2018 we committed to a package of measures in relation to managing and communicating our leakage reduction performance as part of our undertaking to Ofwat for the purpose of section 19 WIA 1991<sup>23</sup>. The programme includes activity to replace and refurbish old water mains, and to repair leaks on both our water supply pipes and our customers' water supply pipes.

0.46 Our performance in 2018/19 has been heavily affected by two challenging weather events: the extreme cold weather in March 2018 – the *Beast from the East*, and the hot, dry weather between April and July 2018. Both have contributed to increases in leakage and we have struggled to recover our performance sufficiently to keep our original forecasts of 2019 year-end value and our 2019/20 annual average leakage level.

0.47 Taking account of this shortfall will mean we are likely to begin 2019/20 at a higher level of leakage than our expected target of 606Ml/d, as shown in Table 0-2. In spite of the challenges we have faced, we are committed to maintain this target as well as make up any lost ground from the current period.

#### ***Metering***

0.48 We have committed to roll out an ambitious programme of smart meters to household customers. Smart meters are an essential tool to help us to understand where water is going, thereby helping to pinpoint and fix leaks on both our network and on our customers' pipes. Additionally they enable us to work with customers to encourage the efficient use of water. Our initial plan to install 441,000 smart meters by 2020 has reduced to 300,000 as part of a revised programme (our progressive metering programme or PMP) that has taken into

<sup>22</sup> Water resources programme for 2015-2020 as part of the 2014 Ofwat Price Review.

<sup>23</sup> <https://www.ofwat.gov.uk/investigation-thames-waters-failure-meet-leakage-performance-commitments>.

account challenges of working across London. We will continue to install meters when customers request them (optant meters) and we have accelerated the delivery of the fixed radio network across London that currently delivers over 6 million reads per day. We are continuing work to install bulk meters which will help to reduce leakage in large blocks of flats. This programme of meter installations, and increased use of data, will help us achieve our water saving commitments made in our WRMP covering this period.

### **Water efficiency**

- 0.49 We are delivering the UK's largest ever water efficiency programme, and are on track to meet our regulatory commitment, saving approximately 40 MI/d of water by 2020. We are promoting water efficiency to encourage our customers to save water, energy and money through a wide range of household and business focussed programmes. We have developed and tested innovative approaches, including a reward scheme for customers who use less water, which we expect to expand in the future. Our award-winning Smarter Home Visit programme provides household customers with tailored advice and installation of free water efficiency devices.

**Table 0-2: Demand management programme 2015-2020**

<b>Activity</b>	<b>Unit</b>	<b>2015/16 Actual</b>	<b>2016/17 Actual</b>	<b>2017/18 Actual</b>	<b>2018/19 forecast</b>	<b>2019/20 forecast</b>
<b>Reported leakage<sup>24</sup></b>	MI/d	642.5	677.2	694.7	708.0	636
<b>Leakage target<sup>25</sup></b>	MI/d	649.0	630.4	619.5	611.4	606.3
<b>Optant metering</b>	Nr	18,689	19,798	16,559	17,406	14,035
<b>Progressive metering</b>	Nr	42,083	103,422	98,053	56,749	– <sup>26</sup>
<b>Water efficiency</b>	MI/d	7.05	11.82	11.57	10.97	6.61

- 0.50 In parallel with activity to manage demand for water we have also implemented new water supply schemes. The schemes are a combination of groundwater development and water trades with external organisations. These have provided over 46 MI/d of water. We report our progress in the Annual Review.
- 0.51 All WRZs are forecast to be in surplus at the end of the AMP6 period, excluding London which has a 24 MI/d deficit. We update the supply demand balance annually as part of our Annual Review of the water resources programme reported to the Environment Agency. As part of preparing our annual performance report we are progressing a number of activities that will improve our supply demand position in London with the aim of returning to a surplus by 2019/20.

<sup>24</sup> These are based on the 'ODI methodology' assumptions and do not include an up-lift for the leakage consistency (shadow reporting) impact.

<sup>25</sup> Thames Water AMP6 Performance Commitments, Annual Return Table 10 consistent.

<sup>26</sup> To be reviewed and balanced with the revenue meter replacement programme which is prioritised in 2019/20.

## ***Update on the environment programme***

- 0.52 We have also committed to complete activities to ensure that we protect the environment. These include reductions in our abstractions, investigations to understand if our abstractions are causing environmental damage, options appraisals, river restoration and the installation of eel screens. We work closely with the Environment Agency to define these activities. Overall we are on target to deliver these commitments. An update on the main activities is provided below.

### ***Reducing abstraction which may be having an adverse environmental impact***

- 0.53 We have agreed to reduce abstractions at Axford, Ogbourne, Childrey Warren and Pann Mill. In addition, a mitigation scheme to address the impact of abstraction from the Lower Thames is being implemented at Mogden Wastewater Treatment Works to improve oxygenation in the Upper Thames estuary.

### ***Investigations to identify the potential environmental impact of abstraction***

- 0.54 We have completed our investigation into the impact from abstraction in the Lower Lee and at Sundridge and Westerham. We are also progressing investigations at Bexley, Hawridge and the Darent. These investigations are due to be completed in 2019. We provide regular updates to the Environment Agency. The Environment Agency has used the findings of these investigations to inform the likely future requirements for sustainability reductions<sup>27</sup> which we have taken into account in developing the WRMP19. The output of these investigations has determined that further work is required for Bexley and Hawridge. We are also completing an options appraisal at Waddon which will be completed in 2019.

### ***Eel screens***

- 0.55 There is a requirement<sup>28</sup> to install screening at all abstraction intakes where the abstraction has the potential to trap eels, and where it is cost beneficial and feasible to do so. We have installed a screen at Walton (March 2017) and Hampton (April 2018), and will use the learning from this to inform the design of other screens required.

### ***River restoration***

- 0.56 We have committed to undertake river restoration at eight sites where we are either undertaking sustainability reductions or where the adverse impacts of abstraction on a watercourse have been identified, but where it is not cost beneficial to implement a sustainability reduction. With the continued support of the EA to develop scope and access to private land we are committed to complete this work by March 2020.

### ***Abstraction Incentive Mechanism (AIM)***

- 0.57 AIM was introduced by Ofwat in 2016 in order to protect watercourses identified to be potentially vulnerable to the effects of abstraction. We have committed to implement AIM at five sites: Axford, Pann Mill, North Orpington, New Gauge and Pangbourne. We have

<sup>27</sup> Environment Agency, Water Industry National Environmental Programme (WINEP), March 2018.

<sup>28</sup> Eel Regulations 2009.

implemented AIM since 2016/17, which was a relatively wet year which meant the AIM was not triggered. Despite some significant supply challenges during the summer of 2017, the availability of alternative sources of water in each case meant we were able to comply with AIM at all of our sites and therefore comply overall with AIM for 2017/18. Our expectation is to continue to comply with AIM in 2018/19.

## **Update on other work**

### **Technical studies**

- 0.58 We have undertaken a number of studies to refine and improve our water resources planning for the WRMP19. These cover all aspects of planning from forecasting demand to identification and assessment of options, to the use of innovative tools to support the development of the preferred programme.

### **WRSE**

- 0.59 This group is a collaboration of six water companies<sup>29</sup>, regulators and stakeholders whose focus is to develop a flexible and robust water resources strategy for the south east of England. By taking a region-wide approach that works across company boundaries, options that might not otherwise be available can be developed. Given the shared challenge of balancing supply and demand in the South East, it is important that we do everything possible to work collaboratively with neighbouring water companies, and others in the sector. To this end we are committed to working as part of the WRSE group, and our plan reflects the principles and commitments set out in the WRSE report.<sup>30</sup> In the plan we include the requirements of our neighbours for both raw and treated water transfers totalling 100 MI/d, due to a large raw water need from Affinity Water. This is a reduction from our draft WRMP19 position of 130MI/d which was driven by a raw water need from Affinity Water and South East Water. The final report from the WRSE group is expected to be published in Spring 2019, which will outline potential solutions available to meet the South East regional deficit.

- 0.60 A note from WRSE states:

*“Following the close of the consultation period, further regional modelling has been undertaken, exploring more scenarios to assess the feedback from customers. In addition, the scenarios being explored include a range of regional targets to assess the effect of meeting the recommendations from the NIC and Defra on leakage and per capita consumption in terms of option selection.*

*This work is currently ongoing. Preliminary outputs have been produced and these are being subject to close examination, as per all previous phases, to ensure robust confidence can be placed in the results. When the review period is completed, the finding of the revised modelling work can be used to update the revised WRMP, if necessary.”*

<sup>29</sup> Six companies within WRSE are Southern Water, Affinity Water, South East Water, Portsmouth Water, Sutton and East Surrey Water and Thames Water.

<sup>30</sup> ‘From Source to Tap: The south east strategy for water’, WRSE, April 2018.



- 0.61 WRSE will play an important role in improving the resilience of the South East region. Recent discussions between the CEOs of the six companies and regulators have confirmed this role, moving the WRSE towards the strategic development of the regional plan for WRMP24. We are committed to our involvement within this group, and have included funding within our Business Plan to support and drive further development of the regional plan.

#### **Ofwat IAP - Regional Strategic Schemes**

- 0.62 In January 2019 we, alongside other water companies, received an action from Ofwat to increase development on a number of strategic supply options. This development is a move beyond the requirement of the statutory WRMP, and has the potential for increased resilience to drought.
- 0.63 We have worked jointly and collaboratively with Affinity Water, Anglian Water, Severn Trent Water, Southern Water, Thames Water, United Utilities and WRSE. The EA and Ofwat have attended meetings as observers. Ofwat requested for joint working, development of the gated process through AMP7 and proposals for an ODI to manage the funding. Whilst we have provided proposals for the above, we have also provided further proposals for changing the schemes being developed, such as Teddington Re-Use, and the governance to pass each gate, expected to be the regulatory alliance. A joint document<sup>31</sup> has been developed between the water companies to address Ofwat's January 2019 Initial Assessment of Plans (IAP) action, with the support of WRSE.
- 0.64 We have included in our WRMP19 a number of transfer opportunities from outside of our region. Although there is no short term need within our plan we are fully committed to explore opportunities for trading and sharing water. We are working with United Utilities, Severn Trent, Welsh Water, the EA and Natural Resources Wales (NRW) to develop potential options, including both pipeline and canal options to transfer raw water to the River Thames. As part of the Regional Strategic Scheme action we have produced jointly with Severn Trent Water and United Utilities a further document<sup>32</sup> for the Severn Thames Transfer, providing more detail on the development of this option.

#### ***Progress reporting***

- 0.65 We provide an annual progress report to the Environment Agency setting out our performance against our commitments and we publish these reports on our website at [www.thameswater.co.uk/wrmp](http://www.thameswater.co.uk/wrmp).

<sup>31</sup> TW-OC-A7: Strategic Water Resource Options Appendix; March 2019; Joint statement from Anglian Water, Affinity Water, Severn Trent Water, Southern Water, Thames Water and United Utilities.

<sup>32</sup> TW-OC-A8: Strategic Water Resource Options- Severn Thames Transfer; March 2019; A joint statement from Severn Trent Water, Thames Water and United Utilities.

## Section 3: Current and future demand for water

0.66 In Section 3 we explain how we calculate the current, and forecast future, demand for water.

### ***What is demand?***

0.67 Water demand is composed of five elements as listed below:

- Household water use: we provide water to nearly 3.7 million households
- Non-household water use (water used by businesses): we provide water to 215,000 businesses
- Operational water use (water used in maintaining the network)
- Water taken unbilled (water used legally or illegally without charge)
- Leakage (from our pipes and those of our customers)

0.68 We develop demand forecasts for different conditions, which describe demand in an average year and in a period in which peaks in demand need to be met. There are two scenarios:

- Dry Year Annual Average scenario (DYAA): this is the forecast for a dry year (a period of low rainfall) where there are no constraints on demand
- Average Day Peak Week scenario (ADPW): this describes the average daily demand during the peak week for water demand

0.69 We do not report peak week demand for the London WRZ as the storage reservoirs and the London Ring Main provide some resilience to peak water demands.

### ***Future demand***

0.70 We use mathematical models, which draw on information such as population and property projections, water use data and trends, and a range of other information to forecast how demand for water is likely to vary over the next 80 years.

0.71 The WRPG requires us to plan for growth projected by the local authorities across our region. We appointed Edge Analytics to collate and analyse the forecast population and property growth set out in the local plans for the planning period to 2045.

0.72 Aligning with base-year totals, we have used the plan-based output to derive population and property forecasts for each of our six water resource zones (WRZs). The rate of population growth is relatively high in the short term (2016-2025), consistent with higher housing growth in Local Plans, reducing towards the end of the Local Plan periods (2030-2035). Population growth is higher thereafter as housing growth totals return to the trend evident in the ONS 2014-based projection.

0.73 For the Thames Water area, the plan-based forecast estimates a population growth of 2.1 million (21.5%) for the 2016-2045 plan period to a total of 11.9 million people.

0.74 The local plan-based forecasts provide a growth perspective to 2045. A second key component of our demand forecasting process has been the consideration of longer-term forecasts of population and property growth.

0.75 In the draft WRMP19 (submitted to Defra in December 2017), population and property output from the University of Leeds demographic forecasting model was used as the basis for the





long-term growth outlook. Since completion of the draft WRMP19, the Office for National Statistics (ONS) has published a new 2016-based long-term projection, the first release of future population growth estimates since the Brexit referendum in June 2016.

- 0.76 To ensure alignment with the latest ONS evidence on the likely trajectory of population growth during the second half of the 21st century, we commissioned updated population and property forecasts for our WRZs for the extended, 2045-2100 period.
- 0.77 Whilst the core and long-term forecasts have used consistent methodologies, the long-term forecasts have been formulated using trend-based inputs and assumptions that are consistent with the ONS 2016-based national population projection; this contrasts with the housing-led approach used in the development of the core, 2016-2045 forecasts.
- 0.78 On the basis of the local plan, we forecast in the draft WRMP that the number of people in our area may increase by over 6 million people, reaching up to 15 million by 2100. The revised approach to forecasting based on ONS 2016 based projection, which is considered more representative, the number of people is forecast to increase by a lower rate by 4.1 million, reaching 13.9 million people by 2100.
- 0.79 The population and property forecasts over the entire planning period are shown in Table 0-3.

**Table 0-3: Growth in population and properties for each WRZ 2016-2100**

WRZ	Total population	Change in population from base year				
	2016/17	2019/20	2024/25	2029/30	2044/45	2099/00
London	7,595,624	246,205	562,497	733,487	1,584,089	3,241,288
SWOX	1,021,824	62,121	134,637	182,091	279,508	460,410
SWA	548,844	21,152	42,819	58,582	114,509	220,443
Kennet Valley	401,735	16,666	37,731	49,905	76,506	132,995
Guildford	160,186	4,909	14,426	24,605	44,019	72,616
Henley	50,901	2,237	3,698	4,132	5,895	12,791
<b>Total</b>	<b>9,779,115</b>	<b>353,289</b>	<b>795,807</b>	<b>1,052,801</b>	<b>2,104,527</b>	<b>4,140,543</b>

WRZ	Total properties	Change in properties from base year				
	2016/17	2019/20	2024/25	2029/30	2044/45	2099/00
London	2,729,586	131,218	332,222	482,909	989,749	2,066,895
SWOX	425,681	25,148	59,520	84,705	145,951	256,414
SWA	205,640	9,339	20,717	30,318	61,080	123,453
Kennet Valley	159,064	4,855	13,083	19,096	37,080	70,795
Guildford	62,720	2,081	6,045	10,455	20,709	37,537
Henley	21,292	508	875	1,290	3,011	7,427
<b>Total</b>	<b>3,603,983</b>	<b>173,148</b>	<b>432,463</b>	<b>628,774</b>	<b>1,257,580</b>	<b>2,562,521</b>

### ***Household and non-household water use***

- 0.80 We have followed UK Water Industry Research (UKWIR) guidance<sup>33</sup> to develop models to forecast household and non-household consumption. Using population and property projections, water use data and trends, and a range of other relevant information we have forecast how the demand for water is likely to vary over the next 80 years in each of our six WRZs.
- 0.81 We forecast an increase in total household demand of more than 220 MI/d by 2045 and a total increase of 410 MI/d by 2100.
- 0.82 We forecast non-household water demand to decline by less than 4% over the planning period to 2045 and then by approximately 7% to 2100, although it should be noted there are differing trends across our six WRZs. Generally, increases in water use from service

<sup>33</sup> UKWIR 2015 WRMP19 Methods – Household Consumption Forecasting 15/WR/02/9.

industries (e.g. offices, call centres) are shown to be offset by reductions in demand from non-service industries (e.g. industrial sites, breweries).

## Section 4: Current and future water supply

0.83 In Section 4 we describe our current water supply and the amount of water we forecast will be available in the future, taking account of the impact of climate change and reductions in the amount of water available to abstract whilst continuing to protect the environment.

### *Where our water comes from*

0.84 The Thames basin is one of the most intensively used water resource systems in the world. Of the rain that falls, two-thirds is either lost in evaporation or used by plants. Of the remaining one third, termed 'effective' rainfall, approximately 55% is licensed for abstraction and for use. Of all the water abstracted, 82% is for public supply, with the remainder being used predominantly by industry and agriculture.

0.85 Our water supplies are derived from a combination of surface (river) water and groundwater. In London approximately 80% of the water comes from surface waters (the River Thames and the River Lee) and is stored in reservoirs before being treated and put into supply, with the remainder taken from groundwater. We also have a desalination plant located in east London that can be used to provide water in periods leading up to and during drought. In the Thames Valley 70% of the water comes from groundwater.

0.86 Figure 0-3 shows the existing water resources in the Thames catchment.

**Figure 0-3: Existing water resources in the Thames catchment**





### **Current water available for use**

0.87 The amount of water leaving our water treatment works and put into our distribution network to deliver to customers' homes and businesses, is called water available for use (WAFU). WAFU is calculated by adjusting the volume of water we can take from rivers and groundwater for factors such as outages and bulk supplies with other companies, as outlined in the equation, and described further below.

$$\text{WAFU} = \text{deployable output (DO)} - \text{climate change} - \text{network constraints} - \text{outage} \pm \text{bulk supplies}$$

0.88 DO is the constrained output of water resources, including process losses (as described in Appendix K: Process Losses), available to meet demand to specified levels of service, and is calculated in line with UKWIR guidance. We use a computer simulation model called Water Resources Management System (WARMS2) to calculate DO. A critical factor for determining London's water supply is how much water is flowing in the River Thames over Teddington weir. When flows over the weir fall below agreed thresholds the amount of water we can abstract changes, placing greater reliance on water stored in reservoirs to meet our customers' needs. We have an agreement with the Environment Agency (known as the Lower Thames Operating Agreement, or LTOA) which is fundamental to the calculation of the DO. It requires us to take actions to work with our customers to manage demand for water in prolonged periods of dry weather and drought. Further information is in Appendix I: Deployable Output.

0.89 Climate change will affect when and how much rain falls in the plan period and is an important factor in long-term water resource management planning. We have used the medium emissions UK Climate Change Projections 2009 (UKCP09) to forecast the impact of climate change on DO in the 2080s, and in accordance with the WRPG. We forecast a significant reduction in DO, especially in our London WRZ where we are planning for a reduction of around 185 MI/d at 2085/86. Further information is in Appendix U: Climate change. This is shown in Table 0-4.

**Table 0-4: UKCP09 climate change impact on DO by the 2080s (2085/86)**

WRZ	UKCP09 climate change impact (MI/d)	
	DYAA	DYCP
London	-187.2	N/A
SWOX	-10.6	-12.1
Kennet Valley	-12.0	-9.0
Henley	0.00	0.00
SWA	-3.5	-2.3
Guildford	-0.4	-0.4

0.90 **Network constraints** occur where existing infrastructure is not capable of distributing or treating all the raw water that can be produced at a site. In recent years we have implemented



a number of schemes to address network constraints and there are only a few constraints remaining. These are deducted from DO.

- 0.91 **Outages** are temporary reductions in DO as a result of both planned and unplanned events, such as the planned maintenance of reservoirs. We use the industry methodology to calculate outage. We have agreed our approach with the Environment Agency. Further information is in Appendix J: Outage.
- 0.92 **Bulk supplies** are transfers of raw or treated water into or out of our water supply area. We have long-standing agreements with neighbouring water companies to export and import water and, for the most part, these can only be terminated by mutual consent. We consulted all our neighbouring companies in the development of the draft WRMP19 to verify the arrangements. Overall we are a net exporter of water of approximately 100 Ml/d to Northumbrian Water South (Essex and Suffolk) and Affinity Water.
- 0.93 Table 0-5 shows how WAFU changes over our planning period for the baseline scenario under DYAA conditions for London and dry year critical period (DYCP) conditions for WRZs in the Thames Valley.

**Table 0-5: WAFU across the planning period**

WRZ	2016/17	2019/20	2024/25	2034/35	2044/45	2099/00
<b>London</b>	2166.22	2154.68	2096.03	2054.75	2013.32	1919.74
<b>SWOX</b>	369.50	354.82	353.30	350.62	349.52	343.45
<b>Kennet Valley</b>	151.77	151.06	149.88	147.89	147.08	142.59
<b>Henley</b>	25.54	25.54	25.54	25.54	25.54	25.54
<b>SWA</b>	197.38	189.89	182.69	182.18	181.97	180.82
<b>Guildford</b>	67.99	67.96	67.90	65.12	64.97	64.88
<b>Total</b>	<b>2978.39</b>	<b>2943.95</b>	<b>2875.34</b>	<b>2826.10</b>	<b>2782.40</b>	<b>2677.02</b>

### ***Sustainability reductions***

- 0.94 These are the reductions in abstraction that we are required to make by the Environment Agency in order to provide environmental improvements, typically through increased flows in rivers which are identified to be suffering the effects of abstraction. We work closely with the Environment Agency to identify where our abstractions may be having adverse impacts on the environment and to put plans in place to address them. The Water Industry National Environmental Programme (WINEP) is issued by the Environment Agency, and sets out where reductions in abstraction are required. The Environment Agency published the first summary of requirements in WINEP1 in March 2017, setting out its first assessment of potential sustainability reductions. A further release issued in September 2017 (WINEP2) provided an indication of the potential sustainability reductions and investigations within our supply area. A final release for WRMP19 of the WINEP was provided on 29 March 2018 (WINEP3) and confirmed the requirement as to what environmental improvements should be accounted for within our WRMP19. The WINEP3 sustainability reductions in terms of DO are included in our WRMP19 DO baseline, along with our AMP6 sustainability reductions, these are shown in Table 0-6.

**Table 0-6: Potential sustainability reductions in DO (WINEP3)**

Loss of DO (MI/d)				
WRZ	Source	DYAA	DYCP	Year
London**	Bexley***	9.0	--	2024/25
	Axford*	5.0	6.0	2017/18
SWOX	Ogbourne*	4.0	4.7	2017/18
	Childrey Warren	3.7	3.7	2019/20
SWA	Hawridge***	6.8	6.9	2024/25
	Pann Mill	0.0	7.3	2019/20

Notes: \* The impact on SWOX shown in the table of the Axford and Ogbourne source deployable output reductions are from the results modelled in WARMS2.

\*\* The DO for our London WRZ is assessed for DYAA only due to both London's reservoirs and ring main providing a buffer during peak periods.

\*\*\* WINEP3 (all other reductions in the table are AMP6 reductions).

## Drought and risk

- 0.95 We know from historical observations that the south east of England has experienced droughts worse than we saw in the 20<sup>th</sup> century and we expect that climate change will increase the frequency of more extreme droughts in the future.
- 0.96 We commissioned research to understand the impact of more severe droughts than are present in the historical record, and found that a 1 in 200 year drought in London would reduce DO by 140 MI/d, and a 1 in 500 year drought would reduce DO by 250 MI/d. These are presented in further detail in Appendix I: Deployable output, and have been detailed in our Drought Plan 2018. The research also showed that the current standard of protection against Level 4 restrictions for drought events which occurred in the 20<sup>th</sup> century in the Thames region is approximately 1 in 100 years.
- 0.97 We have also completed further work to understand drought vulnerability. This has been achieved through the production of Drought Vulnerability Surfaces (DVS). These represent, for the base year, the company's resilience / sensitivity to droughts of different durations, intensities and severities.
- 0.98 The Drought Vulnerability Surfaces show that the London WRZ is resilient to the worst historical droughts. The London WRZ is vulnerable to severe droughts with durations of 18 to 24 months (supply demand deficits are shown with droughts of this type falling into the 1 in 200 year category). Details are shown in Section 4 Chapter D.
- 0.99 In our plan we have committed to improving our resilience to a 1 in 200 year drought from 2030. This level of drought protection aligns with government and regulator guidance and customer preferences. The date of 2030 has been chosen to align with achievable lead times of large water supply options, as the necessary quantum of water will require more than demand reductions in order to be delivered. As we set out in our draft Drought Plan, we can currently maintain supply during such extreme events through the extended use of environmentally damaging drought permits, but we do not consider this to be a sustainable or desirable long-term solution.

## Section 5: Allowing for risk and uncertainty

### ***Methodology and approach***

- 0.100 We cannot predict the future but we can produce forecasts of what we think the water resource future may be like and test scenarios that cover the uncertainties around these forecasts. In Section 5 we describe how we have assessed risk and uncertainty relating to our supply-demand balance.
- 0.101 Given the importance of maintaining a secure supply of water to our customers, we take the management of risk and uncertainty very seriously. We have used the methodology set out in industry best practice guidance to ensure that we assess risk systematically, and as accurately as possible.
- 0.102 In water resource planning, uncertainty is handled through the calculation of ‘target headroom’, which is defined as:
- “The minimum buffer that water companies are required to maintain between supply and demand in order to account for current and future uncertainties in supply and demand.”*
- 0.103 We use a statistical technique called a ‘Monte Carlo simulation’ to examine the uncertainties across a range of factors that affect our supply and demand forecasts to calculate the target headroom for each WRZ.

### ***Supply side and demand side uncertainty***

- 0.104 The supply side uncertainties include issues such as the accuracy of information on how well our supply options perform and, importantly, how climate change may affect the amount of water they can provide in the future. The demand side uncertainties include for components such as population and how well our demand management measures may deliver water use efficiencies.
- 0.105 Our allowance for uncertainty is not a fixed figure over the whole plan period to the year 2100. With more time to adapt to risks in the longer term, we are able to accept greater risks in the long term than in the short term.

## Section 6: Baseline water supply demand position

- 0.106 In Section 6 we set out the baseline supply-demand positions for each of our six WRZs. These are generated by comparing the baseline demand forecast (Section 3: Current and future demand for water) against the available supply (Section 4: Current and future water supply), plus an allowance for uncertainty (Section 5: Allowing for risk and uncertainty). This highlights if there is a ‘planning problem’ that will require demand or supply options to remove any future water deficit.
- 0.107 We forecast supply-demand deficits in our London, SWOX, SWA and Guildford WRZs. Our Kennet Valley and Henley WRZs are forecast to remain in surplus to 2099/00. Table 0-7 gives the baseline supply demand balances for each WRZ.

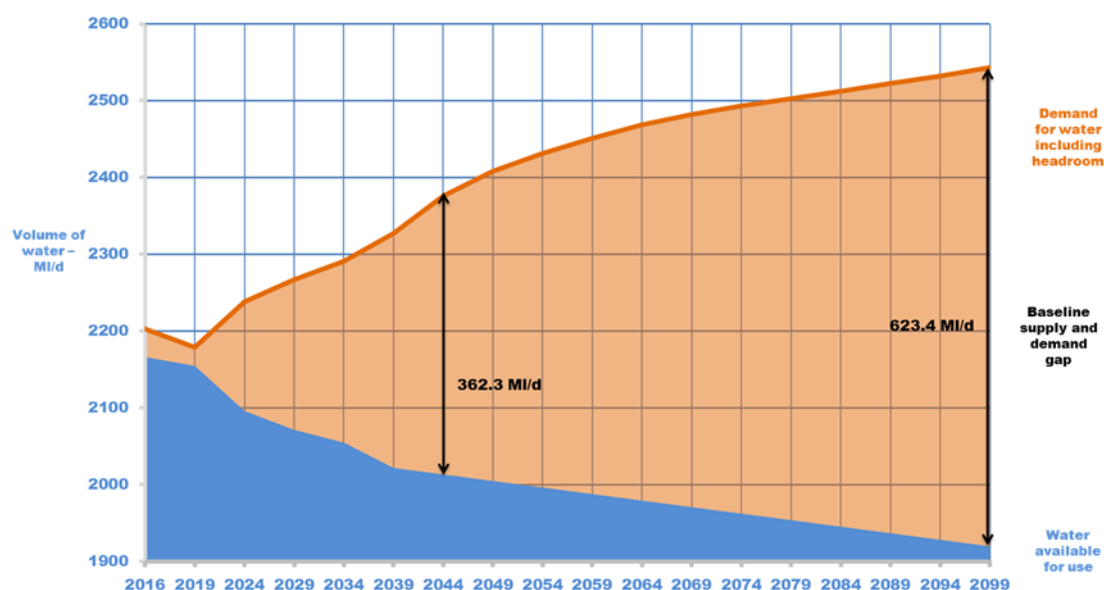
**Table 0-7: Baseline supply demand position by WRZ**

WRZ	WRMP19 Balance					
	2019/20	2024/25	2029/30	2039/40	2074/75	2099/00
London (DYAA)	-24	-143	-195	-306	-531	-623
SWOX (DYCP)	9	-2	-7	-12	-18	-31
SWA (DYCP)	14	4	1	-3	-12	-21
Kennet Valley (DYCP)	23	18	16	13	8	1
Guildford (DYCP)	3	0	-2	-8	-10	-13
Henley (DYCP)	6	5	5	5	5	5

## London

0.108 In our London WRZ (Figure 0-4), demand exceeds supply from the beginning of the new planning period 2020-2025 under DYAA conditions, with the deficit increasing to 362 MI/d by 2044/45 and 623 MI/d by 2099/2100. Overall, the increasing deficit over the forecast period is created by the significant increase in population, exacerbated by the impacts of climate change and increases in exports to neighbouring water companies from our current water trading agreements.

**Figure 0-4: Baseline supply demand balance for London WRZ (DYAA)**



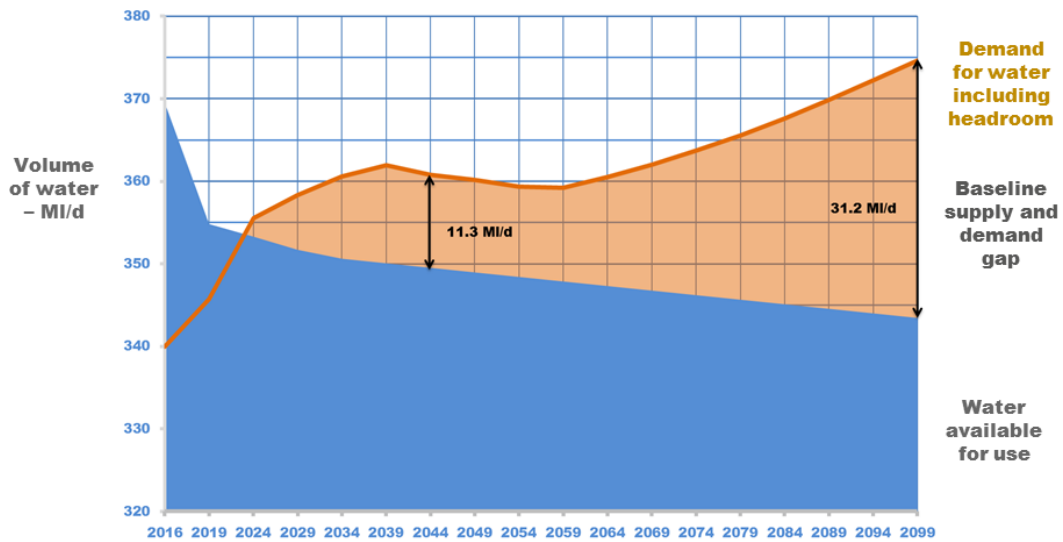
## Swindon and Oxfordshire

0.109 The SWOX WRZ (Figure 0-5) has a supply-demand deficit under dry year peak week (DYCP) conditions from 2022, but in DYAA conditions has a marginal surplus throughout the planning horizon. The DYCP deficit grows to 11.3 MI/d by 2044/45 and 31.2 MI/d by 2099/2100. The deficit is created by the increase in population and the impacts of climate change.





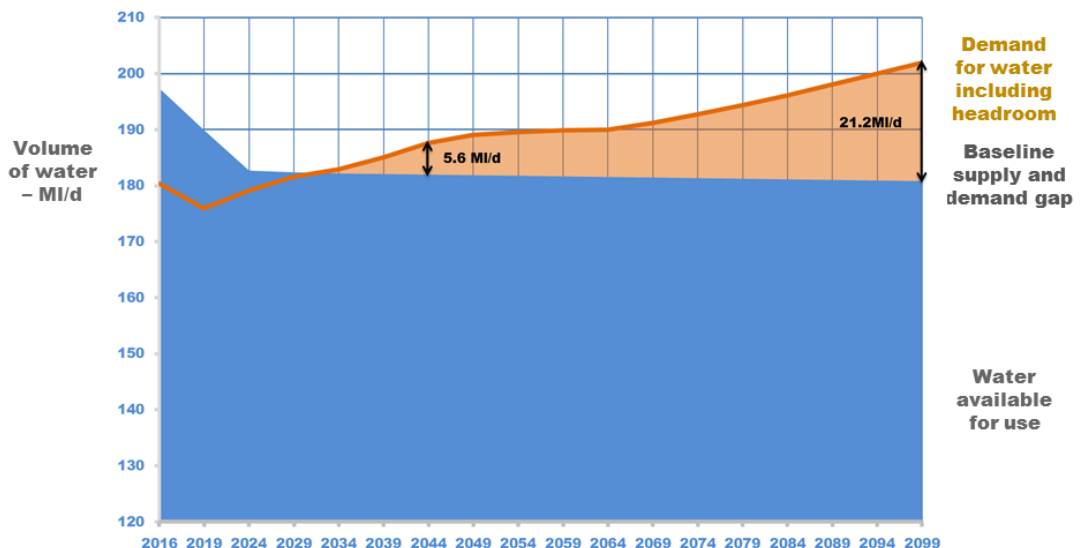
**Figure 0-5: Baseline supply demand balance for SWOX WRZ (DYCP)**



### Slough Wycombe and Aylesbury

0.110 Our SWA WRZ (Figure 0-6) has a supply-demand deficit under dry year peak week (DYCP) conditions of 5.6 MI/d by 2044/45 and 21.2 MI/d by 2099/2100. The deficit is primarily caused by population growth, although there is a sustainability reduction (6.9 MI/d) in 2024/25 in addition to the 7.3 MI/d reduction in 2019/20.

**Figure 0-6: Baseline supply demand balance for SWA WRZ (DYCP)**

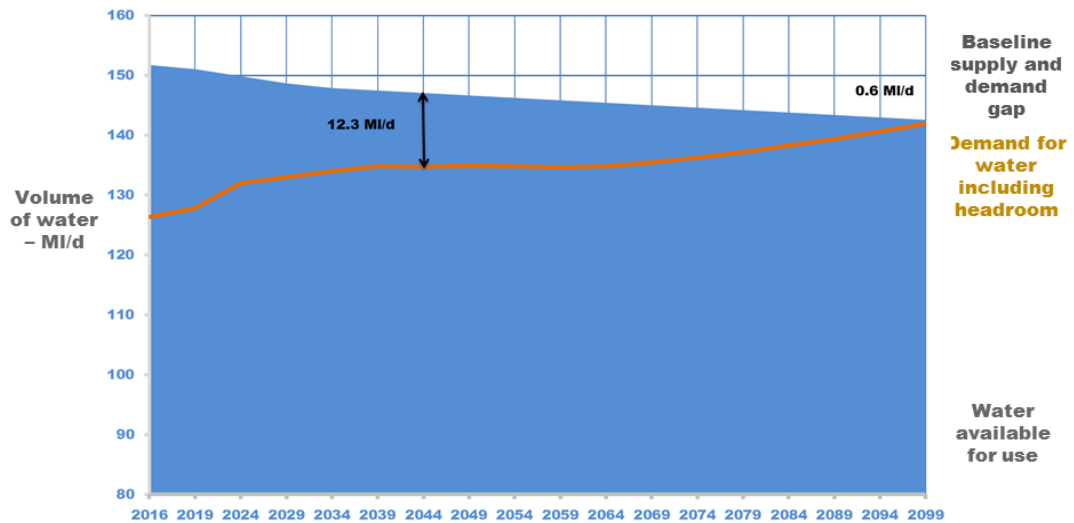


### Kennet Valley

0.111 The Kennet Valley WRZ (Figure 0-7) remains in surplus for the whole period to 2099/00, with a surplus of 12.3MI/d in 2044/45 and a minor surplus of <1MI/d in 2099/2100.



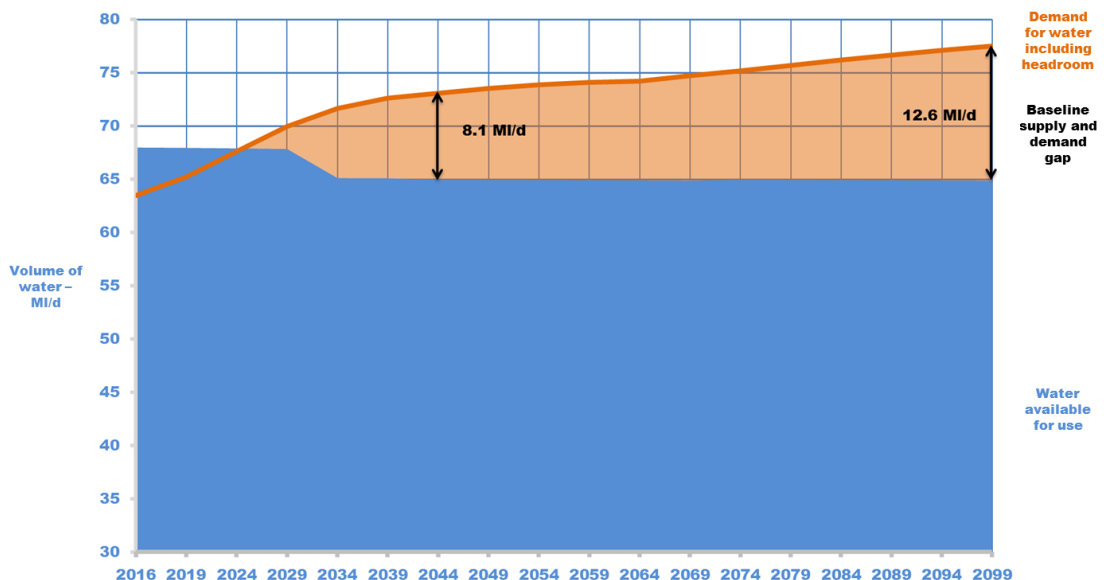
**Figure 0-7: Baseline supply demand balance for Kennet Valley WRZ (DYCP)**



**Guildford**

0.112 We forecast a supply-demand deficit under dry year peak week (DYCP) conditions in the Guildford WRZ (Figure 0-8) in 2025. The deficit rises to 8.1 MI/d by 2044/45 and increases to 12.6 MI/d by 2099/2100. Population growth is the main driver of this deficit. Although the main investment drive is peak conditions, DYAA conditions will be considered in developing the solution.

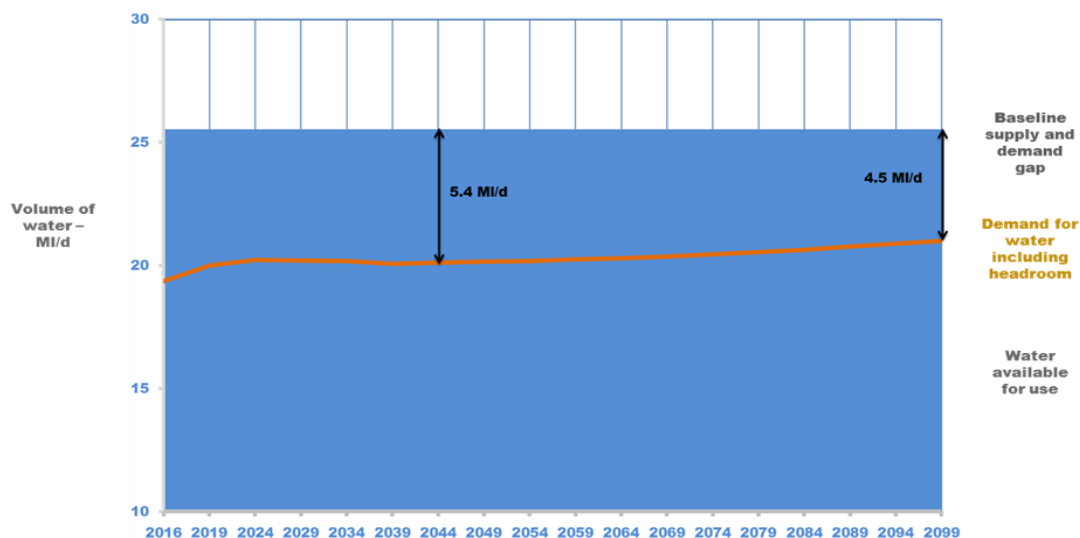
**Figure 0-8: Baseline supply demand balance for Guildford WRZ (DYCP)**



## Henley

0.113 We do forecast a surplus for our Henley WRZ (Figure 0-9) under both peak and dry year conditions for the planning period.

**Figure 0-9: Baseline supply demand balance for Henley WRZ (DYCP)**



## Section 7: Appraisal of resource options

0.114 In Section 7 we outline the approach undertaken to identify potential unconstrained water resource options, and then move on to assess and screen the options to produce a constrained list of options, which could then be taken forward for consideration in programme appraisal (Section 10: Programme appraisal and scenario testing). We worked closely with stakeholders throughout the process covering the methodological approach to identifying options, the application of the methods, and the results of the exercise. We endeavoured to address concerns and respond to comments throughout the process.

### **Identification, screening and assessment**

0.115 The starting point was a review of the generic list of resource options types (e.g. reservoirs, water transfers) to identify potentially feasible option types of new resource. Option types that were rejected are listed in Appendix Q: Scheme rejection register.

0.116 Feasibility reports then identified specific options for each feasible resource type, generating an unconstrained list of potential new resources. As part of this work, we proactively sought to identify potential third party water resource options. This aligns well with the Bid Assessment Framework we have developed to improve transparency, equality and proportionality in how bids are processed. To date we have received options through three main approaches:

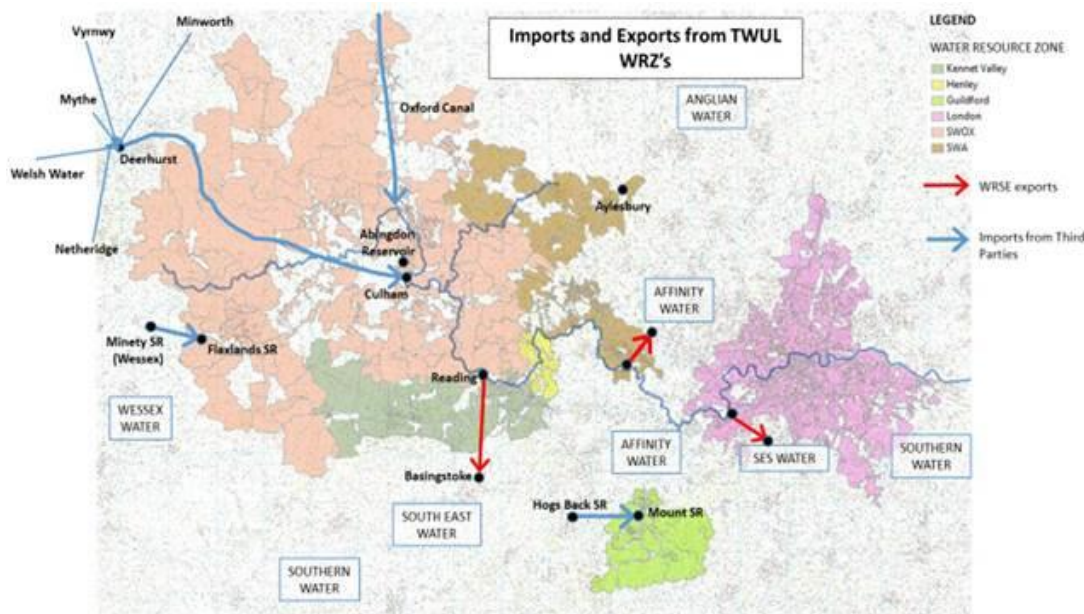
- Request for proposals for water resources in the Official Journal of the European Union (OJEU), initiated in 2011.
- Bilateral discussions with other water companies and other companies who hold abstraction licences (e.g. RWE Npower at Didcot)

- Active engagement with regional water resource planning groups including the WRSE Group, the Water Resources East Group and the River Severn Working Group.
- 0.117 For options identified on the unconstrained list, we then completed a four stage feasibility assessment, against a range of criteria that identified the feasible list of new resources. The feasible resources of each option type were then compared in a fine screening report that identified a constrained list of around 40 new water resource options, although there were many schemes of differing sizes included on the list.
- 0.118 The list of constrained options includes effluent re-use, effluent transfer, desalination, river abstractions, inter-company transfers, innovative groundwater schemes and a reservoir. Their individual delivery lead times are dependent on the size and complexity of the option. To understand their impact on the environment, each option has been subjected to a Strategic Environmental Assessment (SEA) as required by the WRPG.
- 0.119 Sizeable inter-company transfers form an important part of the WRMP19. We have held discussions on raw water transfers with Severn Trent, United Utilities and Welsh Water, involving Natural Resources Wales and the Environment Agency, to agree volumes to trade and the impact future droughts might have on water availability. We understand the potential value of regional transfers and are committed to further developing transfer options with potential suppliers, such as United Utilities, Severn Trent and Welsh Water, and with the support of Government and regulators. Both Ofwat and the Environment Agency requested in their representations to our draft WRMP19 that Thames Water should continue to undertake further work to investigate the Severn Thames transfer, and this need has been further strengthened in the recent joint letter from government bodies 'Building resilient water supplies'.<sup>34</sup> We have committed to do this, and have agreed further work in collaboration with Severn Trent and United Utilities.
- 0.120 Figure 0-10 geographically represents these potential raw water transfers as well as potential treated water imports from Wessex Water and South East Water. The potential exports in response to requirements for water by other WRSE companies are also shown. Since we published the draft WRMP19 the development of each water company's plan has reduced the need for inter-company water transfers, with only Affinity Water's need from Thames Water remaining. All others have been removed and do not at this time require a solution or support from Thames Water.

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<sup>34</sup> 'Building resilient water supplies - a joint letter', Defra, August 2018.

**Figure 0-10: Third party water trading options and WRSE requirements**



0.121 It is not sufficient to only consider the water resource that can be provided by an option; we also need to consider requirements for conveyance, treatment and distribution infrastructure in order for the scheme to be used. These components are referred to as elements. We have considered how all these elements might be provided under different models, such as Direct Procurement.

### ***Constrained list of options***

0.122 The constrained list of options for the London WRZ is shown in Table 0-8 and Thames Valley in Table 0-9. For each of these options we have completed Conceptual Design Reports, which provide information on the location of the works, engineering and land requirements, construction impacts, environmental and social mitigation, programme assumptions and risks. We have used this information as the basis to develop estimates of cost for each option, to build a risk register and to complete the Strategic Environmental Assessment (SEA). At this stage of project development the design is at the conceptual stage, and it is expected that uncertainties will exist. This is taken account of at this early stage of development with the inclusion of risk and optimism bias funding.

0.123 The responses to the consultation and further development work of options have led to changes being made to our constrained list. These are described below.

0.124 Most notably in the London WRZ is the removal of the Teddington DRA option, proposed in the draft plan to be completed by 2030. Although this option was seen by many as a cost effective solution, we received a number of concerns from the Environment Agency in relation to its potential environmental impact. The EA requested that we demonstrate that this option does not cause unacceptable impact on the environment, with the key impact being the higher temperature of the effluent entering the River Thames affecting the ecology, especially the migratory or indigenous fish.

- 0.125 A number of meetings were held with the EA and Port of London Authority (PLA) to discuss their concerns and work undertaken to seek to address them. We proposed solutions to reduce the temperature of the effluent, but due to the volume of water involved this caused a high increase in costs of the scheme, and did not provide the required change in temperature to protect the ecology.
- 0.126 A joint paper<sup>35</sup> has been produced with the Environment Agency that provides a common understanding of the environmental effects of the Teddington DRA option. This has led to two actions being taken:
- 1) The option was removed from the constrained list due the inability for known solutions to sufficiently reduce the temperature of the water.
  - 2) To agree in principle to the continued studies required to improve our understanding of this option for future re-consideration, taking account also of the PLA requirements.
- 0.127 We also received responses from Ofwat and the Environment Agency to further consider water transfers to and from neighbouring companies. With the continued development of new transfer options with United Utilities, Severn Trent Water and Welsh Water, we have included new options in our WRMP that provide a large volume of water. A number of these require further work between water companies and the Environment Agency to confirm the actual volume that would be available in drought conditions without impacting the environment. We have agreed with Severn Trent, United Utilities and the Environment Agency to invest in continuing the work in the next period.<sup>36</sup> This agreement states:
- “Given the national strategic importance of the Severn to Thames transfer scheme, as recognised by the National Infrastructure Commission report ‘Preparing for a Drier Future’, we remain committed to ensuring that momentum is maintained. To this end we will continue to work on appropriate technical and environmental aspects in 2020-25, for example ecological work, losses and reliability, water quality, regulation, river temperature, in partnership with the other companies. We will continue to work closely with the other companies to examine these options in more detail. This will allow the transfer options to be considered further in future WRMPs.”*
- 0.128 This joint agreement provides significant support and direction to continue investment into the development of regional transfer options, and overcome the remaining challenges. This document has been included at the end of the Executive Summary (Annex 3).
- 0.129 With further development work completed since the draft WRMP19 we have also included more groundwater schemes.
- 0.130 We have considered the larger supply options for potential Direct Procurement. A short list of options that fit the Direct Procurement criteria is included in our overall list of options utilised as part of the programme appraisal.

<sup>35</sup> “Thames Water and Environmental Agency: Common understanding of the water environment effects of the Teddington Direct River Abstraction (DRA) option.” TW and EA, 13 July 2018.

<sup>36</sup> “Severn Thames transfer - Common Words”, Severn Trent, United Utilities and Thames Water, August 2018.

**Table 0-8: London water resource zone<sup>37</sup>**

Option type	Resource Element	
	Location	Deployable Output* (DYAA, MI/d)
<b>Water reuse</b>	Deephams 45 MI/d	45
	Beckton 100 MI/d	95
	Beckton 150 MI/d	138
	Beckton 200 MI/d	183
	Beckton 300 MI/d	268
<b>Raw water Transfer</b>	STT – Vyrnwy	60/148/180*
	STT - Mythe	15*
	STT - River Wye to Deerhurst	60*
	STT - Netheridge to River Severn	35*
	STT - Minworth to River Avon	115*
	STT - Redeployment of Shrewsbury abstractions	12/30*
	Oxford Canal	11
<b>Desalination</b>	Beckton 150 MI/d (blended)	142
	Crossness 100 MI/d	95
	Crossness 200 MI/d	189
	Crossness 300 MI/d	284
<b>New Reservoir</b>	Abingdon 75 Mm <sup>3</sup>	142
	Abingdon 100 Mm <sup>3</sup>	190
	Abingdon 125 Mm <sup>3</sup>	253
	Abingdon 150 Mm <sup>3</sup>	294
	Abingdon 30+ 100 Mm <sup>3</sup>	49+199
	Abingdon 80+ 42 Mm <sup>3</sup>	151+83
<b>Aquifer Recharge</b>	AR/SLARS - Kidbrooke (SLARS1)	7
	AR Merton (SLARS3)	5
	AR Streatham (SLARS2)	4
<b>Aquifer storage and recovery</b>	ASR South East London (Addington)	3
	ASR Thames Valley/Thames Central	3
	ASR Horton Kirby	5
<b>Groundwater</b>	GW - Addington	1
	GW - London Confined Chalk (north)	2
	GW - Southfleet/Greenhithe (new WTW)	8
	GW - Honor Oak	1
	GW - Merton recommissioning	2
	Epsom removal of constraints	2
	New River Head	3
<b>Inter-company Transfer</b>	Chingford raw water purchase	20
	Didcot raw water purchase	18

<sup>37</sup> Note: The nominal capacity is the maximum volume that can be provided by the scheme, and not the deployable output (DO) of the scheme. Further information on scheme DOs, including taking account of climate change is presented in Section 7.

**Table 0-9: Thames Valley water resource zone<sup>38</sup>**

Option type	Resource Element	
	Location	Deployable Output* (ADPW, MI/d)
<b>Swindon &amp; Oxfordshire (SWOX)</b>		
<b>Raw water Transfer</b>	Severn Thames Transfer (See London WRZ for support elements)	See Table 7.3
	Oxford Canal	12
<b>New reservoir</b>	Abingdon (See London WRZ Table for sizes)	See Table 7.3
<b>Groundwater</b>	GW - Moulsoford 1	3.5
<b>Removal of constraints to DO</b>	Ashton Keynes borehole pumps	1.5
	Britwell	1.3
<b>Inter-zonal transfers</b>	Henley to SWOX	2.4/5
	Kennet Valley to SWOX (incl. GW Mortimer)	4.5
	Kennet Valley to SWOX	2.3
<b>Inter-company transfer</b>	Wessex Water to SWOX (Flaxlands)	2.9
<b>Slough, Wycombe &amp; Aylesbury (SWA)</b>		
<b>Raw water Transfer</b>	Severn Thames Transfer (See London WRZ for support elements)	See Table 7.3
	Oxford Canal	12
<b>New Reservoir</b>	Abingdon (See London WRZ Table for sizes)	See Table 7.3
<b>Raw Water Purchase</b>	Didcot	18
<b>Groundwater</b>	GW – Datchet	5.4
<b>Inter-zonal transfers</b>	Henley to SWA	2.4/5
<b>Guildford</b>		
<b>Groundwater</b>	Dapdune licence disaggregation	
<b>Removal of constraints to DO</b>	Dapdune removal of constraints	7.8
	Ladymead WTW removal of constraints	
<b>Inter-co. transfers</b>	South East Water to Guildford	10
<b>Kennet Valley</b>		
<b>Groundwater</b>	GW - Mortimer disused source (recommission)	4.5
<b>Removal of constraints to DO</b>	East Woodhay borehole pumps	2.1

<sup>38</sup> Note: The nominal capacity is the maximum volume that can be provided by the scheme, and not the deployable output of the scheme. Further information on scheme DOs, including taking account of climate change is presented in Section 7.



## Section 8: Appraisal of demand options

- 0.131 In Section 8 we outline the process to identify and appraise demand management options to be considered in the development of the demand management programmes for assessment alongside the supply options in programme appraisal (Section 10: Programme appraisal and scenario testing).

### ***Identification, screening and assessment***

- 0.132 We completed a three stage process involving screening, assessment and optimisation of feasible options to produce a range of deliverable demand management programmes. We consulted stakeholders throughout this process and responded to their feedback. We worked closely with stakeholders, covering the methodological approach, the application of the methods, and the results. We endeavoured to address concerns and respond to comments through the process.
- 0.133 The first stage involved identification of a list of generic demand management options and screening based on technological, financial, environmental, risk and resilience constraints. The output was 47 feasible options. These are shown in Figure 0-11, options listed in black font are options considered in our previous plan, and options in green font are new options.
- 0.134 The range of feasible options is provided primarily from the contractual arrangements already in place through our alliancing partners, such as mains replacement or pressure management, or through Thames Water departments already having contracts in place with third party companies, such as metering and water efficiency. All of these contracts meet our procurement policies. Aligned to our Bid Assessment Framework we will continue to invite further bids for demand work, as received from our earlier OJEU notice and look to utilise these bids where there is need and they are found to be cost effective and workable with existing large scale alliance agreements.
- 0.135 We have also tested the potential for direct procurement of our demand options, although none were found to meet the criteria. Our most likely example was metering. This would meet the financial investment criteria due to the scale of work being undertaken, but other criteria such as the complexity and embedded nature of the work within the day-to-day running of the business did not make this work suitable for direct procurement.

**Figure 0-11: Feasible demand management options**

Leakage and Usage Benefit	Leakage Benefit	Usage Benefit		
Metering	Leakage	Water Efficiency	Incentives and Tariffs	Non-Potable Water
Metering houses only	Mains Replacement	Smarter Home Visit	Incentives Programme	Rainwater harvesting
Metering blocks of flats (bulks) only		Smarter Business Visit	Innovative Tariffs	Stormwater harvesting
Metering houses and bulks	Pressure Management	Wastage Fix ('leaky loos')		Greywater harvesting
Metering houses, bulks and individual flats	DMA Enhancement	Housing Association Fix		
Customer Side Leakage (CSL) repair		Intensive area based promotional campaigns		
Metering houses, bulks and individual flats + CSL repair + Smarter Home Visit				
Metering houses, bulks and individual flats + CSL repair + Housing Association Fix				
Metering houses + CSL repair + Smarter Home Visit				

0.136 The feasible options were evaluated in terms of the cost and demand benefit that could be achieved. The majority of the feasible options are part of our current delivery plan to manage reductions in leakage and customer usage. The leakage interventions include DMA enhancement, pressure management, mains rehabilitation and customer side leakage repairs linked to smart metering. The usage interventions predominantly rely on smart metering to achieve behavioural customer water usage reductions and to enable targeting of water efficiency activity. We have also included in the list of feasible options a number of new innovative water resource management options including further water efficiency techniques, non-potable solutions and customer incentive programmes.

### ***Demand management programmes***

0.137 These options were then reviewed within the integrated demand management model to provide combinations of options, called programmes. Each demand management programme provides a level of MI/d water reduction and cost. We have included improvements to our demand programmes due to the responses to consultation, guidance from government and the ongoing development of our WRMP19.

0.138 We have reviewed our programme and confirmed a reduction in leakage by 15% in the period to 2025 from our target of 606 MI/d in 2020. This aligns with the expectations of Ofwat, Defra, the Environment Agency and many others to reduce demand further, primarily focused on leakage. This also aligns with customer preferences, and the reductions align with our twin track approach of demand and supply options. Over the longer term we have aligned to the National Infrastructure Commission recommendations to halve leakage by 2050. There has also been further reduction in customer usage. We acknowledge the views of some stakeholders that such large reductions are high risk, but we consider that we can manage and mitigate that risk in this and future plans, as explained in Section 8.



- 0.139 We have extended our demand management programmes to 2100 to provide longer duration demand reductions.
- 0.140 These programmes have been included in programme appraisal, where the demand and supply options are combined to provide an improved twin track assessment. Unlike the supply options, these demand options are able to deliver from the first year due to their shorter lead times.
- 0.141 An SEA was carried out for each demand programme, as required within the WRPG described in Section 9 and relevant appendices.

## Section 9: Environmental appraisal

- 0.142 In Section 9 we set out the approach we have developed to consider the beneficial and adverse environmental and social effects of the options considered for balancing supply and demand of the preferred programme for each WRZ and of the WRMP19 overall. Our approach is in line with the WRPG, Guiding Principles and UKWIR guidance.<sup>39</sup> Following the consultations on the draft and revised draft WRMP19 we have included within the environmental appraisal updates to the Strategic Environmental Assessment (SEA), Habitats Regulations Assessment (HRA) and Water Framework Directive (WFD). These assessments have been updated in light of further information, comments received and government policy changes. We have also taken account of changes to the option elements within the WRMP19.

### ***Assessment approach***

- 0.143 The SEA<sup>40</sup> provides the overarching structure to our assessment of environmental and social effects, and this has been integrated with the requirements for the EU Habitats Directive<sup>41</sup> and EU Water Framework Directive (WFD). This is summarised in Figure 0-12.
- 0.144 In addition, we have ensured compliance with national legislation, for example Sites of Special Scientific Interest, Scheduled Monuments, Areas of Outstanding Natural Beauty and we have considered the proposed Marine Conservation Zone in the lower River Thames estuary.

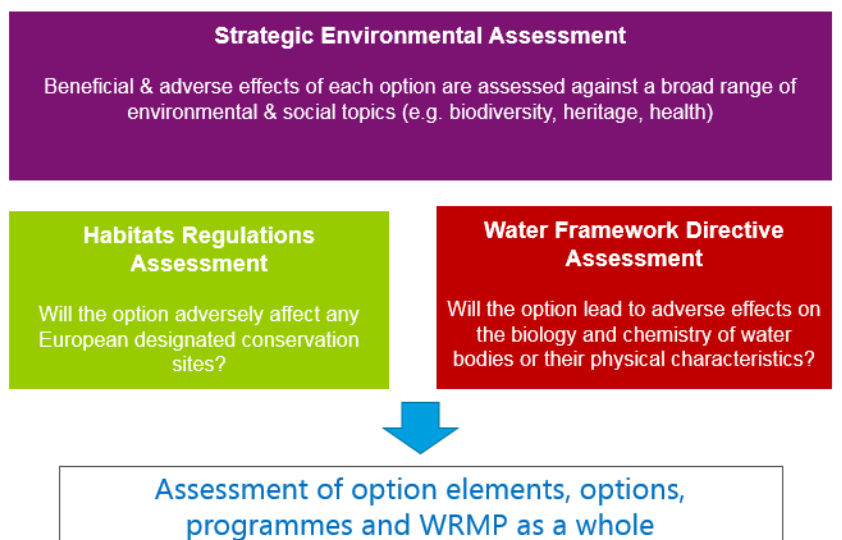
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<sup>39</sup> UKWIR, Strategic Environmental Assessment and Habitats Regulations Assessment - Guidance for Water Resources Management Plans and Drought Plans, 2012.

<sup>40</sup> The Environmental Assessment of Plans and Programmes Regulations 2004 (Statutory Instrument 2004 No. 1633) apply to any plan or programme which relates solely or in part to England.

<sup>41</sup> Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora.

**Figure 0-12: The environmental assessment approach within the WRMP**

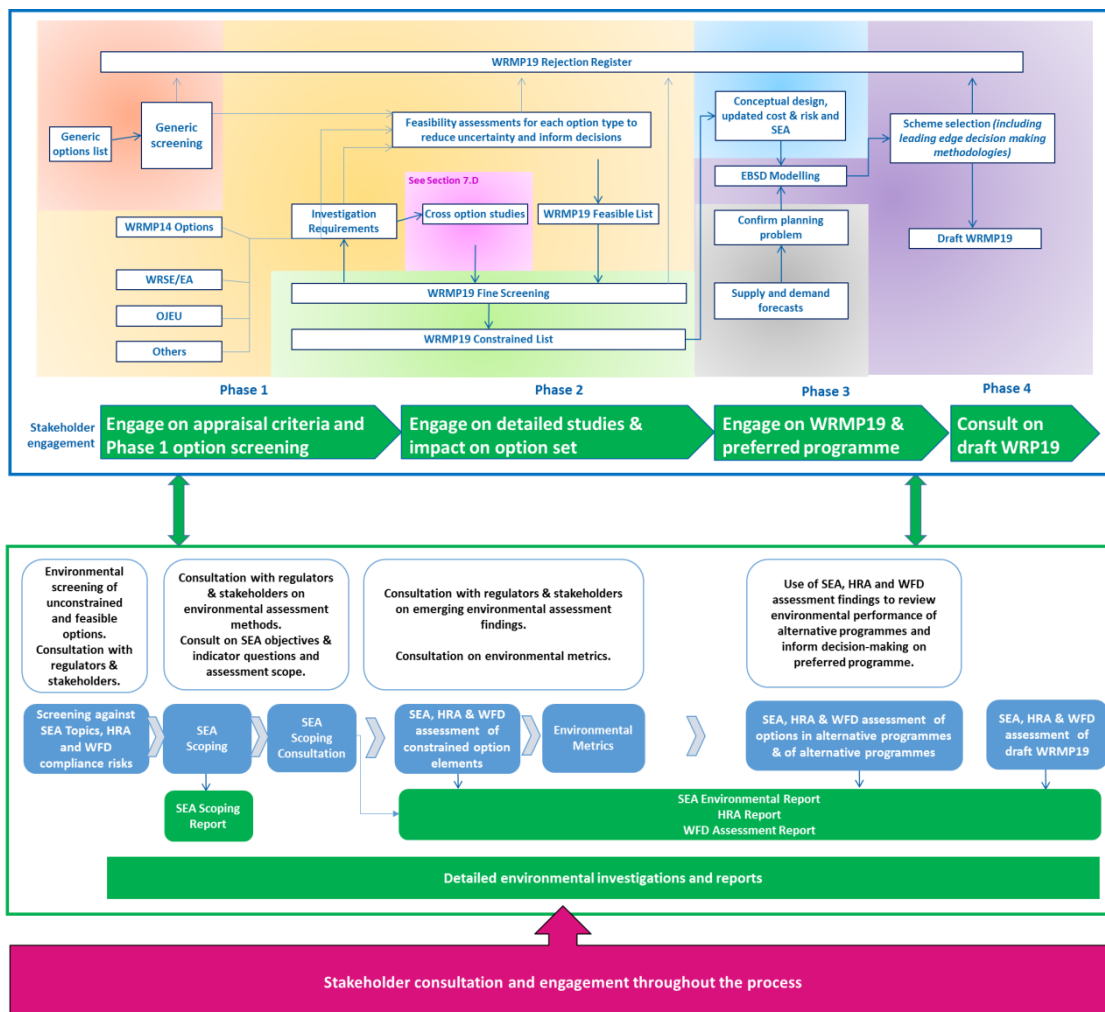


### **Assessment framework**

0.145 We consulted regulators and stakeholders on our proposed assessment framework, supported by Methodology Statements published on our website, together with the statutory consultation on the SEA Scoping Report<sup>42</sup>. Feedback received was used to finalise our assessment framework and this was shared with regulators and stakeholders through a summary report and in presentations at stakeholder meetings. Figure 0-13 summarises the overall framework we adopted.

<sup>42</sup> Cascade Consulting, Strategic Environment Assessment of Water Resources Management Plan 2019, Scoping Report, July 2016.

**Figure 0-13: Integration of environmental assessment in the WRMP19 process**



0.146 In Figure 0-13, the assessment approach covered all stages of the development of the WRMP19, commencing with the ‘coarse’ screening of a very broad ‘unconstrained’ list of options, through to a ‘fine’ screening process, and the final constrained list of options, and assessment of alternative programmes and the plan as a whole.

0.147 We also assessed the cumulative effects between different environmental and social aspects of a particular option, programme or plan, as well as between the alternative options and programmes.

0.148 The Government has also published its 25 year Environment Plan which includes the ‘net environmental gain’ principle, requiring benefits locally and nationally.

### ***Environmental valuation***

0.149 We considered the use of environmental valuation to support the development of WRMP19. A limitation of valuation is that only certain environmental and social effects can be costed, thereby leading to a partial assessment. In dialogue with the Environment Agency and stakeholders we concluded that there would be little benefit to the decision-making process in calculating environmental and social costs for a partial set of effects. We therefore followed

the 'building blocks' approach proposed in the WRPG whereby the SEA (informed by the Habitats Regulations Assessment (HRA) and WFD assessments) provided qualitative and semi-quantitative assessments of the environmental and social effects at a detailed level.

- 0.150 The only exception is carbon. We have monetised the carbon impacts of each option using an accepted methodology and HM Treasury carbon prices. The carbon costs have been included in the option costs and used in the programme appraisal modelling.
- 0.151 Defra's Guiding Principles have set an aspiration to value natural capital in decision-making and report on environmental and social costs and benefits. We completed a pilot to explore a natural capital accounting assessment approach to our supply side options. We found that whilst it was possible to generate natural capital valuations for some of the options, the absence of an agreed methodology and a lack of data meant that the results were not sufficiently robust to inform decision making. We therefore focussed on using the SEA, WFD and HRA to ensure that environmental and social impacts and benefits were fully considered. We have committed to continue to explore this area in partnership with the wider water sector, regulators and stakeholders.

### ***Environmental metrics***

- 0.152 To support the development of the best value preferred programme, we have defined a suite of performance metrics, allowing us to consider a range of factors in the decision making process. To ensure environmental and social effects were fully considered in this, we developed two metrics reflecting the beneficial and adverse environmental and social performance of each constrained option. The metrics are founded on the output of the SEA, HRA and WFD assessments. The use of the environmental metrics is an important tool to inform programme appraisal but they are not a substitute for carrying out full SEA, HRA and WFD assessments.
- 0.153 To avoid 'double-counting' of the carbon effects, the environmental metrics exclude consideration of carbon as these are already included in the option costs.

### ***Key findings***

- 0.154 A summary of the main findings from the detailed environmental assessments are:

#### ***HRA***

- 0.155 We have taken account of the 2018 European Court of Justice "People over Wind" judgement which held that mitigation measures should not be considered as part of the HRA screening assessment. A small number of option elements were identified for further assessment. This demonstrated that the earlier screening processes had effectively removed options that would have a likely significant effect on a European site. Full details of the HRA findings are provided in Appendix C: Habitats Regulations Assessment – Stage 1 screening.

### **WFD**

- 0.156 A small number of option elements were identified to have potential risks to the achievement of WFD objectives with no option elements identified as having a high risk of leading to WFD status deterioration. Full details of the WFD findings are provided in Appendix BB: Water Framework Directive.

### **SEA (Demand management options)**

- 0.157 Overall these showed beneficial effects. There were some adverse effects identified in respect of carbon and air quality associated with traffic movements for leakage control activities.

### **SEA (Resource options)**

- 0.158 For the groundwater options, mainly negligible to minor permanent adverse effects were identified. For the larger options, conveyance and water treatment option elements have a greater magnitude of both adverse and beneficial effects. The precise magnitude of adverse effects do vary markedly between minor and major adverse effects as the impact is highly dependent on the specific location and proximity to sensitive environmental, human and built environment receptors.
- 0.159 Overall the early application of the environmental assessment process ensured that the constrained list of option elements taken forward to programme appraisal did not include options that would lead to unacceptable environmental or social impacts, particularly where there may have been implications for internationally designated sites (e.g. European sites, landscapes or heritage sites) or high risks of WFD status deterioration.

## **Section 10: Programme appraisal and scenario testing**

- 0.160 In Section 10 we set out the programme appraisal of options for each WRZ. Programme appraisal is the process by which the range of supply and demand management options are assessed and optimised against a suite of criteria to identify the 'best value' programme for customers.
- 0.161 We have followed the WRPG and other technical guidance in conducting our programme appraisal. Key changes recommended by the Environment Agency covering clarity of the programme appraisal have been included in the updated Section 10. The development of an adaptive plan from the Section 10 outputs, is described in Section 11.
- 0.162 We have briefed stakeholders and regulators as we have progressed this work, explained our approach and taken into account, where appropriate, their comments and feedback. We have also engaged an Expert Panel of relevant skill bases to provide review and challenge to our appraisal methodologies and processes in delivering a resource programme.
- 0.163 We followed a structured programme appraisal process comprising four distinct phases: problem characterisation; identification and assessment of potential programmes; performance testing; selecting the preferred programme.
- 0.164 To ensure we can provide our customers with the best possible value over the long term we have designed our programme appraisal to satisfy three main objectives:

- To provide a secure supply of water for our customers addressing the supply demand deficits that we forecast in our region;
- To improve our resilience to a severe drought of 1:200 year average frequency; and
- To look beyond the needs and opportunities of our region alone and take into account the growing needs of the wider south east of England. Our draft Plan will allow for transfers to neighbouring companies in the south east of England to achieve the most effective, efficient and economic outcome.

0.165 We have also considered improved protection to be given to the vulnerable chalk streams and water courses within our region, once there is available water to do so.

### ***Understanding the planning problem***

0.166 UKWIR guidance<sup>43</sup> recommends that the appraisal process should be in proportion to the complexity of the planning problem and the options available to solve the problem – this is called ‘problem characterisation’. This analysis also helps us determine the appropriate length of planning horizon, and therefore both assessment method and planning horizon are outcomes of the problem characterisation.

0.167 The problem characterisation assessment demonstrates that London and SWOX WRZs have significant and complex demand/supply water resource challenges. The SWA WRZ has moderate challenges. The solutions required in these WRZs are high cost, with long lifespans. As such, we have planned over an 80-year plan period and used advanced decision support tools to enable a thorough analysis of the demand/supply planning problem and to develop multiple feasible programmes of investment to address it.

0.168 The remaining three WRZs (Kennet Valley, Guildford and Henley) were assessed to have demand/supply planning problems of comparatively lesser complexity. Relatively low-cost options are available and are relatively quickly implemented. As such, less complex approaches to the identification of demand/supply options have been used to develop the preferred programmes in these zones.

### ***Identifying and assessing programmes***

0.169 For many years, ‘least-cost’ was the primary factor advocated by regulators in devising WRMPs. The preferred programme was the cheapest practicable solution to the planning problem. There is now wide support from regulators, stakeholders and our customers, to develop best value plans which take account of a wider range of factors over the long term. These factors include the environmental impacts of programmes, resilience to drought and other outage events, the needs of other water users and future generations, and customer water management preferences, in addition to cost.

0.170 We developed performance metrics for each of these factors and we have worked with other water companies and industry regulators to develop a more advanced, risk based decision making framework and have applied this in developing our WRMP19.

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<sup>43</sup> UK Water Industry Research , WRMP 2019 Methods – Decision Making Process: Guidance Report Ref. No. 16/WR/02/10





- 0.171 The Expert Panel has provided positive feedback that Thames Water has developed new approaches to assessment which are appropriate given the expectation of government and the inherent complexity of the region<sup>44</sup>.
- 0.172 The performance metrics used are as follows:
- Cost – both building and operating costs.
  - Customer preferences – which options they prefer and how they feel about the risk of drought.
  - Impact on the environment – both positive, such as recreational opportunities, and negative, such as loss of land.
  - Deliverability – the confidence that the programme will deliver the water that it is expected to.
  - Resilience – the ability to cope with a range of hazards such as droughts.
  - Inter-generational fairness – how the costs are shared between customers now and in the future.
- 0.173 The starting point for programme appraisal is a least cost solution. Following which, different sizes of demand management programme were assessed to identify the preferred demand management programme. Finally, reasonable alternative programmes (RAPs) were assessed against the performance metrics to shortlist and identify initial programmes of investment.
- 0.174 Potential programmes have been identified to solve the baseline planning problem. We have then repeated the analysis for two alternative scenarios. Firstly, reflecting a greater resilience position to drought in our supply area and secondly, providing greater resilience to drought and, additionally, allowing for transfers to neighbouring companies in the south east of England in line with the objectives set out above.
- 0.175 It is the latter scenario, providing greater resilience to drought (to the Environment Agency's suggested 1:200 year reference level) and allowing for regional transfers (as contributing to best value planning for water supply/demand in the south east of England) that has been adopted as our preferred scenario for WRMP19.

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<sup>44</sup> Appendix Y: 'Final Report of the Thames Water Expert Panel March 2019', led by Professor Adrian MacDonald

## ***Performance testing***

- 0.176 Having identified a shortlist of potential programmes to address the demand/supply scenario providing for a greater resilience to drought and allowing for strategic transfers to neighbouring water companies in the south east of England, these have been subjected to ‘what-if’ scenario analyses to test what would happen if some of the components or supporting information were to change. A larger number of tests have been carried for the plan to take account of constructive consultation responses and further information received. This exercise has included testing their robustness against:
- the achievement of the Environment Agency’s Water Industry National Environment Programme (WINEP, March 2018) and WFD no deterioration scenario
  - the possibility that certain types of resource options become unavailable
  - population and the associated demand for water in the future being lower than expected
  - the loss of part of the capacity of the West Berks Groundwater scheme provided by the EA
  - Variation in droughts, including a more extreme drought of 1 in 500 years, and the timing of resilience to a 1 in 200 year event.
  - Variation in the need of the other WRSE water companies for access to water in our region
- 0.177 The inclusion of adaptability assessment pathways has provided insight into the effect on the shortlist of programmes to variation in a few key parameters that can greatly change our plan. These included population, leakage, climate change and the water supply needs of the other WSRE companies. By varying the need at various points into the future we test to see if a different pathway selects different options to those chosen within our preferred plan.
- 0.178 A further test has been included which utilises the IRAS\_MCS<sup>45</sup> simulation model to test against our current modelling tool EBSD+<sup>46</sup>. This examines our water system’s performance across a wide range of drought return periods, from 1 in 100 to 1 in 2,000 years. A number of test runs were carried out against our objective of baseline, drought protection and South East resilience need.

<sup>45</sup> Interactive River-Aquifer Simulation (IRAS) IRAS\_MCS combines system simulation modelling to assess multiple parameters with Multiple Criteria Searching (MCS).

<sup>46</sup> Economics of Balancing Supply and Demand plus (EBSD+) used to select the optimum demand management programme per WRZ against the programme appraisal metrics.

## ***Programme Appraisal summary***

- 0.179 The programme appraisal has delivered a number of key outputs listed below, ranging from least cost programme to meet the baseline deficit to the overall best value preferred programme. These have been produced taking into account stakeholder feedback.

### ***The least cost solution to solve the baseline deficit***

- 0.180 **Outcome:** Solution does not contain enough demand management to meet regulator, Government, company and stakeholder expectations and customer wishes. Wastewater reuse at Deephams and Beckton form the major resource schemes.

### ***The preferred programme to solve the baseline deficit***

- 0.181 **Outcome:** Maximises deliverable demand management to facilitate a long-term reduction in leakage so that it is reduced to approximately 15% of the water put into supply and aligns with the recommendations of the National Infrastructure Commission. Material additional cost involved but provides a programme more in line with expectations. A modified least cost plan would choose reuse rather than desalination in the 2080s but it does not address the desire of all parties to be more resilient to extreme drought events.

### ***The preferred programme to solve the baseline deficit plus 1:200 drought resilience***

- 0.182 **Outcome:** The solution provides resilience to a 1:200 year drought from 2030. Resource option types remain largely unchanged in the early years but are brought forward at additional cost. The long-term supply demand balance is maintained through wastewater reuse from the 2050s.

The programme does not facilitate inter-zonal transfers as part of a regional solution.

### ***The preferred programme to solve the baseline deficit plus 1:200 drought resilience and providing for regional transfers***

- 0.183 **Outcome:** Preferred final plan scenario. Resource option types unchanged in the early years, but the SESRO is selected in 2037/38 to fulfil the transfer requirement, again at additional cost, although part of this cost would be recovered through commercial agreements with recipient companies.

### ***The overall best value preferred programme***

- 0.184 **Outcome:** Post a substantial programme of performance testing, the investment programme is adapted through expert judgement. This has the inclusion of reduced abstraction from vulnerable chalk streams and watercourses.
- 0.185 The preferred plan has final planning uncertainty addressed, calculated and applied with the result that a number of small, mainly groundwater schemes were added. It has been performance tested for adaptability against a wide variety of uncertain futures and 'What if' scenarios and checked for in-combination and cumulative effects in the SEA.
- 0.186 The best-value preferred plan that has taken account of material and other required changes is shown in Table 0-10 below for all WRZs, and has been shown here against two key

programmes produced in the programme appraisal process. Section 10 provides the description and tests undertaken against a number of other programmes.

- 0.187 We now consider the main costs of our plan within the London, SWA and SWOX (LSS) WRZs which vary due to the programme appraisal steps considered. The further costs for Kennet Valley, Guildford and Henley WRZs, plus the cost of future treatment from the 2050s onwards due to growth and network strengthening to protect vulnerable chalk streams and water courses are added afterwards, as these do not vary.
- 0.188 When considering LSS, the overall long term best value plan for our customers is one that delivers more demand management and solves the baseline deficit and provides greater resilience to drought. The cost of this programme is £3.1bn NPV (Step 2a).
- 0.189 We strongly support working with our neighbours and stakeholders to provide an overall long term best value plan for the south east of England. In doing so, we acknowledge that resources developed in our supply area could be used to support regional transfers and provide greater resilience to drought across the region.
- 0.190 As such, we propose a plan that allows for greater resilience to drought, requiring £3.5bn NPV (Step 2b) and a further programme that also supports the water resources needs in the wider region, and achieves environmental protection including reduced abstraction from a number of vulnerable chalk streams and water courses within our region. The cost of this, our preferred programme in the combined LSS WRZ, is £4.6bn NPV (Step 5).
- 0.191 A further £0.097bn NPV is added to cover the three remaining WRZs, making the overall cost of the preferred programme £4.7bn NPV.
- 0.192 The overall long term best value preferred plan, taking account of the material and other minor changes included in our WRMP19, is shown in bold in Table 0-10 below.

**Table 0-10: All WRZ summary of preferred programmes by scenario**

<b>Preferred programmes by scenario</b>	<b>Step 2a: BASELINE (BL)</b>	<b>Step 2b: BL + Increased Resilience</b>	<b>Preferred Programme: BL + Increased resilience and regional transfers+ chalk streams</b>
Metrics (LSS only)			
<b>Financial (£m NPV)</b>	3,061	3,487	4,726
<b>Environmental +</b>	51	68	81
<b>Environmental -</b>	53	77	77
<b>Deliverability</b>	0.92	0.89	0.95
<b>Resilience</b>	0.52	0.45	0.88
<b>IGEQ</b>	11.94	11.87	11.19
<b>Customer preference</b>	4.39	4.40	4.42

Preferred programmes by scenario		Step 2a: BASELINE (BL)	Step 2b: BL + Increased Resilience	Preferred Programme: BL + Increased resilience and regional transfers+ chalk streams
Option <sup>47</sup>	Benefit (MI/d)	Implementation date		
<b>LONDON</b>				
DMP_LON-S4b	421	2020-50	2020-50	2020-50
RWP_Didcot	18	2020-25	2020-25	2020-25
NTC_New River Head	3	2020	2020	2020
ASR_Horton Kirby	5	2061	2048	2024
GW_Southfleet/Greenhithe	8	2062	2031	2024
GW_Addington	1	2063	2052	2030
GW_Merton	2	2029		2030
IPR_Deephams	45	2064	2030	2030
NTC_Epsom	2	2060	2030	2030
RWP_Oxford Canal to Cropredy	11	2060	2030	2030
GW_London confined chalk	2	2074	2051	
AR_Kidbrooke (SLARS1)	7	2079		2030
AR_Merton (SLARS3)	5	2075	2050	2031
ASR_South East London (Addington)	3	2076	2049	2031
RWP_Chingford (E&S)	20	2035-2060	2035-2060	2035-2060
ASR_Thames Valley/Thames Central	3	2077	2051	
AR_Streatham (SLARS)	4	2078	2052	
RES_Abingdon 150 Mm3	294			2037
RWP_STT Vyrnwy 60	110			2083
RWP_STT Mythe	12			2089
RWP_STT UU/ST Opt B	21			2092
RWP_STT Netheridge	18			2096
DSL_Beckton 150	142	2081		
GW_Honor Oak	1		2092	
IPR_Beckton 100	95		2053	
IPR_Beckton 100 (extension 2)	95		2067	
ASR_South East London (Addington)	3		2049	
IPR_Beckton 100 (extension 3)	95		2093	
<b>SWOX</b>				
DMP_SWX_S4b	51	2020-30	2020-30	2020-30

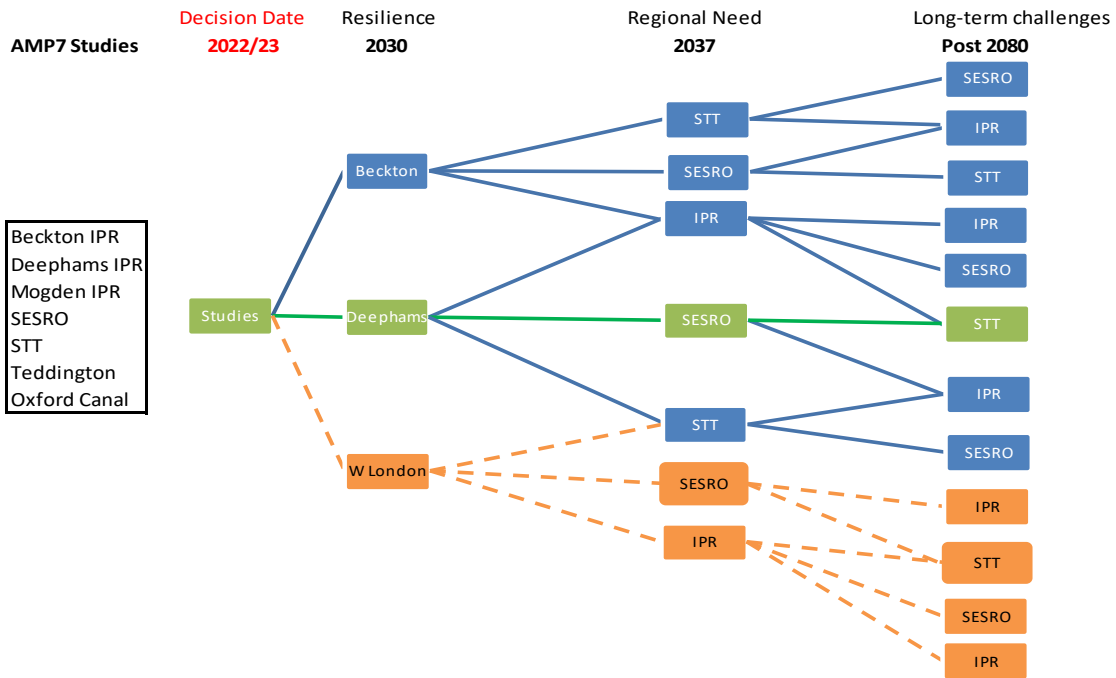
<sup>47</sup> Resource development and demand management only

Preferred programmes by scenario	Step 2a: BASELINE (BL)	Step 2b: BL + Increased Resilience	Preferred Programme: BL + Increased resilience and regional transfers+ chalk streams
GW_Moulsford	3.5		
IZT_Henley to SWOX	2.4		
IZT_Wessex to SWOX	2.9		
<b>SWA</b>			
DMP_SWA_S4b	22	2025-35	2025-35
GW_Datchet	5	2090	2038
IZT Henley WRZ to SWA WRZ	5	2095	
IZT_R Thames to Medmenham	24		2066
<b>KENNET VALLEY</b>			
DMP_KV S4b	13.7		2030-40
NTC_East Woodhay	2.1	2091	
GW_Mortimer recommission	4.5	2098	
<b>GUILDFORD</b>			
DMP_GUI S4b	8.3		2020-30
NTC_Ladymead (+ Shalford to Albury transfer main)	4.6	2024	2024
NTC_Dapdune	1	2031	2081
GW_Dapdune	2.2	2031	2091
Import from South East Water	10	2043	
<b>HENLEY</b>			
DMP_HEN S4b	1.5		2030-40

- 0.193 Our overall preferred best value programme is (as previously) one that addresses and resolves the baseline supply demand problem expected to arise over the 80 year planning period from 2020-2100, allows for an enhancement in system resilience to a 1 in 200 year drought (by 2030) and enables sharing of water resources with neighbouring companies and other sectors to meet regional needs across the south east of England.
- 0.194 The proposed plan will also enable us to make changes to our abstractions to improve chalk stream ecosystems and other vulnerable water courses in our supply area, including the Wandle, Wye and Cray as well as the Lee (at Amwell Magna) and Thames (Oxford water courses).
- 0.195 Our first priority is to reduce waste of water resources. This being so, our preferred programme is demand management focussed in the short-medium term, comprising an integrated package including significant reductions in leakage (in MI/d terms, of 15% by 2025 from our 2020 target of 606 MI/d and of 50% by 2050), the metering of all water supply connections and an enhanced water efficiency programme to encourage reduced consumption by all, subject to affordability and the needs of vulnerable customers.

- 0.196 Demand management programmes (DMPs) will be undertaken in all WRZs in the period from 2020 to 2050 with the goal of maintaining the savings to the end of the planning horizon.
- 0.197 Demand management on its own will not be enough to resolve all supply demand deficits, especially in the London WRZ. A twin track approach with resource development is required in order to maintain sufficient supplies to meet managed demand across the region, consistent with our general duty to develop and maintain an efficient and economical system of water supply.
- 0.198 We have planned accordingly, supplementing the proposed DMP with strategic water resource development at key points in the planning period to 2030 (driven by the need to increase drought resilience), to 2037/38 (driven by regional need for water resources) and the 2080s (to maintain security of supply in the long-term).
- 0.199 Our modelling has indicated that the leading strategic resource options best able to enable us to do so are:
- Indirect Potable Re-use (IPR) (at Deephams, Beckton or in West London) - 2030
  - A strategic reservoir development (the South East Strategic Reservoir Option, SESRO) – 2037/38
  - A Severn-Thames transfer (STT) – 2080s
- 0.200 Desalination is discounted as inferior on cost and environmental grounds, compared to the available re-use options.
- 0.201 Re-use is the leading option type able to be constructed in time to meet the need to improve drought resilience by 2030. The decision is whether to build a single larger plant at Beckton, or a smaller plant at Deephams, supported by smaller innovative groundwater schemes, smaller regional trades and transfers.
- 0.202 Following the rejection of the Teddington Direct River Abstraction (DRA) option, in future plans we will also consider the feasibility of alternative options to use treated effluent from Mogden Wastewater Treatment Works in West London.
- 0.203 We have developed an option decision tree (Figure 0-1), to help visualise the potential pathways. The preferred pathway will be informed by the ongoing investigation of the feasible options in AMP7, with a decision to confirm the timing and characteristics of the preferred investment programme in 2022/23.

**Figure 0-14: Option decision tree**



**Green = Preferred path; Blue = Alternative paths; Orange = Paths not currently feasible**

Table 0-11 sets out the major scheme delivery points over the 80-year planning period from 2020 to 2100 and the drivers for determining the preferred investment programme.

**Table 0-11: Major scheme delivery points over the planning period**

From 2020	
Demand Management Focus	In the next five years, and continuing to 2050, we intend to undertake a substantial and ambitious DMP. We believe this is the right thing to do for future generations and aligns with the expectations of our customers, regulators and stakeholders.
2030	
Providing 1:200 year drought resilience (risk of insufficient supplies to meet demand of 0.5% per annum)	Providing 1:200 year drought resilience by 2030 will require new resource development. Our programme appraisal suggests this could be provided by a series of relatively small options (re-use, Oxford canal raw water transfer and innovative groundwater development) or a single larger wastewater reuse plant. We currently favour the phased construction of small options as it: <ul style="list-style-type: none"> <li>• is less costly</li> <li>• is less risky (it is spread over a range of options)</li> <li>• allows greater flexibility to future needs</li> <li>• enables us to gain practical understanding of implementing options types such as re-use, canal transfers and aquifer storage at a smaller scale, rather than immediate reliance on one larger option.</li> </ul>
2037/38	
Regional need	The SESRO is the leading option to meet regional need across the south east and secure supplies in the medium-term. <ul style="list-style-type: none"> <li>• The implementation date is driven by regional needs and the</li> </ul>





	<p>management of uncertainty</p> <ul style="list-style-type: none"> <li>• The option is most regularly chosen across RAPs, adaptability, What if analysis and IRAS-MCS system simulation modelling</li> <li>• It maximises the capture and storage of water resources already available in the Thames Basin</li> <li>• Extra storage provides flexibility and resilience benefits</li> <li>• It is the option preferred by our customers and provides recreational and biodiversity benefits</li> </ul> <p>Delivering this option will provide sufficient headroom to enable us to cost effectively deliver a series of environmental improvements to vulnerable chalk streams and watercourses through the reduction and re-location of abstraction sites. This responds to a number of stakeholder concerns raised during the consultation process.</p>
<b>Long-term (beyond 2080)</b>	
<p>Managing potential long-term changes</p>	<p>Once the SESRO has been fully utilised (2080s) further options are required to secure supplies to the end of the planning period.</p> <p>Re-use, desalination and the Severn-Thames Transfer are all available to meet this demand.</p> <p>We favour the Severn-Thames Transfer on the basis of:</p> <ul style="list-style-type: none"> <li>• Meeting the potential future need in the west of the Thames catchment, namely:                     <ul style="list-style-type: none"> <li>— Greater need for regional transfers e.g. to meet Southern Water requirements in Hampshire</li> <li>— The uncertainty of the ongoing yield of the West Berkshire Groundwater Scheme</li> <li>— The possibility of further sustainability reductions being needed at environmentally sensitive sources</li> <li>— Increased demand for water supplies in the Cambridge, Milton Keynes Oxford growth corridor (CaMKOx)</li> </ul> </li> <li>• SESRO and the Severn-Thames Transfer are regularly selected by system simulation modelling at higher drought return periods, e.g. in 1:500 year (0.2% per annum) extreme drought resilience.</li> <li>• There is potential for in combination benefits with storage. The SESRO provides regional storage and is a transfer hub for the south east. Its benefit will be enhanced through the Severn-Thames transfer. The risk and high cost associated with the yield of the transfer is mitigated when there is capacity to store water during periods of surplus.</li> </ul> <p>The timing of the need is determined by resilience and growth requirements. Enhancements in either would bring the scheme forwards. Adaptive planning enables appropriate decision making.</p>

0.204 It is apparent that in order to meet the future supply demand challenges in the London, SWOX and SWA WRZs and our contribution to similar challenges at a regional level, multiple strategic options will be required. It is no longer a question of which single option is best; it is which option is needed when.

0.205 On the basis of current information, we favour IPR (at Deephams) and a set of smaller schemes to meet our needs by 2030; SESRO, to meet regional needs by 2037/38 and the STT by the 2080s, to maintain resilience in the longer term.

0.206 Having an adaptive planning approach enables us to vary our plan as we proceed, taking account of changing circumstances, information and options.



- 0.207 We recognise concerns raised by stakeholders regarding the likelihood of achieving our planned leakage reductions by 2020 and the ambitious further reductions from demand management built into the preferred programme in AMP7 and out to 2050.
- 0.208 We will be able to track our progress and report the impact of deviation from the forecast in our annual performance reviews as well as in developing our next full reiteration of the plan in 2022. Our monitoring plan is set out in Section 11.
- 0.209 If the supply demand situation improves before 2030, we can defer or cancel construction of some of the smaller options in our preferred programme. If Deephams reuse or the Oxford Canal transfer were not available, or if the supply demand situation turns out to be worse than now conceived, we would need to implement a larger re-use option at Beckton (or potentially in West London from the Mogden catchment). Our adaptive planning approach provides confidence that we will be able to plan and implement appropriate actions on a dynamic basis, with efficiency and reliability gains.
- 0.210 We intend to complete studies and pre-planning on both reuse options (and similar options in West London) in AMP7, ready for implementation in 2030.
- 0.211 Our long-term proposal for a major new reservoir will allow the transfer of surplus winter rainfall from the wetter west of our region to the drier east, and so benefit both Thames Water and Affinity Water customers in London and potentially other companies in the South East (Figure 0-15). This also provides the support required to allow further environmental protection to chalk streams and water courses within our region.
- 0.212 A preferred programme featuring the construction of the SESRO before a STT is supported by Affinity Water. The STT in isolation would not provide a resilient solution for Affinity Water and is more expensive. A joint letter between Affinity Water and ourselves confirms our position is provided in Annex 4. This position is also supported by Water Resources in the South East Group (WRSE).
- 0.213 However, the final decision on which option is needed in 2037 need not be made now. We have a performance commitment to undertake further work on the SESRO, the STT and other strategic schemes in AMP7, to complete studies and to confirm option designs.
- 0.214 We have an adaptive plan that allows the definitive decision on which strategic schemes to develop in 2030 and 2037/38 to be made in 2022/23, in alignment with Affinity Water, Anglian Water, Southern Water, Severn Trent Water, United Utilities and regional-level WRMPs (including from WRSE) will also be available then, to better inform the decision making process by ourselves and others.
- 0.215 The immediate investment decisions (in the AMP7 period, from 2020-25) supported by this plan are therefore the ramp up of leakage reduction and demand management activity, and an increase in pre-planning activity on the key strategic options (on the SESRO, the Severn-Thames transfer and Re-use in London).
- 0.216 Further details on the content of the preferred plan, particularly with respect to the demand management programme and the environmental assessment of the preferred programme, are provided in the following section, Section 11: Preferred programme.

**Figure 0-14: SESRO: A regional storage and transfer hub for London and the South East**



## Section 11: Preferred plan

- 0.217 In this section the preferred planning solutions for each WRZ for the planning period to 2100 are presented and discussed. These solutions are referred to as our preferred plan.
- 0.218 Our preferred plan has been developed to give the long-term, best-value balance between the preferences of our customers, the impacts on the environment, and flexibility to deal with a range of risks and uncertainties as well as to contribute to sustainable development for future generations. It addresses the predicted water supply/demand deficit in the plan period, affordability, the preferences of our customers, further protection for the environment, the need for flexibility to manage a range of risks including a 1:200 year drought. It also provides best value planning of water supply to the south east of England and takes account of uncertainties in our modelling, and the need to facilitate, where possible, sustainable development.
- 0.219 From the feedback received from stakeholders, Government guidance and new and improved data, we have made changes to the input data to our plan. There are four significant changes that have been included in our WRMP19 since our draft plan, being:
- **Population:** A material reduction in population growth in the period 2045 to 2100
  - **Demand:** Our commitment and ambition to reduce leakage and customer usage, and to continue reductions to 2050 and beyond.
  - **Teddington Direct River Abstraction (DRA):** The removal of this option from the constrained list.
  - **SESRO:** Bringing forward the development of a new reservoir in Oxfordshire to 2037/38 from 2043, to address the raw water requirement for Affinity Water.

- 0.220 We have agreed with the Environment Agency to continue investigation into the potential development of the Teddington DRA scheme and the remaining challenges associated with the scheme.<sup>48</sup>
- 0.221 Overall our strategy is to make the best value use of available water, and to combine demand management with resource schemes to secure long term resilience and provide best value outcomes for our customers, by way of a robust twin track approach that delivers government and regulatory policy expectations, whilst focusing appropriately in the short term on enhanced demand management.
- 0.222 The London WRZ has a complex planning problem to address, with a dry year annual average supply demand imbalance developing in the first few years of the planning period and growing to 362 MI/d by 2044/45, and 623 MI/d by 2099/00.
- 0.223 We have set ourselves an ambitious leakage reduction target taking account of the cost to customers, and disruption caused by the work we need to do. Our programme goes significantly beyond the sustainable economic level of leakage (SELL) and will reduce leakage by 15% by 2025 from our target of 606 MI/d in 2020 and halving leakage by 2050. This reduction aligns with customer expectations, regulatory and government guidance, and the recommendations of the National Infrastructure Commission<sup>49</sup>. We have used the best available information to define our programme and will keep the programme under review to ensure we take account of innovation in leakage detection and also the benefits afforded by smart metering to help to target leakage efficiently and effectively.
- 0.224 Although we are committed to delivery, we recognise the risk within the ambition of our demand management programme. This has been taken account of through activities underway in this current period to develop options and by building option uncertainty into headroom as advised within the WRP. We have also provided a level of protection in the short term through the water trade agreement with RWE Npower and a small number of groundwater options.
- 0.225 We are also planning to help customers to use less water through the continued roll out of smart water meters together with providing support and advice on how to use water efficiently. Our programme goes beyond the economic levels of demand reduction and will reduce the average volume of water used per person (Per Capita Consumption or PCC) to 135 l/p/d by 2024/25, 121 l/p/d by 2044/45 and 117 l/p/d by the end of the planning period 2099/00.
- 0.226 Managing demand for water will not be sufficient on its own to ensure a secure and resilient water supply and we will also need to develop new water resources. There is no single large scale resource scheme that can provide sufficient resilience for our customers and the wider South East region in the long-term.
- 0.227 Our preferred plan is therefore a combination of new water resource schemes. This includes continued groundwater development, the delivery of the Deephams reuse scheme (45 MI/d)<sup>50</sup> and the Oxford canal raw water transfer (15 MI/d) in 2030 to maintain security of supply in

<sup>48</sup> "Thames Water and the Environment Agency: Common understanding of the water environment effects of Teddington DRA option.", EA and TW Joint paper, July 2018.

<sup>49</sup> 'Preparing for a drier future', National Infrastructure Commission, April 2018.

<sup>50</sup> Joint discussions have been held with the Environment Agency on this option. These discussions are ongoing and details of the subjects are held within Appendix L: Water Reuse, Annex 1, including environmental, flow and navigation assessments.

London during the early part of the 80-year planning period. This will improve resilience against severe 1 in 200 year drought events. Additional water resources then become available in the mid-2030s associated with the development of the South East Strategic Reservoir Option, which gradually provides a maximum 294 MI/d to supply London, the Thames Valley and WRSE regional demand of Affinity Water (100 MI/d). In the long-term the supported Severn Thames transfer helps to maintain sufficient resilience for London and the South East region to the end of the planning period in 2100.

- 0.228 Three of the five Thames Valley WRZs have baseline supply-demand deficits within the 80-year planning period; these zones are Swindon and Oxfordshire (SWOX), Slough, Wycombe and Aylesbury (SWA) and Guildford. Kennet Valley and Henley are the remaining zones and the baseline forecasts are in surplus throughout the planning period.
- 0.229 SWOX is in deficit as early as 2022/23 in peak week conditions with an imbalance of 0.12 MI/d which grows thereafter to 31 MI/d by the end of the planning period; SWA has a peak week deficit starting in 2033/34 and increasing to over 10 MI/d by 2070/71 with ongoing growth thereafter and finally Guildford has a growing peak week deficit from 2025/26. Our core water management strategy in Thames Valley is to rollout our progressive household metering programme (PMP) from 2020, further supported by limited groundwater scheme development in Guildford and SWA WRZs. For SWA, inter-zonal water transfers are required long-term and will be facilitated by the new South East Strategic reservoir scheme in south west Oxfordshire.
- 0.230 With the completion of the SESRO option providing resilience to our region, we have opted to include a level of protection to vulnerable chalk streams and water courses that confirms our ambition to achieve environmental improvements where possible.
- 0.231 Both Deephams and SESRO options have been considered as Direct Procurement options against the Ofwat definition. We have also initiated work with Affinity to develop the SESRO option and the shared ownership of the water.
- 0.232 Throughout our planning we have included the development of a number of transfer options, including sizeable volumes from United Utilities, Severn Trent and Welsh Water. Although these have not been chosen in our preferred programme in the short to medium term, we are committed to continuing their development. A joint paper has been produced with United Utilities, Severn Trent and the Environment Agency that describes the key challenges. The paper is attached to this Executive Summary in Annex 3.
- 0.233 This section now goes through each of the six water resource zones in detail to describe the preferred plan.
- 0.234 Overall, due to the alignment of WRMP to our business plan performance commitments, including leakage and pcc, we plan to be in surplus in AMP7 and AMP8. This surplus provides the glide path to improving drought protection, and achieving 1 in 200 year protection by 2030.

## **London**

- 0.235 There is a significant supply-demand deficit against the dry year annual average (DYAA) demand in London throughout the planning period. Without investment, security of supply would not be maintained in this zone.

0.236 The deficit is largely driven by the combination of population growth and reductions in raw water availability due to the impacts of climate change.

0.237 As a result of our preferred plan, the supply-demand deficit will be removed in AMP7 and supply and demand will remain in balance throughout the remainder of the planning period. A combination of demand management and resource development is applied to balance water supply and demand.

0.238 The key features of our preferred plan are:

0.239 **Short-term (2020/21-2024/25) - demand management**

- Continue our Progressive Metering Programme (PMP) with 365,000 household meters being installed in AMP7 achieving total household penetration of 59%.
- Introduction of a reward based incentive scheme in AMP7 to promote water efficiency
- Reduce leakage through a combination of mains rehabilitation, pressure management, active leakage control, DMA Enhancement and customer side leakage reduction.
- Continue to promote water efficiency activity to help customers use water wisely and promote behavioural change that will stem the underlying increase in water use.

0.240 **Short-term plan (2020/21-2024/25) – water resource development**

- Water trading agreement with RWE NPower to provide a deployable output (DO) gain of 18 MI/d from 2020 to 2025.
- Release of a network constraint in the Lee Valley to yield 3 MI/d additional benefit from existing sources in 2020 together with the development of new groundwater schemes providing approximately 13 MI/d additional water available for use from 2024.

0.241 **Medium-term plan (2025-2045) - demand management**

- Continue to roll out our PMP to deliver a further 320,000 meter installations by the end of AMP8 (2029/30), achieving 73% of individual household smart meter penetration in London WRZ.
- Deliver a further 141.7 MI/d leakage reduction in London through a combination of customer-side leakage reduction, pressure management, DMA Enhancement and mains rehabilitation, and continued reduction in customer usage.
- With company meter penetration at >70% we implement a financial incentive based tariff scheme from 2035. The scheme will incentivise lower household consumption and assumes a 5% reduction in usage.

0.242 **Medium-term plan (2025-2045) – water resource development**

- Delivery of further innovative groundwater schemes, the Deephams wastewater reuse scheme, Oxford canal raw water transfer and release of network constraints in South London, providing more than 75 MI/d DO benefits for supply in London from 2030 onwards.
- Extension of the existing water import trade with Essex and Suffolk Water, due to expire in 2035, until 2060.

- 150 Mm<sup>3</sup> South East Strategic reservoir scheme in 2037/38 to secure long-term resilience. This solution allows us to maintain supply resilience and be able to support WRSE 100 MI/d regional raw water demand from Affinity Water.
- Reduce existing abstraction at Waddon, North Orpington and New Gauge sources to improve flows in the River Wandle, River Cray and River Lee (Amwell Magna reach), respectively.

0.243 **Long-term plan (2045-2099) – demand management & water resource development**

- Demand management – total forecast leakage reduction from our 2020 target of 606MI/d is 282 MI/d together with further customer usage savings.
- From the 2080s delivery of the supported Severn Thames Transfer to support long-term resilience.

0.244 Our supply-demand balance is in deficit as early as the first year of AMP7 (2020/21) and grows rapidly thereafter. We will use demand management as much as possible to resolve the deficit, but we will require new resource as part of a twin track delivery approach.

0.245 In AMP7, we will continue to deliver our integrated demand management approach by rolling out the PMP that has been established in AMP6, aiming to install 365,000 household meters by the end of AMP7. The installation of smart meters will actively support the reduction in demand, both leakage and customer usage. Our comprehensive water efficiency programme, engaging and enabling customers to reduce water usage will be an integral part of delivering the benefits. We anticipate that significant behavioural change will result from a high profile metering and water efficiency campaign. This is accompanied by a mains rehabilitation programme, pressure management and DMA Enhancement for leakage reduction to deliver the bulk of the 15% reduction from the 2020 target of 606 MI/d. At the end of AMP7, smart meter penetration in London will have increased to 59% of individual household properties.

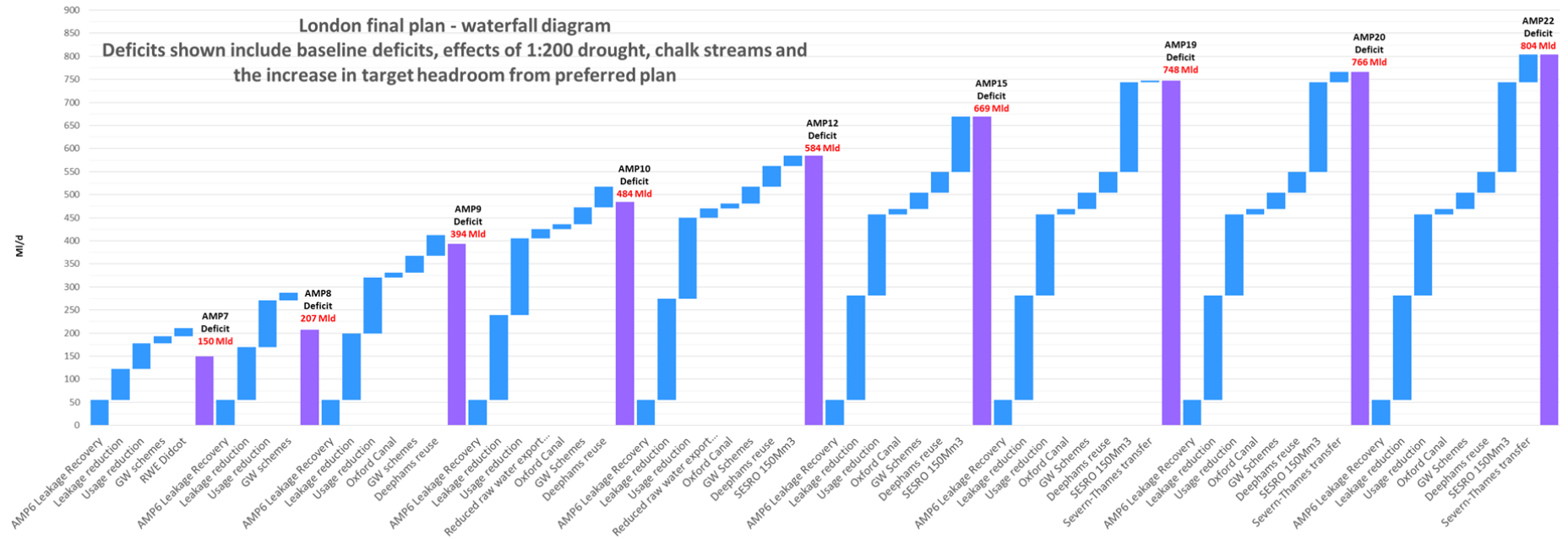
0.246 Water resource development in the first five-year period (2020/21-2024/25) is dominated by groundwater schemes and continuation of the RWE NPower water trading scheme. This is followed by options which assist in providing higher customer protection to drought, such as the Deephams wastewater reuse scheme, Oxford canal raw water transfer and innovative groundwater development. These have replaced the need for the Teddington DRA option. In 2037/38 the SESRO is available to support our needs and also the 100 MI/d raw water requirement from Affinity Water. Once built, the reservoir will also provide support to allow further protection to a number of chalk streams and water courses within our region.

0.247 Figure 0-15 presents the London preferred programme graphically.

0.248 Overall the programme ensures that London WRZ will remain in balance throughout the planning period and meet key policy objectives and stakeholder expectation, providing greater resilience, reductions in leakage and achieving a reduction in PCC from 142 litres/person/day to 124 litres/person/day by 2045.



Figure 0-15: London final plan across the 80-year planning horizon







## ***Swindon and Oxfordshire***

- 0.249 SWOX has a supply/demand deficit in dry year critical period (DYCP) starting from 2022/23 and growing throughout the planning period to 31 Ml/d by 2099/00.
- 0.250 The deficit at peak demand is driven by a combination of population growth and the impact of climate change on available water for use.
- 0.251 Our preferred plan removes the supply-demand deficit in AMP7 and the zone will remain in balance throughout the planning horizon. We propose to maintain the supply and demand balance through demand reduction, including leakage reduction, and the implementation of a new strategic water resource scheme to provide resilience and to facilitate export to the London and SWA WRZs, as well as WRSE regional water demands in the medium-term.
- 0.252 The key features of the preferred plan are:
- 0.253 **Short term (2020-2024) demand management**
- From 2020 start the roll out of a PMP. The aim is to achieve total SWOX household smart meter penetration of 79% by 2025.
  - We will continue to promote water efficiency and metering to help customers use water wisely (in direct response to customer research findings). By the end of AMP7, we aim to deliver circa 12.1 Ml/d benefits through reductions in household usage.
- 0.254 **Medium-term plan (2024/25-2040/41) water resource management and demand management**
- As set out in the preferred plan for our London WRZ, the South East strategic reservoir will be available from 2037/38 to provide raw water benefits for SWOX, as well as facilitating transfer to the London and SWA WRZs and Affinity Water.
  - The reservoir also creates an opportunity to reduce abstraction at Farmoor which should not result in a loss of deployable output if new infrastructure is installed during construction of the scheme. The saved water from the Farmoor abstractions can be abstracted downstream through the reservoir intakes, stored, and then transferred back to Farmoor to be put into supply during periods of low flow. Reduced abstraction at Farmoor would enable flows through the Oxford watercourses to increase.
  - With company smart meter penetration at >90% at 2035 we initiate an incentive based financial tariff to reduce household consumption by a further 5%.
- 0.255 **Long-term plan (2040 to 2099) water resource management**
- An inter-zonal raw water transfer from SWOX to SWA WRZ via the River Thames and a new surface water intake at Medmenham will reduce available water resources in SWOX by up to a maximum of 24 Ml/d and will help SWA to mitigate its long-term deficit from 2066 onwards.
- 0.256 Increased population projections associated with the Cambridge, Milton Keynes and Oxford (CaMKOx) growth corridor are not currently included in our baseline forecasts for the SWOX WRZ given that to date they have not been formally adopted within local plans. As such the forecast supply demand deficit in the SWOX WRZ can be considered to be conservative and there may be a requirement for additional supply sooner than currently allowed for within our



preferred plan. The timing of the reservoir in the plan allows for any further growth beyond that allowed for in the baseline forecasts.

- 0.257 The preferred plan for SWOX ensures that security of supply is maintained through the planning period and removes the forecast baseline supply-demand deficit.

### ***Slough Wycombe and Aylesbury***

- 0.258 SWA WRZ is forecast to go into deficit in 2033/34 (DYCP) which grows to 21 MI/d by 2099/00. However, there are insufficient local resource schemes within the SWA WRZ that can resolve the long-term deficit and raw water imports into the zone are required.

- 0.259 Our PMP is the core demand management strategy implemented from 2025 together with a proactive water efficiency campaign and leakage reduction.

- 0.260 The preferred plan for the London-SWOX-SWA WRZs, as described earlier in Section 10: Programme appraisal and scenario testing, is to implement an inter-zonal raw water transfer from SWOX to SWA to meet the growing long-term deficit observed from 2066. This transfer is facilitated by the South East strategic reservoir.

- 0.261 The key features of the preferred plan are:

0.262 **Medium to long-term (2025 – 2099)**

- Demand management for SWA will start from 2025 (AMP8). Smart meter penetration of over 90% of individual household customers will be delivered by 2035, which, along with the promotion of water efficiency, will help customers reduce consumption, achieving 22 MI/d of demand savings.
- With company smart meter penetration at more than 90% we initiate further financial incentive based tariffs in 2035.
- The Datchet groundwater scheme in 2038 will provide 5 MI/d to maintain security of supply until an inter-zonal transfer from SWOX is required in 2066 at times of peak demand to provide a maximum benefit up to 24 MI/d to meet the long-term needs in SWA.
- The delivery of the SESRO in 2037/38 provides an opportunity to stop any remaining abstraction at the Pann Mill groundwater source. Previous investigations concluded that it was not cost beneficial to stop abstraction at this site. The SESRO with its low annual opex costs will help to more cost effectively stop using the remaining licence at Pann Mill.

- 0.263 The preferred plan for SWA ensures that security of supply is maintained through the planning period and removes the forecast baseline supply-demand deficit.



## ***Kennet Valley***

- 0.264 Kennet Valley WRZ has no deficit against average or peak year to 2099/00. However, the zone is not resilient to a 1 in 200 year severe drought event and, as such, requires investment to improve security of supply resilience. Due to this, a critical period deficit emerges at the end of the planning period in the 2090s.
- 0.265 The key features of the preferred plan are:
- 0.266 **Medium-term (2030-2045) demand management**
- Start roll-out of PMP and aim to achieve more than 95% household smart meter penetration by the end of AMP10 (2039/40).
  - A proactive water efficiency campaign will be implemented to promote reduction of household usage and together with metering this approach is expected to deliver 10 MI/d usage savings by 2039/40.
  - With company smart meter penetration at >90% we initiate incentive based financial tariffs in 2035.
- 0.267 The potential loss of output from the West Berkshire Groundwater Scheme, managed by the Environment Agency, has been examined through a 'What-if' scenario within Section 10. To manage this risk the demand management programme would need to be brought forward in time and, in the long term, a new surface water intake on the River Thames would be required.
- 0.268 The preferred plan for Kennet Valley WRZ ensures that security of supply is maintained through the planning period and removes the forecast baseline supply-demand deficit.

## ***Guildford***

- 0.269 In Guildford WRZ there is a baseline DYCP supply-demand deficit starting as early as 2025/26, increasing to 13 MI/d over the rest of the planning period.
- 0.270 Similar to other WRZs, integrated demand management with a focus on our PMP is applied in Guildford together with the removal of a network constraint at Ladymeads which provides an additional 4.6 MI/d supply to Guildford in 2024.
- 0.271 A new main is required to transfer water from sources in the west of the zone to the east, where resource availability is limited and demand management activity will be insufficient in itself to meet the forecast growth in demand associated with new housing development.
- 0.272 The key features of the preferred plan are:
- 0.273 **Short to medium-term (2020-2040) demand management**
- Proactive promotion of water efficiency and implementing our PMP.
  - Our PMP in Guildford will achieve over 90% individual smart meter household penetration by the end of 2035.
  - With company smart meter penetration at >90% we initiate an incentive based financial tariff in 2035.



#### 0.274 **Short to long-term (2020 to 2099) water resource management**

- Removal of a network constraint at Ladymeads allows an extra 4.6 Ml/d supply to Guildford from 2024 during critical periods.
- A transfer main from Shalford water treatment works to Netley Mill in 2024 facilitates movement of water from the west of the resource zone to the east.
- To maintain security of supply in the long-term requires removal of a network constraint at Dapdune in 2081 followed by development of a groundwater source at Dapdune in 2091.

0.275 The preferred plan for Guildford WRZ ensures that security of supply is maintained through the planning period and removes the forecast baseline supply-demand deficit

### **Henley**

0.276 Henley WRZ has no forecast supply-demand deficit over the planning period for either DYAA or DYCP and is resilient to 1 in 200 year severe drought event.

0.277 To ensure an equitable policy for our customers across our WRZs, our PMP will be the core demand management strategy implemented in the Henley WRZ. This is consistent with the policy set out in our WRMP14.

0.278 The key features of the preferred plan are:

#### 0.279 **Plan description (2020 – 2100)**

- Although we forecast that Henley will be in surplus throughout the planning period, integrated demand management is implemented from 2030-2040.
- The preferred plan reduces leakage by 0.35 Ml/d and total demand by 1.47 Ml/d.
- With company smart meter penetration at >90% we initiate further incentive based financial tariffs in 2035.

0.280 The preferred plan for Henley WRZ ensures that security of supply is maintained through the planning period and removes the forecast baseline supply-demand deficit

### **Monitoring and reporting**

0.281 In the period to 2022/23 we will put in place a system of monitoring to report on the delivery of our demand management programme and the ongoing programme of water resource option studies. This will facilitate stakeholder input and engagement with the work. We will continue to report progress through our Water Resources Forum and the associated technical stakeholder meetings. An annual update of progress will be reported through the Environment Agency's Annual Review of the water resources programme. Full details of the outputs and monitoring plan are given in Section 11 and include:

- Progress against target with the demand management programme (water efficiency savings, reduction in pcc, progressive metering programme installations, leakage reduction);
- Population growth against forecast;
- Reporting progress on industry workstreams, coordinated through Water UK and Waterwise, to facilitate mandatory water labelling on water using products, changes to fitting standards and building regulations;



- Delivery of water supply schemes, including several groundwater schemes against the investment programme (scheme milestones, associated yield and quality against expectations), and;
- Ongoing results of options studies against the programme of investigations.

### ***Alternative options plan 2022/23 decision point and regulatory governance***

- 0.282 Our WRMP19 is adaptive and allows for results of the ongoing programme of studies to continue to inform the selection of strategic options that will be promoted as part of the best value investment programme. In order to enable the schemes to be delivered within their respective lead times without risk to the overall robustness of the plan, a decision will need to be made in 2022/23 which finalises the strategic water supply schemes for promotion and delivery. This decision point relates to both the resource options being promoted to secure resilience to a severe 1 in 200 drought event by 2030 as well as the strategic regional resource options to maintain ongoing security of supply resilience in the medium and long-term (Figure 0-17).
- 0.283 The timing of this decision point in 2022/23 aligns with one chosen by Affinity Water to confirm the strategic options that it will promote as part of its own WRMP. This allows for the completion of investigations that Affinity Water is undertaking on a number of strategic water supply options for its plan, as well as the success of its demand management programme.
- 0.284 The 2022/23 date also aligns extremely well with the regulatory timetable for the next WRMP, i.e. WRMP24, and as such it will facilitate stakeholder and customer engagement and input to the decision making process through the statutory consultation process associated with the next set of WRMPs. The timeline allows for programme appraisal at WRSE regional level, as well as at the individual water company plan level for both Affinity Water and Thames Water.
- 0.285 A studies programme of the available options will continue to 2022/23, detailed in Appendix XX: Programme of Further Studies. This includes the Severn Thames Transfer option and the requirement from the EA to carry out detailed studies to confirm the available water from the River Severn during drought conditions.
- 0.286 The timetable aligns closely with Ofwat's January 2019 Initial Assessment of Plans (IAP)<sup>51</sup> which has confirmed development to planning application stage of regional strategic water resource schemes for the South East and East regions. We welcome this development of multiple options that provide the potential to improve drought protection in the south east.
- 0.287 Ofwat's IAP requirements have been reviewed with the other five water companies<sup>52</sup> who have also included the promotion of the strategic water resource options within their WRMP19 plans. This document provides proposals covering joint working, changes to the gated process, and potential ODI models. It also proposes a method for changes to the list of schemes, and how the sign off per gate can be achieved, expected to be through the

<sup>51</sup> Ofwat Initial Assessment of Plans. Supply demand balance enhancement: feeder models summaries. Cost assessment team, January 2019

<sup>52</sup> TW-OC-A7: Joint statement on strategic regional solution development Affinity Water, Anglian Water, Severn Trent Water, Southern Water, Thames Water, United Utilities and Water Resources South East; March 2019

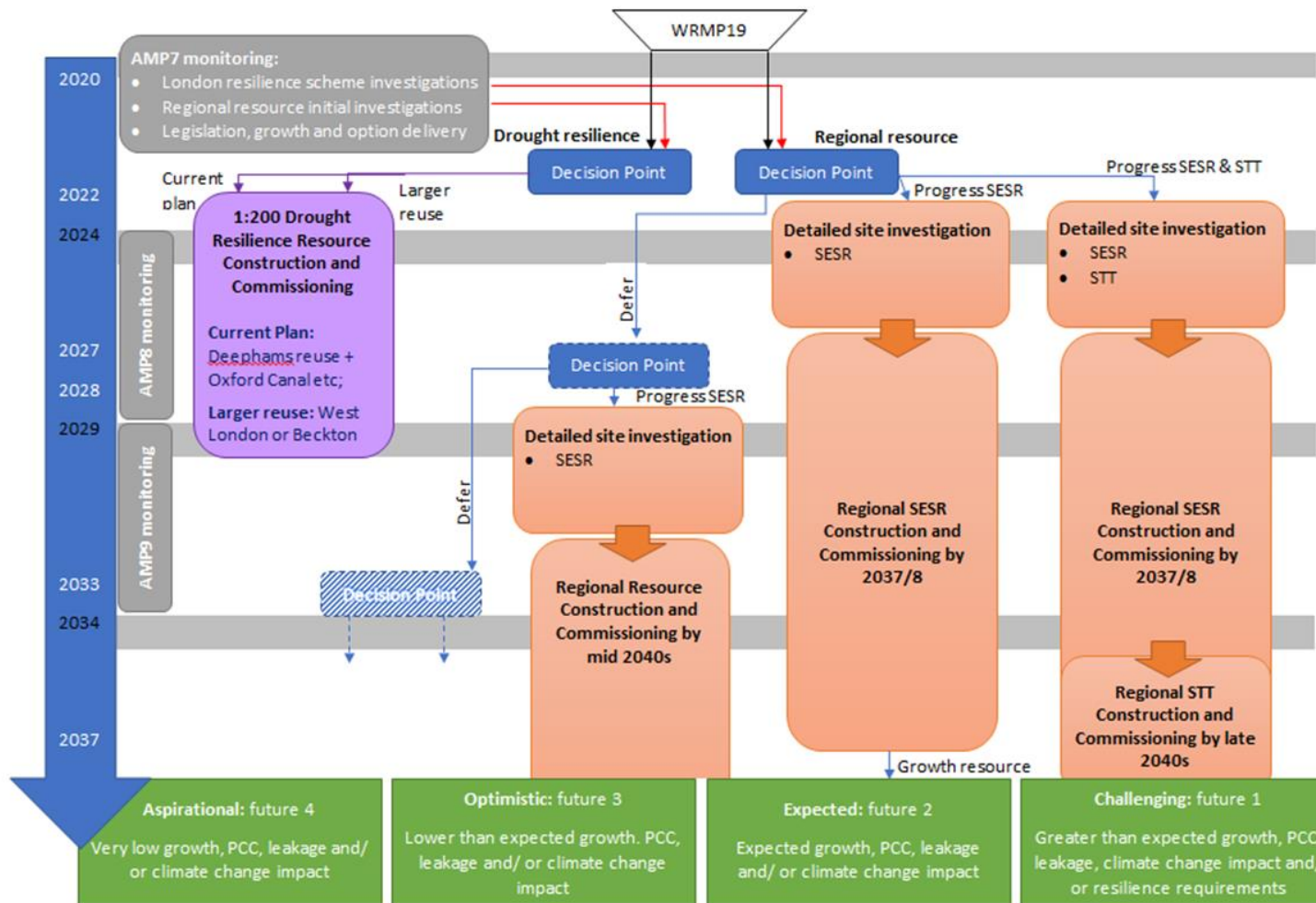


regulatory alliance. Further time prior to draft and final determination has been requested to complete and agree this activity between the relevant water companies.

- 0.288 Of the options relevant to ourselves, Ofwat included Teddington Re-Use. In our WRMP19 this option has been replaced by Deephams Re-Use and Oxford Canal Transfer. These two options are also under review with the EA. As part of our adaptive pathway, the next option is currently Beckton Re-Use. If this option was chosen then further funding of c£60m would be required in AMP7, between 2020 and 2025, than is currently allowed for in our plan. At this stage we are relying on the Ofwat IAP action to deliver this funding.
- 0.289 In 2022/23, the findings of the supply option studies together with the findings of the wider monitoring activities will be evaluated and provide confirmation of the path to be taken at the decision point for Thames Water's resilience to drought and the region's security of supply as shown in Figure 0-17.



Figure 0-17: Alternative Options Plan decision points





## **Summary**

0.290 In conclusion, we have selected our preferred plan by examining a wide-range of factors, including financial, environmental and social impacts, resilience, customer preference and deliverability. A series of scenario tests have been undertaken to demonstrate that the plan is robust and adaptable. We consider that our plan is consistent with an adaptive pathways approach where no regrets investment is consistently selected. The proposed investment represents no regrets, best value investment that is consistently selected under a wide variety of different and uncertain futures.



## Annex 1: Quality assurance

- 0.291 In Sections 1 to 11 we have described our WRMP19.
- 0.292 In producing this plan we have complied with the WRPG set down by the Environment Agency and further government guidance. To date, we have achieved the requirements of the Defra Direction by providing a plan from 2020 to a minimum of 25 years, and have comprehensively covered the 'matters to be addressed'.
- 0.293 Throughout the development of our plan we have carried out a comprehensive level of engagement and checks to ensure the high quality of our plan. These included:
- Engagement with our customers to understand their preferences for the longer term, and drop-in sessions and workshops across our region aligned with the development of our wider business plan.
  - External forums and technical meetings, and engagement with our regulators to inform the development of the draft plan.
  - The involvement of a number of external bodies to input into and review our progress.
- 0.294 We undertook 2 stages of consultation during the development of our plan that provided constructive criticism of our planning, and enabled us to improve our water resources planning for the short and longer term. We commissioned Community Research, an independent research and consultation specialist agency, to ensure the approach we adopted, the materials published, and the analysis undertaken were robust and fair. Community Research prepared separate reports on the consultations and the main issues arising to give confidence to all stakeholders that the process followed was fair and transparent<sup>53</sup>.
- 0.295 Also, an Expert Panel has been engaged to review and challenge the validity of the programme appraisal process. Their overall positive findings are summarised in a final report<sup>54</sup>. This process has enabled the utilisation of complex innovative planning tools to produce a range of programmes and allow choices to be made consistent with the WRPG July 2018.

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<sup>53</sup> Community Research, Shape your water future: revised draft WRMP19 Report on the consultation response, January 2019 available on [www.thameswater.co.uk/wrmp](http://www.thameswater.co.uk/wrmp)

<sup>54</sup> Final Report of the Thames Water Expert Panel March 2019', led by Professor Adrian MacDonald



## Annex 2: Board sign-off

0.296 Our Board is accountable to shareholders, customers and other stakeholders for the performance of the company and in promoting its long-term success. As such, the Board is responsible for setting the company's strategy and for leading the development of our business plan and the WRMP. We have engaged with our Executive Management Team, and the Board, and have had separate review sessions with Board members at key stages in the development of the WRMP19. The Board approved the revised draft WRMP19 in August 2018 prior to submission to the Secretary of State for Environment, Food and Rural Affairs and inclusion within our Price Review 2019 submission to Ofwat on 3 September 2018. This approval included:

- The Statement of Response of the draft WRMP19,
- The need for a further consultation due to material changes to our draft WRMP19 and
- The revised draft WRMP19

0.297 The Board noted the update of the revised draft WRMP19 when it met on 27 March 2019.



## Annex 3: Severn Thames transfer – common words<sup>55</sup>

These common words have been developed through ongoing conversations between United Utilities, Severn Trent Water, Ofwat and ourselves. Aligning with the recent Ofwat IAP action, a joint note has been produced between our three water companies providing more detail.<sup>56</sup>

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<sup>55</sup> An update of this document is referenced in Thames Water's Business Plan 2019 as TW-OC-A8: Strategic Regional Schemes – Severn Thames Transfer

<sup>56</sup>

## Severn Thames transfer

The pressures of population growth and climate change are affecting the whole of the South East of England. By working together with other water companies across England and Wales we're taking a coordinated approach to planning for the future and making sure all our plans offer customers the best possible value for money. The water transfers we have looked at include transferring water from the Midlands, Wales and the North West and transferring it via the River Seven and across to the River Thames.

A number of variants of the Severn Thames transfer have been considered as we developed our plans. United Utilities, Severn Trent, Welsh Water and the Canal and River Trust have provided options to free-up water in the River Severn catchment. Thames Water has considered these options for transferring water from the River Severn and River Wye to the River Thames.

In appraising options to meet its own needs, and the needs of other companies in the South East, Thames Water has selected a Severn Thames transfer as part of its long term preferred plan. This includes, from 2083 onwards:

- 300 MI/d pipeline transfer between Deerhurst on the River Severn and Culham on the River Thames, including treatment for invasive non-native species
- 110 MI/d of support from Vyrnwy reservoir provided by United Utilities, 60 MI/d of which would be released into tributaries of the Upper Severn and 30 MI/d would be provided to Severn Trent Water to offset their abstractions further downstream
- 15 MI/d of support from Severn Trent at Mythe in Gloucestershire
- 35 MI/d of support from Severn Trent's Netheridge sewerage treatment works in Gloucestershire

Thames Water also considered a number of scenarios. The Severn Thames transfer is called on under some scenarios tested. The earliest the transfer is required in these scenarios is 2039. The scenarios select a range of different support options up to 250 MI/d in total. The 250 MI/d support comprises of 125 MI/d from Vyrnwy reservoir and 125 MI/d from Severn Trent options.

Given the national strategic importance of the Severn to Thames transfer scheme, as recognised by the National Infrastructure Commission report 'Preparing for a Drier Future', we remain committed to ensuring that momentum is maintained. To this end we will continue to work on appropriate technical and environmental aspects in 2020-25, for example ecological work, losses and reliability, water quality, regulation, river temperature, in partnership with the other companies. We will continue to work closely with the other companies to examine these options in more detail. This will allow the transfer options to be considered further in future WRMPs.

0.298 Working together to assess water trading and transfers, United Utilities, Seven Trent and Thames Water commissioned market research company Verve to evaluate customer views. The research was carried out from March to May 2018. Verve has provided the following summary statement for the three companies to report the findings of the research.

## Water trading customer research

*Customers have limited knowledge about the water scarcity issue, but quickly recognise the need for long term sustainable solutions*

**Informed reaction to water scarcity:** 7 in 10 are concerned about water scarcity, particularly those in the Thames Water catchment area. Customers recognise that water scarcity is a long term issue requiring immediate nationally co-ordinated action.

Customers call for widespread education on the issue. They assume that fixing leaks will be the major priority for water companies – the preferred demand management solution for all customers irrespective of region.

**Preference for supply solutions:** Water reuse is the most preferred supply solution across all water company regions, closely followed by building new reservoirs. Whilst regional transfer is the least preferred of the three solutions, 62% rank it as their first or second choice.

Customers see sustainability (ability to provide water for the long term), environmental impact and the volume of water produced as the key evaluation criteria when choosing solutions to put in place.

*Water trading, delivered cost effectively with assurances, works for customers*

**Level of support for water trading:** Customers raise multiple concerns about water trading - the security of supply, environmental and financial impacts. Potential 'donor' customers are concerned as to the impact on their own supply, whilst Thames Water customers ask whether water will be available when needed.

Despite concerns, 74% of all customers \*agree they support water trading as part of the solution - it's logical to share. Support declines for a proportion of Thames Water customers (from 80% to 70%) on being told the cost will be paid back through the bill over a long period of time – they are unable to assess fully without a figure. In donor regions, 40p is seen as better reinvested into future water resource management.

\*agree is a total of those who agree strongly or slightly with the statement "I support water trading as part of the solution to the water scarcity in the UK"

**Key assurances required:** Eight assurance statements have been developed to help mitigate core areas of concern with water trading

1. Companies selling the water only do so if they can ensure they have a reliable source in the future
2. Water will only be taken when it is needed by Thames Water and the wider South-East region
3. There are plans in place to maintain new pipework
4. The 40p per donor customer is used for the improvement and upgrade of water services, with no impact on bills
5. Impact on bills for recipient regions will be kept to a minimum by spreading the cost over a long period
6. The regulator ensures water is traded at a fair price, and any cost to customers fairly reflects the level of investment made
7. External bodies will be involved in monitoring processes which could pose a risk to the environment
8. Water companies will be regulated on environmental impacts and must conduct due diligence checks

Assurances are also required about the continued improvement of demand management.

**The Welsh perspective:** Customers in Wales, whilst still concerned, have lower levels of support for water trading than observed in other potential donor regions.

- Their preference for demand and supply solutions is consistent with other water company regions – reducing leakage, water reuse and building new reservoirs are most preferred
- Wariness remains about supply side solutions given the history of issues such as the Tryweryn Reservoir
- They are the most concerned to know that there is enough water left within 'donor' region post



transfer (61% raise this as a concern compared with 54% of all customers)

- Whilst 65% support water trading as part of the solution, those in Wales have the lowest levels of support (65% \*agree they support water trading compared with 73% for Severn Trent England and United Utilities).

\*agree is a total of those who agree strongly or slightly with the statement "I support water trading as part of the solution to the water scarcity in the UK"



## Severn Thames transfer – work planned to inform 2024 WRMPs

The continued development of water transfer options is important in protecting the resilience of the South East region. There is a need to ensure that both the recipient and donor companies for the water transfer can provide safe and reliable water supplies for customers, both now and into the future, and that in doing so they continue to evaluate all feasible options to provide raw water for supply.

Throughout 2015-2020 there has been an extensive programme of work undertaken and engagement with interested stakeholders and regulators on the Severn Thames transfer scheme. The proposed work to be undertaken in the following five years builds on this substantial collaborative work that has already been undertaken. We are committed to fully understanding the viability of the Severn Thames transfer by continuing to work with other water companies and the regulators.

The joint work will include:

Scope	Lead organisation
(1) understanding the magnitude of water losses that could occur during transfer, (2) the changes that would be required to the regulation of the River Severn to ensure water is available for transfer when required and that the Severn Estuary Special Area of Conservation is not detrimentally impacted by the increased upstream abstraction, (3) further environmental investigations and survey requirements for the River Severn flow augmentation options (Vyrnwy reservoir and Minworth sewage treatment works <sup>57</sup> ), and (4) understanding water quality issues associated with how River Severn algae behave when transferred into the River Thames.	Thames Water/Affinity Water/WRSE
(5) Environmental studies for a number of supporting options, including a screening phase and more detailed investigations at a smaller number of sites. (6) More detailed engineering assessments of the scope and costs of the supporting options, supported by multi-discipline site based investigations. (7) A study to assess the contribution that United Utilities transfer options will make to the well-being goals for Wales contained in the Well-being of Future Generations (Wales) Act 2015. (8) A study to assess whether changes to the magnitude of timing of River Severn support would affect water levels at Vyrnwy reservoir and the environmental effects of any changes to water level.	United Utilities
Senior management providing leadership and coordination of the work on the transfer scheme across the various parties, ensuring effective governance arrangements are in place, and engagement with multiple stakeholders.	TBC between regulators and water companies

To achieve governance for the future work programme, a new coordination group has been established named “Water Resources West”.

<sup>57</sup> Further studies of Minworth sewage treatment works option are being undertaken by Affinity Water as an augmentation scheme in support of the Grand Union Canal transfer option

## Annex 4: Affinity Water and Thames Water Joint letter

Sent by Affinity Water and Thames Water to CEO Ofwat, Rachel Fletcher on 4<sup>th</sup> March 2019:

“Dear Rachel,

### **Alignment of Water Resources Management Plans**

We wanted to provide you with an update on the progress in the development of our revised draft Water Resources Management Plans and confirm alignment in our proposals for the delivery of long-term resilience in water resources.

Our revised draft Water Resource Management Plans (rdWRMP), which are being published or updated in the next few weeks, will include the necessary alignment in relation to both the timing of delivery and utilisation of regional strategic options. Both companies have also developed and incorporated innovative adaptive pathway approaches that will allow us to manage future uncertainties in the delivery of our plans and will ensure that decisions and timing involved in those plans are fully aligned.

Both Affinity Water and Thames Water have independently considered the need, nature and timing of strategic supply-side options required to support long-term growth and water resource needs within our supply areas. We have identified the South East Strategic Reservoir Option (SESRO) as the best-value next strategic option and we propose to deliver it as a joint scheme.

The WRSE has carried a wide range of future scenarios setting out the challenges that our region faces. The results have shown that the reservoir, along with a number of other regional schemes, has been selected as one of the next strategic options to manage resilience of the South East.

Using our adaptive pathway approach, we will continue to investigate other strategic options working in close collaboration with the Regional Groups and the National Framework. For Affinity Water this includes the transfer of water using the Grand Union Canal. For Thames Water this includes the transfer of water from the River Severn to the River Thames. Currently we are not proposing to develop these as joint schemes. Thames Water will continue to work with the Environment Agency, Severn Trent Water and United Utilities Water to develop the Severn Thames transfer scheme, aligned to the Terms of Reference in place.

Whilst the Severn-Thames transfer is of sufficient size to represent a regional strategic option, Affinity Water does not have the raw water storage that is required to efficiently generate reliable yield from the scheme and intends to explore further the Grand Union Canal transfer as a secondary option if it is not possible to develop SESRO. Affinity Water will also continue to consider options for the development and transfer of water from Anglian Water as a longer term adaptive strategy.

Thames Water will publish an update to its revised draft WRMP19 on April 1<sup>st</sup> to align with the Business Plan submission, taking into account responses from its autumn 2018 consultation.





Affinity Water has published its revised draft Water Resources Management Plan for consultation on 1<sup>st</sup> March 2019. It includes a summary consistent with the proposals outlined in this letter and will provide further opportunities to listen to our stakeholders' views.

We agree that resilience in water resources for the South East in the long term will come from a mix of solutions and, of course, we support any innovative water resources planning initiatives that will promote the prompt delivery of resilience during the next cycle of water resource management planning.

We will continue to work closely with the Water Resources in the South East, Water Resources West and Water Resources in the East groups, along with our economic and environmental regulators. We also fully support the national water resources group initiative and the recent formation of the Regulatory Alliance to facilitate strategic water resource developments and commit to working with them to support growth and deliver resilience for our customers.

Yours sincerely

Pauline Walsh  
CEO  
Affinity Water

Steve Robertson  
CEO  
Thames Water Utilities Ltd"