REVISED DRAFT WATER RESOURCES MANAGEMENT PLAN 2019

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RESPONSIBLE BUSINESS OF THE YEAR 2017
BUSINESS IN THE COMMUNITY

CONTENTS

EXECUTIVE SUMMARY

Introduction

This is our revised draft Water Resources Management Plan (dWRMP). It should be read in conjunction with our Statement of Response, which summarises feedback on our dWRMP and how we have revised our plan. The revised dWRMP is a technical document written primarily for our regulators, as well as other technical stakeholders, following principles set out in the Water Resources Planning Guideline. Our separate Summary document will provide a non-technical overview of our plan. This will be made available when we publish our revised dWRMP.

We have a number of immediate and longer-term challenges. We are responsible for managing water resources in a region that is water scarce, vulnerable to climate change, has a precious environment and a fast growing population.

We have worked nationally (Water Resource Long Term Planning Framework) and regionally to understand these challenges; our plan is consistent with the Water Resources East (WRE) long-term strategy as well as the conclusions of the National Infrastructure Commission's report on future water infrastructure needs. We fully support the focus from Government, the Environment Agency and Ofwat on continuing to build resilient water supplies. Our revised dWRMP is ambitious, pushing further the frontier on leakage reduction, whilst building on the regional collaboration developed through WRE to deliver cross-sector approaches to managing water resources across our region. This latter point is captured in the recent regulators joint letter sent to water companies.

We published our dWRMP for consultation in March 2018 and responses showed strong overall support for our approach, particularly our prioritisation of demand management and our proposed investments in drought resilience. The constructive feedback we received from the consultation process has played a significant role in shaping our revised dWRMP.

As set out in our Statement of Response (SoR) we have now met all statutory requirements under the WRMP Directions and where we consider them valid have addressed other issues raised in the consultation on the dWRMP. Our SoR also explains why consultation responses on specific issues have not led to revisions in the revised dWRMP.

Our revised dWRMP is consistent with our PR19 business plan submission, where we have included over £850m of TOTEX investment to deliver our demand-side and supply-side strategies. It has been through rigorous internal and external assurance processes. Our plan has been approved by the Anglian Water Services Board.

As stated, our plans have been through rigorous internal and external assurance processes. This includes a three step process of:

a) challenging and justifying the need for an investment
b) ensuring we select the most appropriate solution to meet need, including considering innovative approaches, and
c) costing the selected solution from a baseline of our own achieved efficiencies, testing against industry benchmarks, and then applying further productivity enhancements and stretch efficiencies across our entire investment programme.

This is set out in detail in the efficiency and innovation chapter of our PR19 Plan.

The revised dWRMP planning period runs from 2020 to 2045. There is a particular focus on actions required in the period 2020 to 2025, known as AMP7. We will prepare a new WRMP for consultation in 2023 based on updated forecasts and options.

Our revised dWRMP:

- Promotes the efficient and effective use of available resources, through an ambitious, customer-supported and cost-beneficial demand management programme that includes including reducing leakage by 22% by 2025 and 42% by 2045, with average per-capita consumption falling to 120 l/h/d by 2045.
- Improves the resilience of public water supplies by adapting to climate change from 2020 and moving to a higher level of service for all our customers by 2024. The reduced risk of severe restrictions is cost-beneficial and supported by our customers.
- Supports the delivery of our wider resilience strategy, whereby we will reduce the population served by a single supply to 14% by 2025, with a long term ambition to reach zero by 2035.

- Enhances the environment by reducing abstraction in sensitive areas, including the capping of time-limited abstraction licences by 2022.
- Is supported by our customers, who have been consulted extensively.
- Reflects feedback from our consultation, including early adaptation to climate change, improving drought resilience, planning for growth, and the need to develop a plan that represents 'best-value' over the long-term.
- Fully considers every potential water resource option, including third party options and inter-company transfers. We have undertaken additional analyses to support options appraisal in producing the revised dWRMP, and have held meetings with all of our neighbouring companies in finalising our trading position.

The scale of the challenge

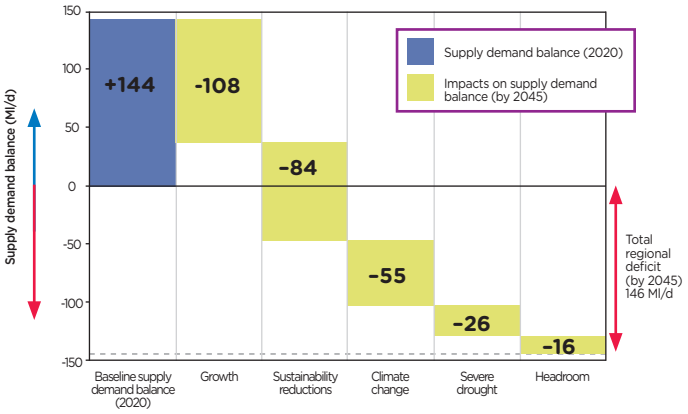
Our supply-demand balance is under significant pressure from population growth, climate change, sustainability reductions and the need to increase our resilience to severe drought. These challenges are acute in our region, which is characterised by low rainfall and is home to a significant proportion of wetland sites of conservation interest. These pressures drive the need for investment in both demand management and supply-side options, particularly in the short-term.

The total impact to our supply-demand balance is 290 Ml/d by 2045. This is equivalent to more than a quarter of the average daily distribution input in 2017-18. The impacts are broken down into the following and illustrated in the figure below:

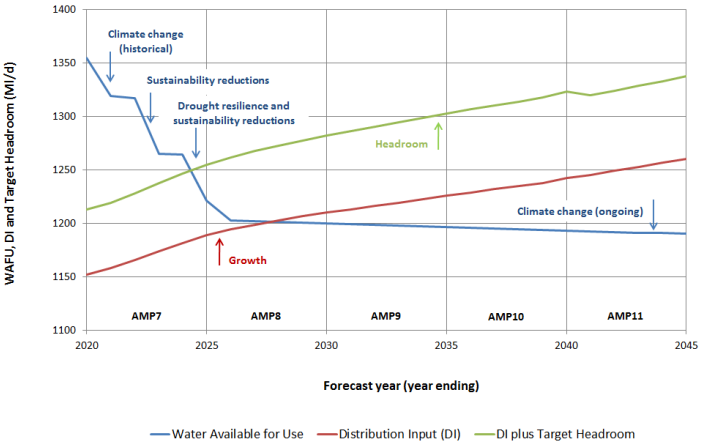
- 109 Ml/d: Growth (throughout the planning period)
- 84 Ml/d: Sustainability reductions (between 2020-25)
- 55 Ml/d: Climate change (from 2020)
- 26 Ml/d: Increasing resilience to severe drought (2024)
- 16 Ml/d: Additional headroom to manage uncertainties (increasing through the planning period)

When these impacts are combined, this results in a reduction in our baseline supply-demand balance from a total regional surplus of 144 Ml/d in 2020, to a total regional deficit of -32 Ml/d by 2025 and -146 Ml/d by 2045.

Pressures on our supply-demand balance

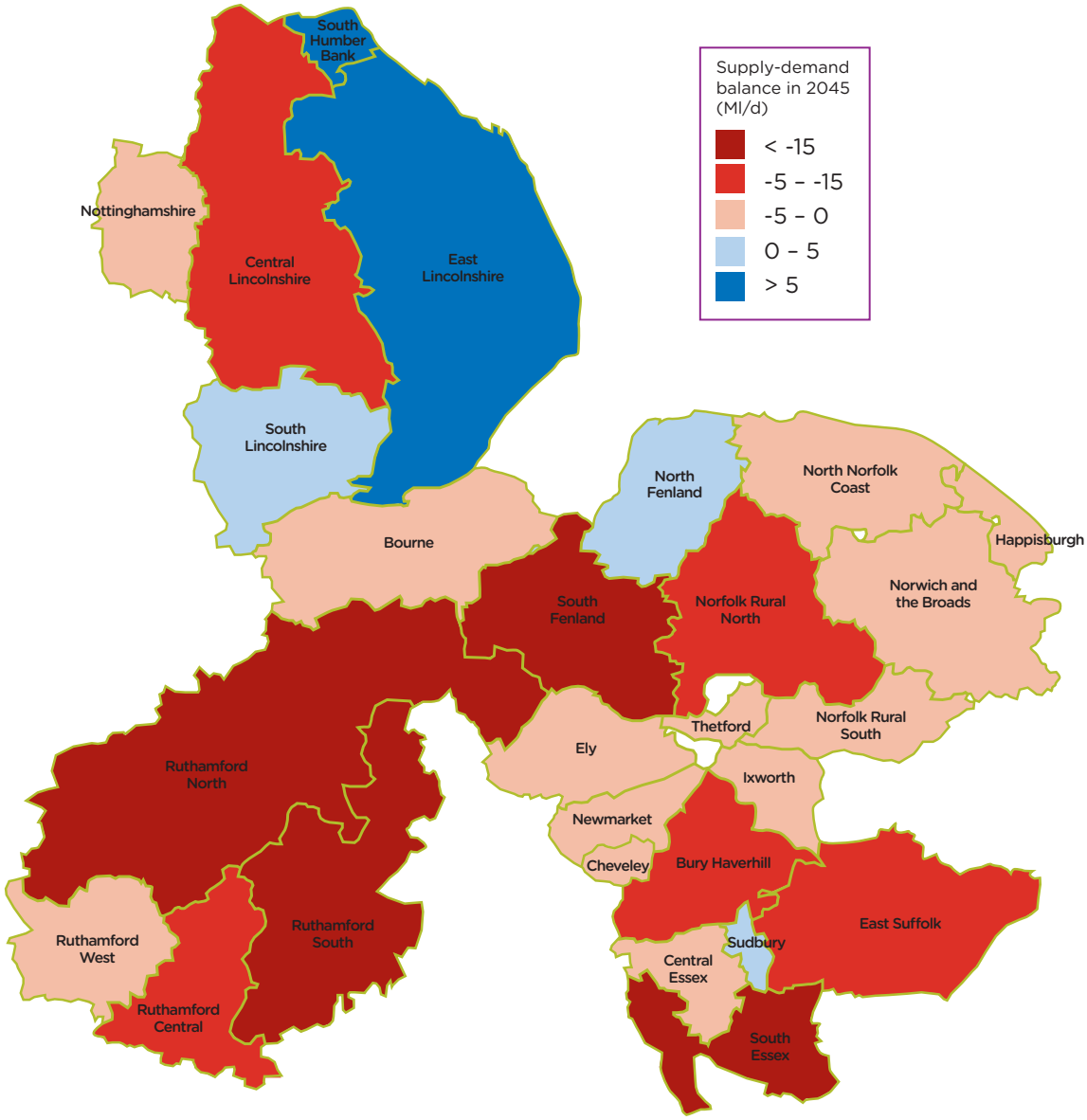


As shown in the figure below, a significant proportion (60 per cent) of the impact is experienced by 2025. Beyond this, population growth and climate change cause the supply-demand deficit to increase. There are also additional uncertainties not included here such as further sustainability reductions, higher climate change and extreme droughts; these will be considered in our adaptive planning process (see below).



As illustrated in the map overleaf, these impacts are not distributed evenly; some Water Resource Zones (WRZs) are affected more than others. Central Lincolnshire, Ruthamford North and South, South Fenland, Bury Haverhill, East Suffolk and South Essex are particularly affected. By 2045, only six WRZs remain in surplus: East Lincolnshire, South Lincolnshire, North Fenland, Sudbury, South Humber Bank and Hartlepool.

Baseline supply-demand balance in 2044-45 (DYAA scenario)



How customers have shaped our plan

We have engaged extensively with our customers to understand their views of the risks and impacts associated with investment in resilient water supplies. We focussed the conversation on three areas:

- Views on resilience and severe restrictions (such as rota-cuts and standpipes)
- Views on the choices of solution (i.e. demand management, supply-side options), and
- Impacts on bills and what customers are willing to pay for.

We have worked hard to ensure that engagement is as meaningful as possible, by testing the language and materials used to communicate risk, and by ensuring that the descriptions and indicators used can be readily understood. This was achieved partly through our co-creation process and partly through the testing of materials used for each initiative. We have also provided customers with a range of information to ensure informed engagement, including:

- Alternative Levels of Service
- The options required to improve resilience
- How our current performance compares with that of other companies, and
- The associated bill impacts.

The results of this research were central to the development of our revised dWRMP and particularly informed the following decisions.

- The prioritisation of demand management, including further ambitious leakage reductions and the installation of smart meters across our region.
- Investment in drought resilience, to ensure that no customers are vulnerable to severe restrictions in a severe drought event.
- The development of the strategic grid, which seeks to make best use of existing resources before developing new ones.

We then consulted on the dWRMP both as part of our business plan consultation, and as a separate activity in March 2018 with our online community. This phase of engagement considered the acceptability of the proposed plan, and the associated bill impacts.

Water Resource Zone integrity

The uneven nature of impacts has meant we have had to review the integrity of our Water Resource Zones (WRZs). WRZs are the geographical areas used to develop forecasts of supply and demand and supply-demand balances. The WRZ describes an area within which supply infrastructure and demand centres are linked such that customers in the WRZ experience the same risk of supply failure.

Some of the challenges we face, especially supply-side impacts such as sustainability reductions, occur in discrete parts of some of our larger WRZs. This means that the risks within WRZs become imbalanced and therefore WRZs need to be split or adjusted in order to isolate spacial deficits so that schemes are identified to bring these areas back into balance. Overall we have increased the number of WRZs from 19 at WRMP 2015 to 28 for WRMP 2019, including the addition of South Humber Bank which is a non-potable WRZ that sits within Central Lincolnshire (see map below).

WRZs in revised dWRMP 2019

Best value decision-making

Recognising the challenges described above, we have adopted a planning approach that uses least-cost optimisation as well as broader criteria to develop a Best Value Plan which takes account of 'best value' decision making criteria:

- Cost – how much does the plan cost to build and operate? In areas where we are departing from 'least cost', does the additional investment deliver additional benefit to customers and the environment?
- Adaptability and flexibility – is the plan flexible enough to cope with uncertain future needs? Does it include potentially 'high regret' options, or limit future choices?
- Alignment to WRE – how well does the plan align to the regional strategy?
- Risk and resilience – how resilient is the plan to severe and extreme drought and other hazards, and what are the residual risks?
- Deliverability – can the plan be delivered on the timescales needed to manage risks?
- Customer preferences – how well does the plan align to customer preferences?
- Environmental and social impacts – what are the environmental and social impacts? Does the plan result in a net environmental benefit?

Demand management is our priority

Demand management has been, and continues to be, our priority. We put less water into supply today than at privatisation in 1989, despite an increase of more than 30% in the number of properties we serve. In addition, our leakage performance is industry leading and, by the end of AMP6 (2015-20), we aim to have 93% of households metered and 86% paying measured charges.

In developing our revised dWRMP, we have looked first to see what risk could be offset from demand management, before seeking to develop supply-side options. Demand management continues to be our priority because it:

- Meets customer and government expectations to continue to reduce leakage and manage demand
- Saves water that would otherwise be abstracted from the environment, allowing us to mitigate water body status deterioration risk,
- Reduces the need to develop additional supply-side capacity, and,
- Is required to ensure the reliability, sustainability and affordability of water resources over the long-term.

Our objective was to develop an integrated, multi-AMP demand management strategy that:

- Recognises the value of demand management to our customers and the environment
- Develops demand management programmes holistically
- Recognises the role demand management can play in managing future uncertainty, and,
- Challenges us and our customers to push the boundaries of what is achievable.

In developing the strategy, we considered three alternative strategic demand management options, each of which consisted of a combination of smart metering, leakage reduction and water efficiency activity. We then undertook a cost benefit analysis of the three strategic options, using a building blocks approach. Each strategic option was also evaluated against the wider best-value criteria above.

Supply-side investment is also required

Despite our ambitious demand management strategy, the scale of the challenge is such that we still need carefully targeted investment in supply-side capacity.

The supply-side options considered for inclusion in our revised dWRMP have been developed following industry and regulator guidance. We have limited options for new local water resources in many parts of our region. This is largely due to constraints on the amount of new water we can abstract from the environment, as well as planning factors.

In addition, we included a number of trading and third party options in our feasible option set. We have engaged in detailed discussions with our neighbouring water companies (Affinity Water, Severn Trent Water, Cambridge Water, Essex and Suffolk Water), as well as water management organisations in our region such as the Environment Agency and the Canal and River Trust. We have also held discussions with third party suppliers and other large industrial users in our region to explore trading opportunities.

Our Preferred Plan

Our Preferred Plan provides the best value for customers in the long term. The strategy:

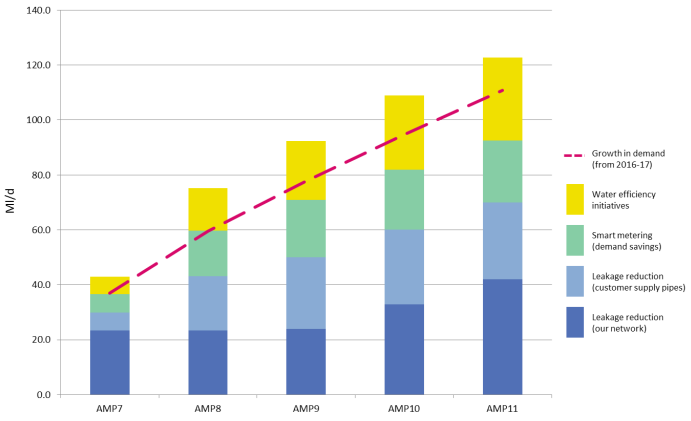
- Prioritises demand management, which aligns with customers expectations
- Recognises the environmental benefits of demand management, such as offsetting treatment and pumping costs and carbon
- Challenges us and our customers to push the boundaries of what is achievable, with respect to levels of future consumption
- Maximises the use of existing resources before developing new ones
- Provides future flexibility over the location and type of new resource inputs
- Delivers significant additional resilience across our region both to drought and non-drought events (e.g. freeze-thaw)
- Delivers environmental benefits, by reducing abstraction from the environment and ensuring no deterioration in the ecological status of water bodies in our region

Ambitious and deliverable demand management

We have developed an ambitious 25-year demand management strategy, which will more than offset the projected growth in household demand (as illustrated in the figure below). The savings are estimated to be up to 43 Ml/d by the end of AMP7 (2025), and up to 123 Ml/d by 2045.

Our preferred strategy consists of smart metering combined with behaviour change, leakage reduction and additional water efficiency activity.

Cumulative savings of our selected demand management strategy



Smart metering

We plan to install smart meters across our region, reaching the limit of feasible meter penetration by the end of AMP8 (2030). Specifically, we will install Advanced Meter Infrastructure (AMI) that takes meter readings every 15 minutes, which are then transmitted centrally every hour over a fixed, long-range radio network. This data is then provided to customers over a dedicated website or 'customer portal'.

Smart meters offer the potential to deliver significant demand savings, as experience to date shows that customers with a smart meter tend to save more water than those with a dumb meter. In addition, smart meters make possible a range of future water efficiency initiatives, such as non-price behavioural change incentives, financial incentives, or rising block tariffs.

Smart metering is also an integral part of our leakage strategy. We will be able to analyse individual customer's consumption patterns and identify customer supply pipe leaks (CSPL) and leaks within the property (plumbing losses). We will then notify customers proactively of the leak so that they can fix it, saving both water and money. Our smart metering trials have shown significant benefits to finding and reducing leakages, especially from leaking toilets.

By the end of AMP7, we estimate that smart meters, combined with the behavioural change and improvements in leakage performance that they enable, will result in up to 7 Ml/d demand savings, and up to 7 Ml/d reduction in CSPL. By 2045, we estimate smart meters will result in up to 22 Ml/d demand savings, and up to 28 Ml/d reduction in CSPL.

Ambitious leakage reduction

Leakage is a particular concern for our customers and our performance leads the industry: we have cut leakage by a third since privatisation in 1989. Our future plans are also ambitious: we aim to reduce leakage from a three year average of 182 Ml/d in 2017-18 to 142 Ml/d by the end of the AMP7, a reduction of 22%. By 2045, we plan to reduce our leakage to 106 Ml/d, a reduction of 42%; at this point leakage will be less than 10% of distribution input. We will achieve these reductions by using a mixture of tried and tested techniques and innovation, including the savings in CSPL facilitated by smart meters described above.

Water efficiency

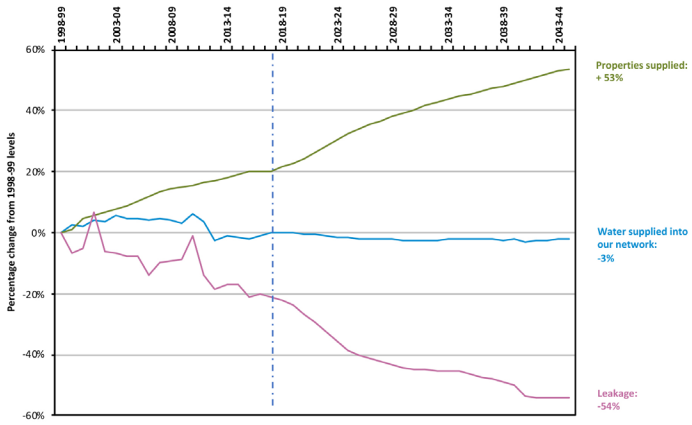
Our strategy includes a range of household water efficiency and conservation activities. This is based on the continuation of current activities, such as a Bits and Bobs campaign (where we retrofit water efficiency devices free of charge) and The Potting Shed (where we provide water efficiency advice to gardeners). It also includes innovative new initiatives including a water savings rewards scheme, incentives for customers to replace old toilets with more efficient brands and the installation of water butts. Our programmes for helping to identify 'leaky loos' and providing rebates to customers for toilet replacement will be important in helping customers improve efficiency, while tacking plumbing losses. We will also work collaboratively with developers to ensure that new housing is as water-efficient as possible. This includes trialling the use of greywater and rainwater harvesting technology at a development scale to achieve 80 l/h/d potable consumption.

We forecast that these activities will result in savings of 6 Ml/d by the end of AMP7, and 30 Ml/d by 2045.

The scale of our ambition

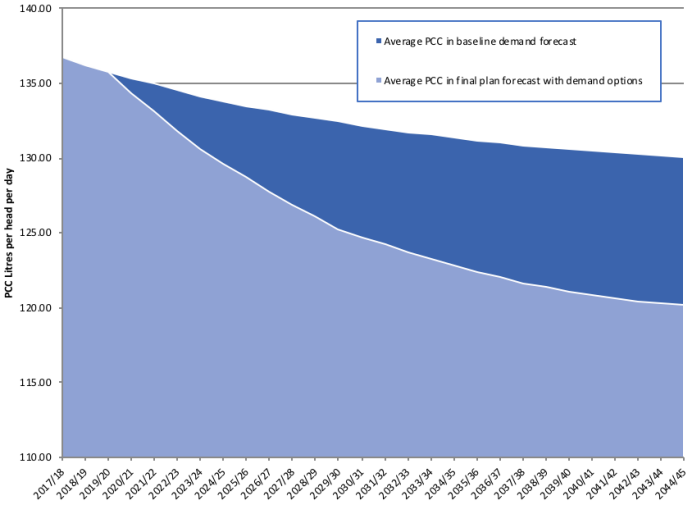
The scale of our ambition is illustrated in the figure below, which shows the percentage change in the number of properties supplied, the water we put into our network and leakage since 1998, projected forward to 2045

Demand management: past achievements and future ambition



The impact of our demand management strategy on PCC is shown in the figure below. By the end of the planning period (2045), we expect that our average PCC will be 120 l/h/d, a reduction of 12% (16 l/h/d) compared with 2017-18. This will be one of the lowest in England and Wales.

The impact of our demand management strategy on average PCC



In order to inform our decision making, we have undertaken a cost benefit analysis of the three strategic demand management options. The Extended Plus strategy has the strongest business case and remains cost beneficial when subjected to sensitivity testing. In addition, our selected strategy performed best when evaluated using the best value decision making criteria outlined above.

Maximising using of existing resources through a strategic grid

Despite our ambitious demand management strategy, the scale of the challenge is such that we still need carefully targeted investment in supply-side capacity.

Largely due to supply-side pressures, by 2025 only three WRZs will have a surplus greater than 3 Ml/d (East Lincolnshire, South Humber Bank and Hartlepool) compared to 14 at the beginning of the forecast period. We have limited options for new local surface and groundwater resources in many parts of our region due to the over allocation of existing resources; the only feasible supply options for 14 WRZs out of 22 in deficit are transfers; and transfers are the least cost options.

As a result, our Preferred Plan is to build on our existing infrastucture to develop a more integrated strategic grid. The least cost and most sustainable inputs to the grid are existing resources; hence we are able to utilise surpluses in Lincolnshire (especially Central and East Lincolnshire) and North Fenland to support 'downstream' WRZs, notably Ruthamford, Bury Haverhill, East Suffolk and South Essex. Use of existing resources is favoured by our customers.

In addition, we will develop new resources on the South Humber Bank, which will feed into the grid. Our preferred option is to convert some of the non-potable water at Elsham to potable standard, and to develop a reuse scheme at Pyewipe to supply non-potable water. However, we will continue to investigate alternatives to this in the next 18 months.

Our plan includes the development of metaldehyde treatment to address the water quality risks associated with moving water between WRZs. This is consistent with the relevant Drinking Water Inspectorate guidance and water quality regulations.

Our supply-side strategy is illustrated in the figure below. This figure also shows the areas we use to complete our problem characterisation assessment.

Supply-side strategy

Developing a network of strategic transfers provides future flexibility over the location and type of new resource inputs. For this reason we have deferred the selection of a desalination scheme at Felixstowe and ensured that we have adequately sized the grid to cope with future inputs whilst avoiding over-sizing. To do this, we have created a Best Value Plan that has wider benefits (as defined using the criteria above) than a purely Least Cost Plan. We have also subjected the Best Value Plan to a number of 'stress-test' scenarios including a higher level of climate change, lower rate of demand savings and potential export requirements. This has demonstrated that the Best Value Plan is robust to a range of potential future scenarios. The grid will also increase resilience to drought and other hazards, with benefits for us and our neighbouring water companies.

Water Industry National Environment Programme (WINEP) mitigation options

In order to ensure our abstractions are sustainable, we are implementing a number of mitigation schemes alongside sustainability reductions. WINEP mitigation options include river restoration, river support, recirculation, and adaptive management. Mitigation options will be delivered according to their obligation dates, mainly in 2024. The sustainability reductions in the revised dWRMP are dependent upon the delivery of the selected WINEP mitigation options. If for whatever reason these options cannot be delivered, then the sustainability reductions required would be much greater so the programmes of demand-side and supply-side options would need to be brought forward and new options added.

Alignment of plans

Our plan is consistent with the emerging national water resources policy position, as informed by the Water UK Water Resources Long Term Planning Framework and the National Infrastructure Commission. Our plan prioritises demand management ahead of developing new resources which is a key recommendation in both of these reports. Our demand management first approach is also consistent with the Government's Strategic Policy Statement and is supported by customers.

Our strategy also promotes transfers across our region from areas of surplus to areas of deficit. In addition, by deferring the development of new resources to later in the planning period, our strategy provides flexibility to support the development of winter storage reservoirs in our region.

Our plan is also consistent with the preliminary WRE strategy which includes a strategic regional grid and future strategic supply options, as well as need to manage levels of per capita consumption.

Cost of our plan

The costs of delivering our Preferred Plan are outlined in the table below. Our WRMP is a significant investment driver for AMP7. We outline our WRMP investment plan in the Resilient Water Supplies chapter of our PR19 Business Plan and the supporting enhancement expenditure reports.

	Whole Planning Period (2020-2045)		AMP7 Totals (2020-2025)	
Investment Area	**Capex £m**	**Opex £m/yr**	**Capex £m**	**Opex £m**
Supply-side programme	624	17	584	10
Demand management strategy	635	15	199	71
WINEP mitigation options	21	1.7	21	9
Adaptive planning	20	–	20	–
TOTAL	**1,300**	**34**	**824**	**90**

NOTE: The costs presented here do not include the productivity assumptions included in our PR19 Business Plan.

Forward look

Our revised dWRMP is a low regret plan focussed on demand management, the transfer and use of existing resources and supply resilience. It will enable us to support growth, adapt to climate change, enhance the environment and ensure a high level of supply resilience for our customers. Whilst we have incorporated a number of uncertainties into our revised plan, and have undertaken stress testing, the realisation of some future scenarios will mean that further investment in strategic schemes is required. In some cases we may not have a long lead time to implement schemes and therefore we need to develop a plan which identifies thresholds beyond which we need to take further action.

Once we have finalised our WRMP, we will embark on a phase of adaptive planning that will include further assessment of scenarios, identification of critical thresholds that should trigger alternative courses of action, monitoring and the development of pathways.

We will work with regional partners including WRE as well as other stakeholders to develop our adaptive plan. We will use further scenarios in our supply system, demand and headroom models to assess the robustness of additional options. We will develop pathways that could be used to navigate through different uncertainties and identify lead times and thresholds. This will be undertaken using new methods that link robust decision making, multi-criteria search and scheduling, or/and using techniques such as real options. We will relate our monitoring to thresholds and identify if and when we need to adopt an alternative path. We anticipate regularly reviewing this in advance of WRMP 2024.

Alongside the adaptive water resource planning described above, we intend to continue pre-planning activities for a number of options. We have committed to a significant level of demand management, including full roll-out of smart meters and near halving of leakage levels by 2045; with existing resources well utilised, further challenges will require supply-side investments. We are committed to undertaking pre-planning activities for a number of supply-side options, which will ensure that these schemes are ready to implement if they emerge in our Preferred Plan at WRMP 2024.

The strategic options we are focussing on are those which we believe to be most favourable, as supported by our recent option appraisal. As shown in the map overleaf they include reservoir storage options, trades, desalination and water reuse schemes.

We will also continue to develop innovative water resources options such as Aquifer Storage and Recovery.

Pre-planning activities

ANGLIAN WATER'S WATER RESOURCES MANAGEMENT PLAN 2019

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WATER RESOURCES IN THE EAST OF ENGLAND ARE UNDER INCREASING PRESSURE FROM A RAPIDLY GROWING POPULATION, CLIMATE CHANGE AND ENVIRONMENTAL NEEDS. THERE IS ALSO A SIGNIFICANT AND GROWING RISK OF SEVERE DROUGHT. WE NEED TO ACT NOW TO ADDRESS THESE CHALLENGES.

POPULATION GROWTH

- We serve 20% more properties now than we did in 1998.
- Regional population is expected to increase by 20% over the next 25 years compared with population levels in 2011-12.
- Total impact is 109 Ml/d by 2045.

CLIMATE CHANGE

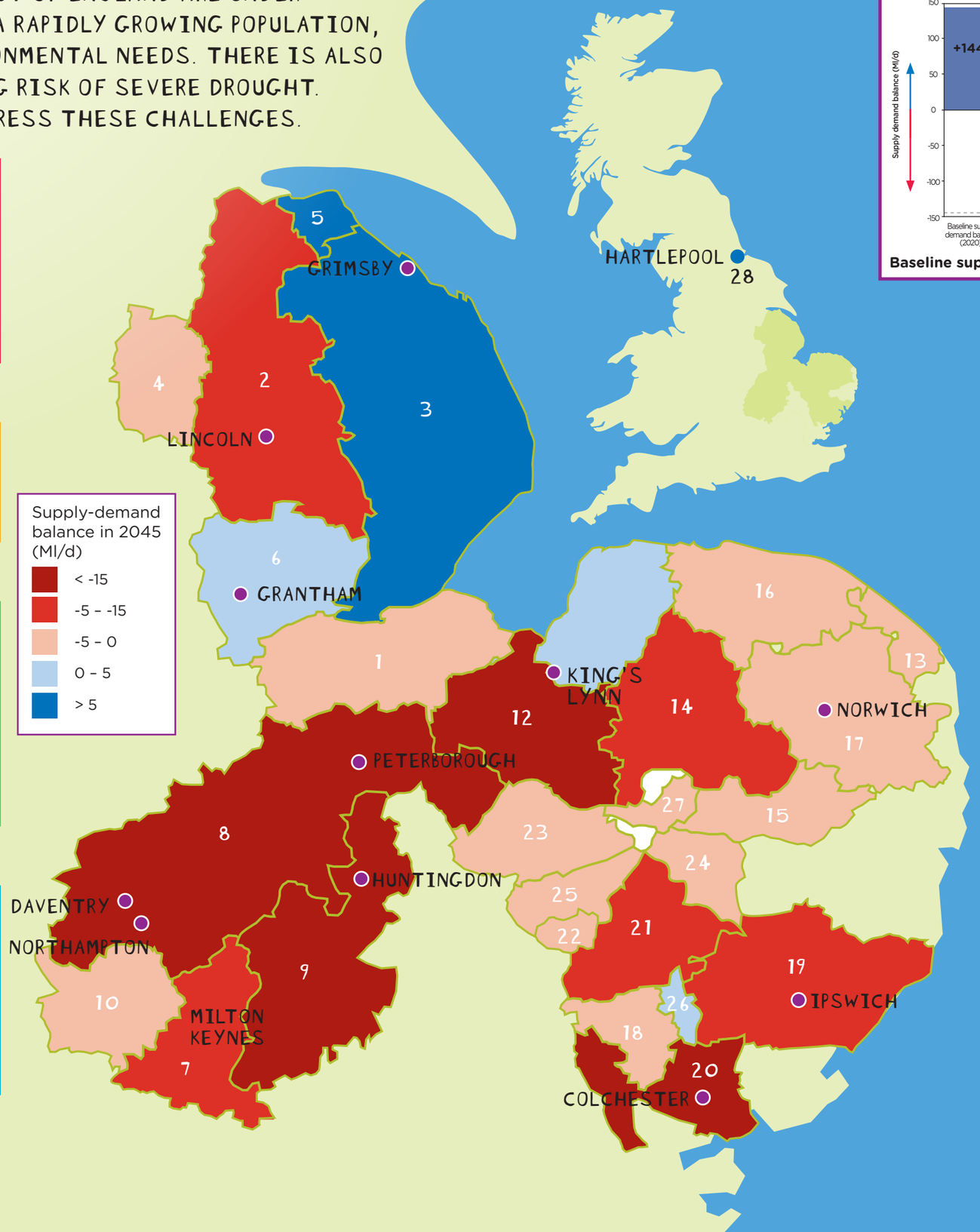
- Climate change is one of the most significant threats we face.
- Total impact is 55 Ml/d by 2045.

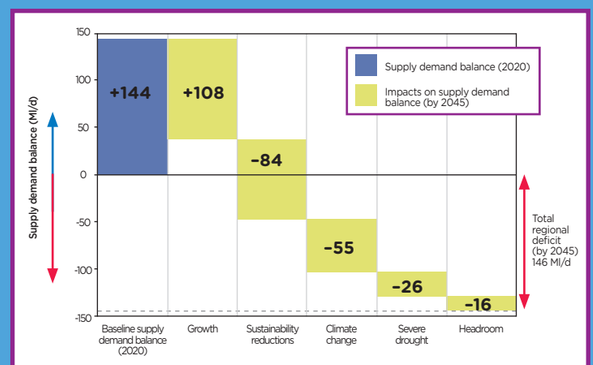
ENVIRONMENTAL NEEDS

- Our region is environmentally sensitive and home to many internationally important wetland ecosystems that need protecting.
- We need to reduce our abstractions to prevent actual or potential environmental harm.
- Total impact is 84 Ml/d by 2045

DROUGHT RESILIENCE

- Our customers have told us that the use of severe restrictions is not appropriate or acceptable.
- But parts of our system are vulnerable to severe drought, so we need to act now to reduce this risk.
- Total impact is 26 Ml/d by 2045





Baseline supply-demand balance in 2045

THE SCALE OF THE CHALLENGE...

- The total impact on our supply-demand balance is 290 Ml/d by 2045.
- There is a total regional deficit of 146 Ml/d by 2045.

Key	Water Resource Zone				
1	Bourne	✓		✓	
2	Central Lincolnshire	✓		✓	✓
3	East Lincolnshire			✓	
4	Nottinghamshire	✓		✓	
5	South Humber Bank				
6	South Lincolnshire	✓	✓	✓	
7	Ruthamford Central	✓			
8	Ruthamford North	✓	✓		
9	Ruthamford South	✓	✓	✓	
10	Ruthamford West	✓			
11	North Fenland	✓		✓	
12	South Fenland			✓	✓
13	Happisburgh	✓		✓	
14	Norfolk Rural North	✓		✓	
15	Norfolk Rural South	✓		✓	
16	North Norfolk Coast	✓		✓	
17	Norwich and the Broads	✓		✓	
18	Central Essex	✓			
19	East Suffolk	✓	✓	✓	
20	South Essex	✓	✓		
21	Bury Haverhill	✓		✓	✓
22	Cheveley			✓	✓
23	Ely	✓		✓	
24	Ixworth	✓		✓	
25	Newmarket	✓		✓	✓
26	Sudbury	✓		✓	
27	Thetford	✓		✓	
28	Hartlepool				

OUR PREFERRED PLAN

Demand management is our priority:

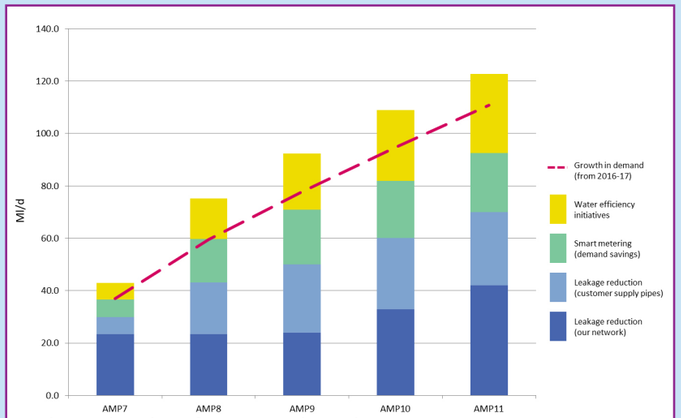
- Managing demand and reducing leakage is a customer, government and regulatory priority
- It saves water that would otherwise be abstracted from the environment, treated and pumped through our network
- It is required to ensure the reliability, sustainability and affordability of water resources over the long-term.

We have developed an ambitious, cost beneficial demand management strategy that will more than offset the effects of growth.

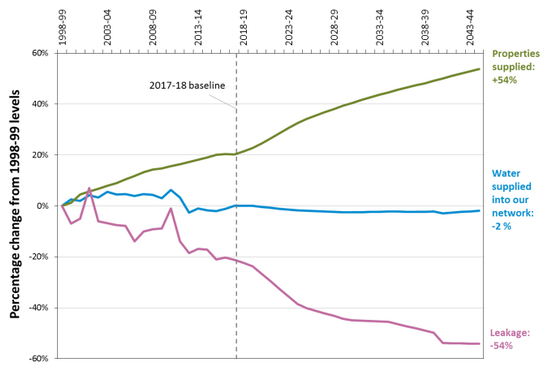
Total estimated demand savings of up to 43 Ml/d by the end of AMP7 (2020-25), and 123 Ml/d by the end of the planning period (2045).

Our strategy consists of:

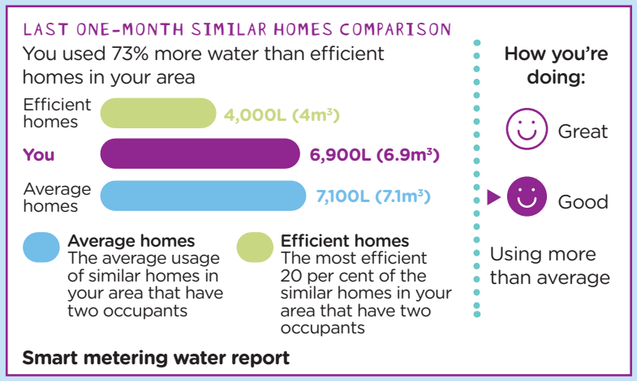
- Leakage reduction (including 23% decrease by 2025 and 42% decrease by 2045)
- Installing smart meters across our region
- Innovative water efficiency schemes including behavioural change initiatives.



Estimated savings from our selected strategy



Demand management: past achievements and future ambition



Smart metering water report

Smart metering

The next step-change in demand management will be achieved through technological innovation, including smart metering.

Smart meters can reduce demand in several ways:

- They allow us to identify customer supply pipe leaks (CSPL) and internal plumbing losses. We can then notify customers proactively of the leak so that they can fix it, saving both water and money.
- Customers with a smart meter save 3% more water than those with a dumb meter, but the savings can be much greater if the smart meters are introduced alongside behaviour change initiatives.
- They make possible a range of future water efficiency initiatives, such as non-price behavioural change incentives, financial incentives, and rising block tariffs.

Our smart metering programme is expected to save 13 Ml/d by 2025 and 51 Ml/d by 2045.

DESPITE OUR AMBITIOUS DEMAND MANAGEMENT STRATEGY, THE SCALE OF THE CHALLENGE IS SUCH THAT WE STILL NEED CAREFULLY TARGETED INVESTMENT IN SUPPLY-SIDE CAPACITY.

love every drop anglianwater

We will develop a strategic grid, that maximises the use of existing surpluses in AMP7 (2020-25), ensuring that we make best use of available resources before developing new ones. The only new resource scheme we need to develop in the short-term is Pyewipe Water Reuse for non-potable use. In the medium- to long-term, we are likely to need additional resources. This could include winter storage, recirculation of recycled water, or desalination. We will be working with regional stakeholders and neighbouring water companies over the next 2-3 years to identify the best options to take forward to WRMP 2024.

There is no supply-demand deficit in Hartlepool and therefore no selection supply-side options.

Our Revised dWRMP is...

Reliable

- ✓ Resilient to severe drought, ensuring no customers would experience stand pipes or rota cuts in a 1 in 200 year drought
- ✓ Adapting to climate change impacts from 2020

Sustainable

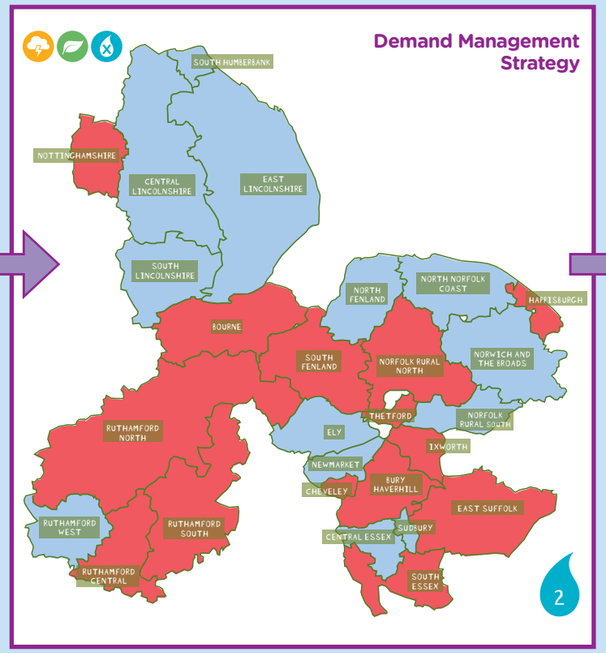
- ✓ Prioritises demand management
- ✓ Makes best use of existing resources
- ✓ Protects and enhances the environment through sustainability reductions
- ✓ Supports regional growth

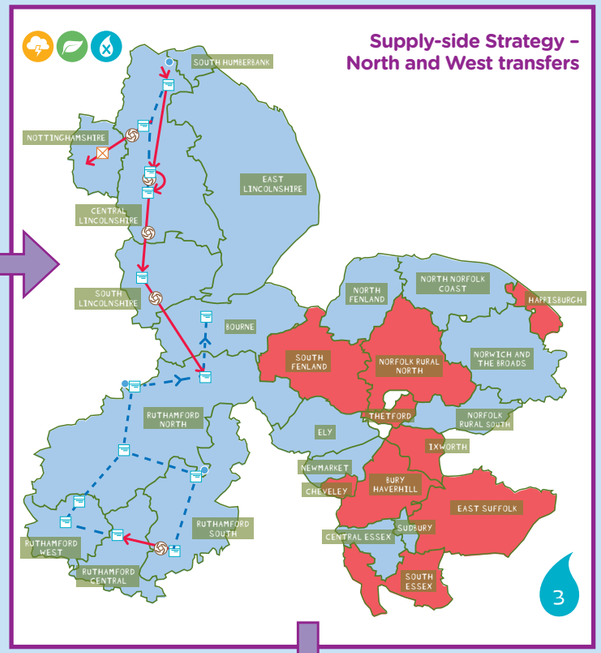
Affordable

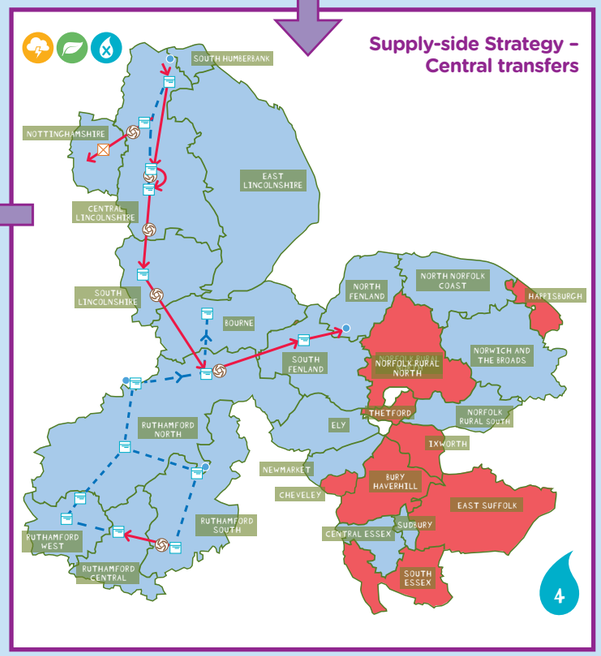
- ✓ Identifies the 'best value' solution to our region's challenges
- ✓ The majority of our customers think our plan is affordable and we offer a comprehensive package of support for those who struggle to pay their bills

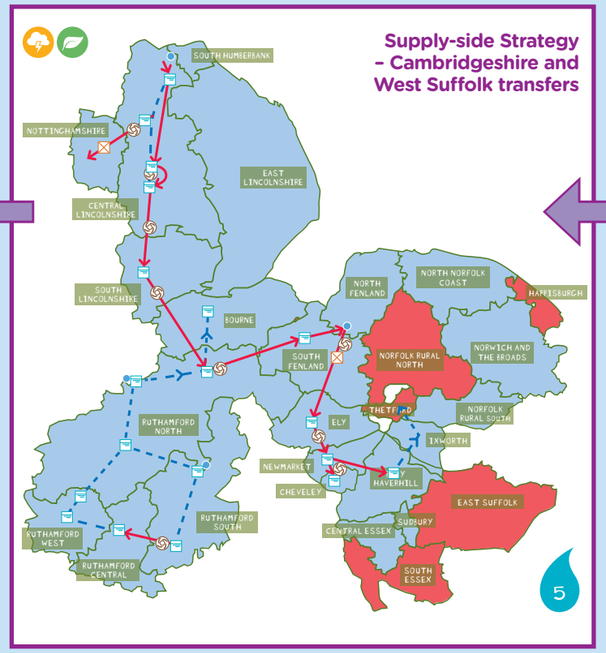
OUR WRMP STRATEGY

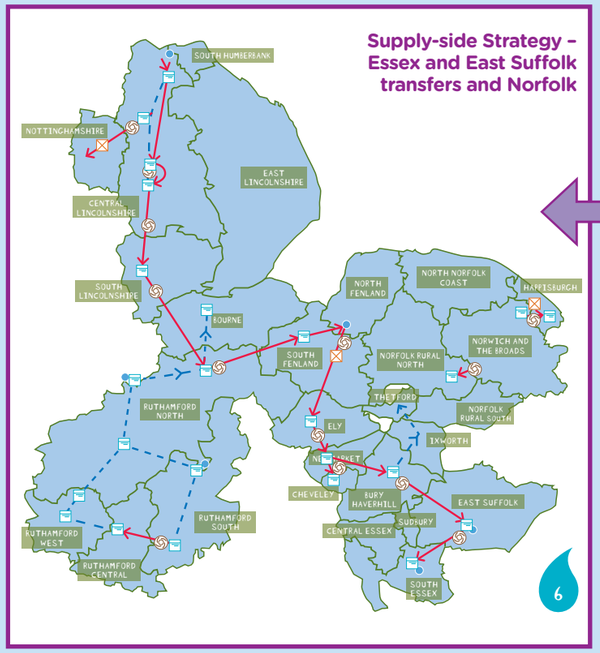
love every drop
anglianwater











1. WRZs in surplus/deficit by 2044-45 (baseline).

2. WRZs in surplus/deficit by 2044-45, after Demand Management schemes implemented.

3. New treatment capacity to create new resource (Pyewipe) and maximise existing resource in our East Lincolnshire zone.
   Transfer south, utilising new capacity, to address deficits in our Central Lincolnshire WRZ, driven by drought and sustainability reduction impacts.
   Deficits driven by climate change and sustainability reductions in Ruthamford WRZs addressed by transfer into Ruthamford North. Using existing infrastructure, this water is distributed to Ruthamford South and Bourne WRZ.

4. Key strategic transfer between our Ruthamford North and Fenland WRZs. Scheme supports deficits in our South Fenland WRZ, which are driven by sustainability reductions and drought impacts.
   Allows resources to be "bumped" across to North Fenland and transferred into the East of our region where we have further deficits.

5. Transfers utilising resource from the west of our region, and surplus from North Fenland WRZ address sustainability reduction and drought impacts in discrete groundwater systems, where there are no other resource options available.

6. A transfer linking the East Suffolk WRZ to the South Essex WRZ allows resources to be shared between these two WRZs, supported by transferred/'bumped' resource from the north and central areas.
   The Norfolk area is mainly in surplus for the entire plan with the exception of Happisbugh WRZ and North Norfolk Rural, where deficits are driven by environmental needs. There is adequate surplus resource to allow a local transfer between neighbouring WRZs.

Surplus
Deficit
Population growth
Climate change
Environmental needs
Drought resilience

1 INTRODUCTION

1.1 Guide to this submission

We published our draft Water Resource Management Plan (dWRMP) for public consultation between March and June 2018. We have received consultation responses and prepared a revised dWRMP and Statement of Response (SoR).

This document is the our revised dWRMP 2019, which covers the 25-year period from 2020 to 2045. Through WRE we have also carried out longer-term planning (beyond 2045) at the regional level.

Our revised dWRMP describes the pressures on our supply-demand balance (growth, climate change, sustainability reductions and increasing our resilience to severe drought), and our twin-track strategy to lessen the severity of their effects.

Our revised dWRMP submission comprises several reports, as set out in the diagram below. The main submission is supported by technical documents which explain our methodologies and provide the detailed findings of our analysis.

In addition, our submission includes the results of the following statutory environmental assessments:

- Habitats Regulation Assessment Report (WRMP 2019), and
- Strategic Environmental Assessment: Environmental Report (WRMP 2019).

We have checked to ensure that our plan does not include any information that would be contrary to the interests of national security.

Table 1.1 shows the chapter structure and a content summary of this report.

Figure 1.1: Revised dWRMP 2019 submission

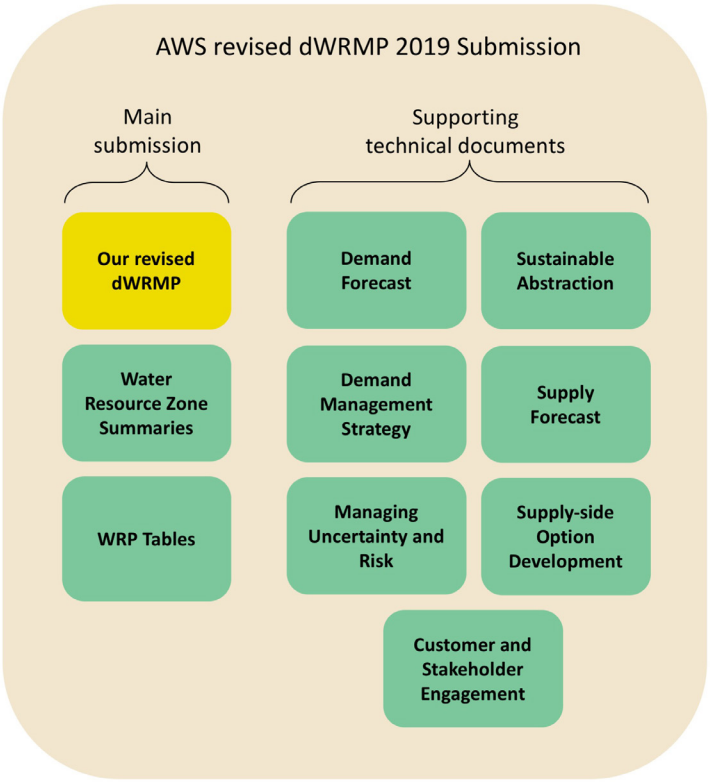


Table 1.1: Revised dWRMP chapter structure and content summary

Chapter	Content summary
Executive Summary	• A summary of our revised dWRMP.
Chapter 1 – Introduction	• Report structure. • Our planning objectives. • An introduction to our region. • Developing our revised dWRMP.
Chapter 2 – The scale of the challenge	• Our 25 year supply-demand planning scenarios and explanation of the factors considered, including growth, climate change, sustainability reductions
Chapter 3 – Water Resource Zone Integrity	• Introduction to the use of Water Resource Zones. • Our WRZ approach in the WRMP 2019, including our decision to use 28 zones.
Chapter 4 – Demand management strategy	• Explanation of our decision to prioritise demand management. • Summary of strategic demand management options. • Our selected demand management strategy and decision making process.
Chapter 5 – Supply-side strategy	• Summary of our supply-side options. • Our Preferred Plan of supply-side options and explanation of our decision making process.
Chapter 6 – Preferred Plan	• Overview of our Best Value Plan twin-track approach. • Detailed description of selected options and benefits. • Assessment of deliverability, uncertainty and residual risk. • Alignment with resilience programme and wider regional strategy (WRE).
Chapter 7 – Forward Look	• Outline of our adaptive planning schemes and explanation of our approach. • Next steps in regional and national planning.
Appendix – Glossary	

1.2 Our planning objectives

Our planning objectives from the dWRMP have not changed. The overall aim of our WRMP is to develop a system of supply that is reliable, affordable and sustainable. This includes meeting customer and government expectations and complying with all statutory obligations. We have considered the scale and complexity of our planning problem, vulnerability to strategic issues, risk and uncertainties, together with the outcomes of customer and stakeholder engagement to develop the specific planning objectives listed below.

Reliable:

- Ensure our system is resilient to the combined effects of severe drought (defined as an event with an approximate one in 200 year return period) and climate change, so that none of our household and non-household customers are exposed to an unacceptable risk of standpipes and rota-cuts.

Sustainable:

- Provide enough water to meet local authority growth targets
- Meet all of our statutory environmental obligations. These include restoring abstraction to sustainable levels and preventing deterioration in water body status
- Make best use of available water resources, before developing new ones. This includes prioritising cost-beneficial demand management and trading to share any available surpluses, and
- Ensure that solutions for the WRMP 2019 are flexible enough to be adapted to meet unknown AMP8 needs, including possible future exports to Affinity Water (Central) and future sustainability reductions.

Affordable:

- Ensure the economic evidence used to develop our investment strategy is robust and transparent
- Clearly set out the bill implications of our investment strategy and ensure they are supported by customers
- Ensure our Preferred Plan represents 'best value' for customers over the long-term, and
- Minimise the risk of delivering assets that become stranded or under-utilised in the longer term.

Further details of our affordability and vulnerability strategy can be found in our PR19 Business Plan

1.3 Our business today

Anglian Water is the largest water and wastewater company in England and Wales by geographic area. We employ over 4,000 people and supply water and water recycling services to more than six million customers in the east of England and Hartlepool.

Our assets include:

- 143 water treatment works and 38,200 km of water mains
- 77,000 km of sewers and 1,130 water recycling centres (18 per cent of all those in England and Wales)
- Approximately 6,000 pumping stations, and
- A high proportion of meters with water consumption in more than four in every five households billed on a measured basis.

Our region

The East of England is the driest region in the UK, with low rainfall (71 per cent of the UK average) and high evaporation losses. Water resources are already under pressure: the region is designated by the Environment Agency as an area of serious water stress, and opportunities for new water resources are limited to winter storage, high summer river flows, water reuse and desalination.

Climate change projections show our region is expected to experience lower summer rainfall and increased evaporation, leading to lower groundwater recharge in the future. More frequent and intense downpours are also predicted. These could result in increased nitrate and pesticide run-off from fields, lowering the water quality of our region's rivers.

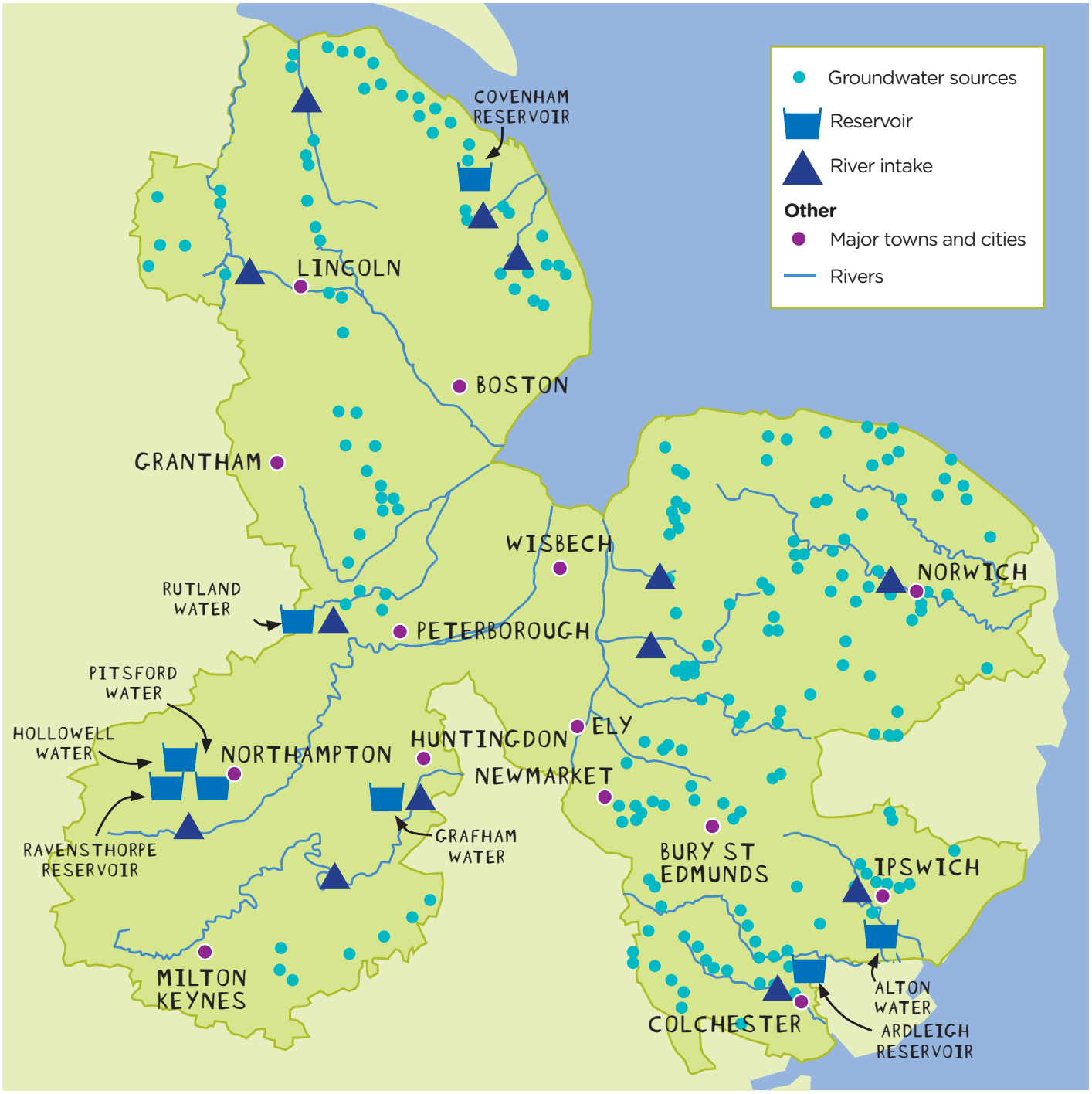
We value the environment: our business depends on a healthy, flourishing environment to supply clean water and receive recycled water after treatment. Our region is home to many internationally important wetland ecosystems that need protecting, including 40 Special Areas of Conservation (SAC)[1], 28 Special Protection Areas (SPA)[2] and 28 Ramsar wetlands[3]. In addition, many unique habitats are located within our area, including reedbeds, inter-tidal mudflats, and grazing marshes.

[1] *SAC is an area classified under the EC Habitats Directive and agreed with the EU to contribute to biodiversity by maintaining and restoring habitats and species.*
[2] *SPA is an area classified under the EC Birds Directive to provide protection for birds, their eggs, nests and habitats.*
[3] *An area of international conservation importance classified at the 'Convention on Wetlands of International Importance' 1971, ratified by the UK Government in 1976.*

Our region is predominantly agricultural, producing half of the UK's sugar beet, a third of its potatoes and a quarter of its wheat. This means our region is a major contributor to national food security and prosperity, creating jobs and opportunities. However, there is potential for challenges to the environment and water supply for example from pesticides and other agricultural by-products. That is why we work in partnership with landowners to promote best practice in sustainable pesticide use and the prevention of soil erosion.

Our region is one the fastest growing. The number of households we supply has grown by over 30% since the water industry was privatised in 1989, and is expected to grow rapidly in coming decades.

Figure 1.2: Our region's groundwater and surface water sources



Our water sources

We abstract from a combination of groundwater and surface water sources. On average we abstract 1,050 Ml of water per day (Ml/d) for storage and treatment. Abstraction can peak up to approximately 1,400 Ml/d during high demand periods, as was experienced during the recent hot, dry weather of summer 2018.

In the west of our region, water supply is mainly provided by the large pumped storage reservoirs of Rutland Water, Grafham Water and Pitsford Water. We also operate pumped storage reservoirs at Alton Water, Covenham Reservoir and Ardleigh Reservoir (shared with Affinity Water under the Ardleigh Reservoir Order), and two natural catchment reservoirs. Our eight raw water reservoirs, along with eight direct supply river intakes, provide approximately 50 per cent of our water supply.

The remaining 50 per cent of supply is from groundwater abstraction. This means of supply is complex. It involves over 200 water sources and over 450 boreholes ranging in depth from only 10m to 500m which are sited in many different types of rock. The rock type affects the chemical composition of the water and so it needs bespoke treatment and management.

The greenhouse gas emissions from our water operations was 142 $ktCO^2e$, in the base year (2017-18).

1.4 Developing our dWRMP

Water companies have a statutory obligation to prepare and maintain a WRMP. In the WRMP, companies must set out how they will ensure that they have sufficient water resources to meet the current and future demands of their customers, over a minimum 25 year period. WRMPs are published on a five-yearly basis and must follow the Water Resources Planning Guideline[4]. Development of the dWRMP follows the following process:

- Release of new Direction – Spring 2017
- Pre-consultation – Spring 2016 to Autumn 2017
- Submission of dWRMP for security checking – 1 December 2017
- Public consultation – March to June 2018
- Statement of Response – September 2018, and
- Authorisation to publish WRMP – subject to Secretary of State approval.

Summary of our dWRMP (March 2018):

- We created two planning scenarios to manage uncertainty over the scale of sustainability reductions required in AMP8 (2025-30) and ensure we have the flexibility to meet unknown AMP8 needs, including possible future exports to Affinity Water and South Staffs Water (Cambridge Water).
- Our Principal Planning Scenario included the confirmed impacts of growth, climate change, sustainability reductions and severe drought. The Adaptive Planning Scenario built on this to include additional uncertain impacts from sustainability reductions and future exports in AMP8.
- Our Preferred Plan addressed the deficits identified in the Principal Planning Scenario by prioritising demand management, to meet customer and government expectations on leakage reductions. By using new technology and innovation, including smart metering and leakage detection techniques, demand savings of up to 43 Ml/d by the end of AMP8 (2020-25) were identified.
- Our preferred supply-side strategy was based on schemes selected using the Principal Planning Scenario. The Adaptive Planning Scenario was then used to identify opportunities to 'future proof' our plan against identified future uncertainties.
- Our supply-side strategy consisted of: trading water with Severn Trent Water and Affinity Water, increasing the connectivity of our network to create a strategic grid, and the development of new resources for the treatment and transfer of surplus water from northern Lincolnshire.
- Our Adaptive Planning Scenario showed that large supply options, such as a new winter storage reservoir, desalination and water reuse may be required by AMP8 (2025-30). Considering the long lead times required to plan for these schemes we included investment for pre-planning work.

[4] *Environment Agency & Natural Resources Wales, April 2017, 'Water Resources Planning Guideline: Interim update'*

We published our dWRMP in January 2018. Our dWRMP was subject to the full 12-week consultation process, allowing interested stakeholders and customers to review and comment upon our proposals.

We posed six questions during the consultation, focusing on the key long-term planning challenges we face. A summary of the basis for each question and the questions themselves are given in the box below:

Consultation on our dWRMP 2018

1. Do you agree with our approach of planning to meet local authority growth targets, or should we switch to an approach of using trend-based projections using past delivery rates?
Growth is a key challenge our WRMP sets out to meet. We have used the latest local authority growth targets to develop our strategy, ensuring there will be enough water to meet these targets. We have taken this approach because housing growth is regularly cited as a top priority for national and local Government. Of course, targets do not always turn into achieved growth and currently, in some areas, local growth targets are not quite being met.

2. Are we right to prioritise demand management?
We have developed an ambitious, cost-beneficial demand management strategy that will more than offset the effects of growth. Using new technology and innovation, our strategy will unlock estimated demand savings of up to 43 Ml/d by the end of AMP7 (2020-25), and 123 Ml/d by the end of the planning period (2045). The success of our strategy depends on action by us and by our customers. Given the innovative nature of our approach, the savings that our strategy will deliver are uncertain.

3. Should we consider compulsory metering in AMP7?
The results from multiple sources show that generally, customers are much more supportive of compulsory metering than has been the case previously. However, customers who pay measured charges tend to support compulsory metering, whereas those who pay unmeasured charges do not. We believe the higher levels of support for compulsory metering reflect the larger proportion of customers paying measured charges compared to previously, and we have not included compulsory metering in our dWRMP 2019.

4. We have used the scheme selection in the Adaptive Planning Scenario to identify opportunities to 'future proof' our Plan against potential AMP8 sustainability reductions, by increasing option capacity. Should the investment programme that we deliver include this additional investment?
We have used the scheme selection in the Adaptive Planning Scenario to identify opportunities to 'future proof' our Plan against potential AMP8 sustainability reductions, by increasing option capacity. It would cost an additional £88 million to 'future proof' our Plan, which equates to an additional bill impact of around £1.70 per annum on average customer bills by 2025.

5. Our Plan is designed to increase our resilience to drought, so that no customers are exposed to a risk of rota-cuts and standpipes in a severe drought event. Is this an acceptable strategy?
Our Plan is designed to increase our resilience to drought, so that no customers are exposed to a risk of rota-cuts and standpipes in a severe drought event. The investment required to increase resilience to drought is relatively modest, and equates to approximately £2.20 per annum on the average household bill by 2025 (assuming the other factors that influence bills remain unchanged).

6. Should we delay investment in climate change?
Climate change is one of the key strategic risks our business faces. As a result, we have decided to adopt the Environment Agency's 2017 method for calculating the impact of climate change. Using this method shows that there would be a sizeable impact of climate change on the deployable output (DO) in 2024-25. One option is to defer this impact and the associated investment needed until 2029-30. Doing so would remove circa £300 million from the AMP7 investment programme, which equates to a bill increase of around £6.10 p.a. on average customer bills by 2025 (assuming the other factors that influence bills remain unchanged).

We also consulted extensively with our customers on the acceptability of our dWRMP using a range of methods. These activities were linked directly to our wider PR19 customer enagagement programme.

Table 1.2: Summary of customer engagement

Method	Summary
Focus groups	Seven focus groups held across the region including Hartlepool, with attendees drawn from diverse groups including vulnerable customers.
Online community	**dWRMP** Deliberative research via our online community to test the acceptability of the dWRMP and explore consultation questions, including: should reducing demand be a priority, the extent to which customers are willing to change their behaviours, compulsory metering, approach to climate change and future proofing.
	PR19 (draft plan) A community of 500 customers was taken through a six-week programme of activities. Consultation topics were reviewed in detail, to produce a mixture of qualitative research results and votes on key questions.
Acceptability research	Quantitative survey of 1,600 households including Hartlepool and 500 non-household customers, with robust representative sample quotas, looking in detail at the consultation topics.
H_2OMG	In August 2017 we held a week-long water festival in Norwich called H2OMG, where 33,000 visitors were able to interact with fairground themed attractions, all based on the water resource challenges we face, to elicit customers preferences in how we should tackle them.
H_2O Let's Go	Tour with electric vehicle around our region to 14 sites. The main method of engagement was our 'Be the Boss'[5] tool. 'Be the Boss' was also promoted through My Account home page, and directly to 330,000 customers via email.
Stakeholders	Stakeholder summary prepared and sent to 378 VIP stakeholders.
Retailers	As part of regular meetings with retailers, we asked a series of questions about the outline plan. Five retailers' meetings took place during the consultation window.
Customer Board	Meeting held in April 2018, where responses to the Customer Board's top 10 questions on the plan were presented.

[5] *'Be the Boss' was designed as an interactive, fun, digital engagement channel to consult with customers on the key questions in our outline plan.*

Consultation question responses

The consultation question responses showed strong overall support for our dWRMP approach, particularly our use of local authority growth targets, prioritisation of demand management and our proposed investments in adaptive planning and drought resilience.

The table below summarises the consultation responses by question.

Table 1.3: Summary of consultation question responses

Question	Summary
1	All respondents agreed that local authority growth targets were the most appropriate data source for our demand forecasts. Some respondents added it would be beneficial to work with local authorities and to monitor housing delivery throughout the five year planning cycle.
2	All respondents but one[6] agreed that we should prioritise demand management strategies. Some respondents emphasised the importance of continuing to develop supply-side options to mitigate forecasted deficits, particularly in the longer term.
3	Respondents had a range of views on compulsory metering. Local authority responses generally either agreed that water meters should remain voluntary, emphasised the need for more evidence of the benefits of compulsory metering, or declined to comment. Other stakeholders, including the water retail companies and the NFU, supported the introduction of compulsory metering.
4	All respondents supported investment in our Adaptive Plan to 'future proof' our strategy against identified uncertainties. Some respondents added that it would be beneficial to review the need for adaptive planning investments on an on-going basis.
5	All consultation responses agreed with our proposed strategy to increase resilience to drought.
6	Most respondents believe that investment in climate change should not be delayed. Their responses highlighted that postponing investment may increase the risk of prohibitive restrictions (e.g. rota cuts and standpipes). The need to spread long-term investments over time to avoid spikes in bills was also highlighted. Some respondents commented that there were also merits for delaying investment, as it would allow more time for evidence to be collected, potentially leading to a more effective longer-term plan.

Wider feedback on our dWRMP

More detailed feedback on our dWRMP from the Environment Agency and Ofwat showed support for our ambition to improve resilience to drought and do the right thing for our customers and the environment in the long-term. Both welcomed our demand management proposals to reduce leakage and per capita consumption. Our engagement work with our regional partners via WRE was praised and encouraged to continue.

Our regulators also identified areas where further development and explanation was required. Our supply forecast (Chapter 4), including the timing of climate change impacts and sustainability reductions, coupled with the selection of an updated, single Preferred Plan (Chapter 7) were identified as the most significant development areas. See table overleaf for further detail.

[6] *Huntingdonshire District Council commented that supply and demand options should be given equal priority.*

Table 1.4: Main areas of development identified from our dWRMP consultation

Supply Forecast	Preferred Plan
• Clarity on risks to security of supply, including delay of showing the impacts of climate change and incorporation of changes to time-limited licences that are due to be reappraised in 2022. • Clarification of hydrological yield and deployable output from Hall WTW. • Clarification of bulk transfers required by neighbouring companies and their impacts on our plan. • Further detail on sustainability reduction risks faced by neighbouring companies and their impact.	• Improved justification of investment decisions to provide customers with confidence that they have a secure supply of water at all times and that the environment is protected. • Improved justification of our chosen investment plan (demand and supply), to demonstrate our solutions are appropriate, have considered key uncertainties and are deliverable within proposed timelines (including customer support). • Set out our approach to manage uncertainty and deliverability risk associated with our proposed 2020-25 investment programme. • Further detail on our plans to develop shared resources that may benefit other water companies and non-water companies.

Reshaping the dWRMP

The constructive feedback we received from the consultation process has played a significant role in shaping our revised dWRMP.

The key changes we made to the modelling assumptions used in our dWRMP Principal Planning Scenario are set out in the table below.

Given the strong positive feedback received during our consultation, our demand management strategy has remained unchanged from the dWRMP.

Table 1.5: Key changes between dWRMP and revised dWRMP

	dWRMP	revised dWRMP
Supply forecast	• Climate change impacts in AMP7 from 2024-25. • Sustainability reductions phased over AMP7 and AMP8. • Drought impacts in AMP7.	• **Climate change impacts in AMP7 from 2020-21.** • **Sustainability reductions take effect in AMP7.** • Drought impacts in AMP7.
Demand forecast	• 2015-16 base year. • Housing forecast based on local authority plans.	• **Updated to 2017-18 base year.** • **Housing forecast based on local authority plans but re-profiled in early AMP7 to take account of recent build rates.**
Neighbouring company trades	• Grafham reverse trade available from Affinity Central until 2029 (18 Ml/d). • Ardleigh agreement with Affinity Water East 70:30 in our favour for entire 25 year plan.	• **Grafham reverse trade not included.** • **Ardleigh agreement with Affinity Water East 50:50 from 2025.**

Adaptive Planning Scenario	• Single scenario selected, to include AMP8 Sustainability reductions and 60 Ml/d exports (50 Ml/d to Affinity Central, 10 Ml/d to Cambridge).	• **Best Value Plan stress tested using multiple scenarios, including:**
		  • **50 Ml/d exports (Affinity only)**
		  • **Demand savings scenarios**
		  • **Extreme drought scenarios, and**
		  • **Alternative climate change scenarios.**

Note: changes between the Draft Plan and revised dWRMP are highlighted in **purple**.

2 THE SCALE OF THE CHALLENGE

2.1 Introduction

This chapter describes the pressures we face and their impact which affect our supply-demand balance. We also outline our problem characterisation assessment and highlight the nature of the risks these problems pose for us.

The chapter then describes each impact in more detail and presents the data that has gone into our supply-demand balance calculations, before summarising our baseline supply-demand balance for the 25-year planning period.

Using outputs from the WRE initiative, we then consider the longer term regional context, looking at our needs alongside those of other abstractors and users of water in the East of England.

Finally, the chapter highlights some of the challenges that we face at a Water Resource Zone (WRZ) level in parts of our supply system.

2.2 Problem characterisation

We have completed a problem characterisation assessment, in accordance with UKWIR technical guidance[1]. The problem characterisation process identifies the scale and complexity of our water resources planning problem and our vulnerability to strategic issues, risk and uncertainties. There are two elements to the assessment: strategic needs (the size of the problem) and complexity factors (how difficult is it to solve). A score of 'low level of concern' suggests that the industry standard Economics of Balancing Supply and Demand (EBSD)[2] approach to decision making is adequate, and the use of additional decision-making tools is not recommended.

We completed a draft problem characterisation assessment in June 2016, which was discussed with the Environment Agency at various stages of pre-consultation. The results showed moderate to high levels of concern across our region. This was primarily driven by uncertainty associated with complexity factors, including vulnerability to severe drought and deployable output calculations[3].

Since completing the draft assessment, we have significantly improved our understanding of the planning problem. For example, we carried out further modelling to allow us to refine our understanding of current deployable output. We also completed a detailed analysis of our vulnerability to severe drought and an extensive programme of customer engagement to explore trade-offs related to our WRMP.

In our final problem characterisation we have updated our assessment to reflect this improved understanding. The final assessment confirms that our supply-demand balance is under significant pressure; however, the associated complexity is greatly reduced. Consequently we are facing lower concerns across our region compared with the draft assessment, and the EBSD approach to decision making is appropriate for use in our dWRMP. Nonetheless, we have supplemented the EBSD approach by using a set of 'best value' criteria in developing our Preferred Plan. Further detail is provided in the description of the Final problem characterisation in the Managing Uncertainty and Risk supporting technical document.

2.3 Impacts on our supply-demand balance

Future supply-demand balances are forecast at the WRZ level. WRZs describe a discrete area where the resource units, supply infrastructure and demand centres are linked such that customers in the WRZ experience the same risk of supply failure. Further detail on how WRZs are used in long-term water resource planning and how the 28 WRZs used in our revised dWRMP were determined is provided in chapter 3.

For each WRZ, the impacts of population growth, sustainability reductions, drought and climate change are modelled up to 2045, and the resulting supply-demand balance determined.

In supply-demand planning, population and housing growth is the dominant factor that drives increased demand for water.

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[1] *UKWIR (2018), – Decision Making Process: Guidance'*
[2] *UKWIR (2012), 'The economics of balancing supply and demand' (WR27 water resources tools project)*
[3] *As part of the WRMP process, water companies need to determine how much water is available to them. They do this through calculating deployable output (DO), which is essentially the volume of water that each water treatment works can put into supply. Multiple factors are considered in the calculation of DO, including the hydrological yield of abstraction sources (assessed against the historic hydrological record), treatment works capacity, licensed volume and any licence constraints, such as Hands Off Flow conditions.*

The other impacts (sustainability reductions, drought and climate change) reduce the amount of water we have available to supply (deployable output). Each of these impacts may affect the same water sources; as such, we have avoided double counting by adopting an order of impact:

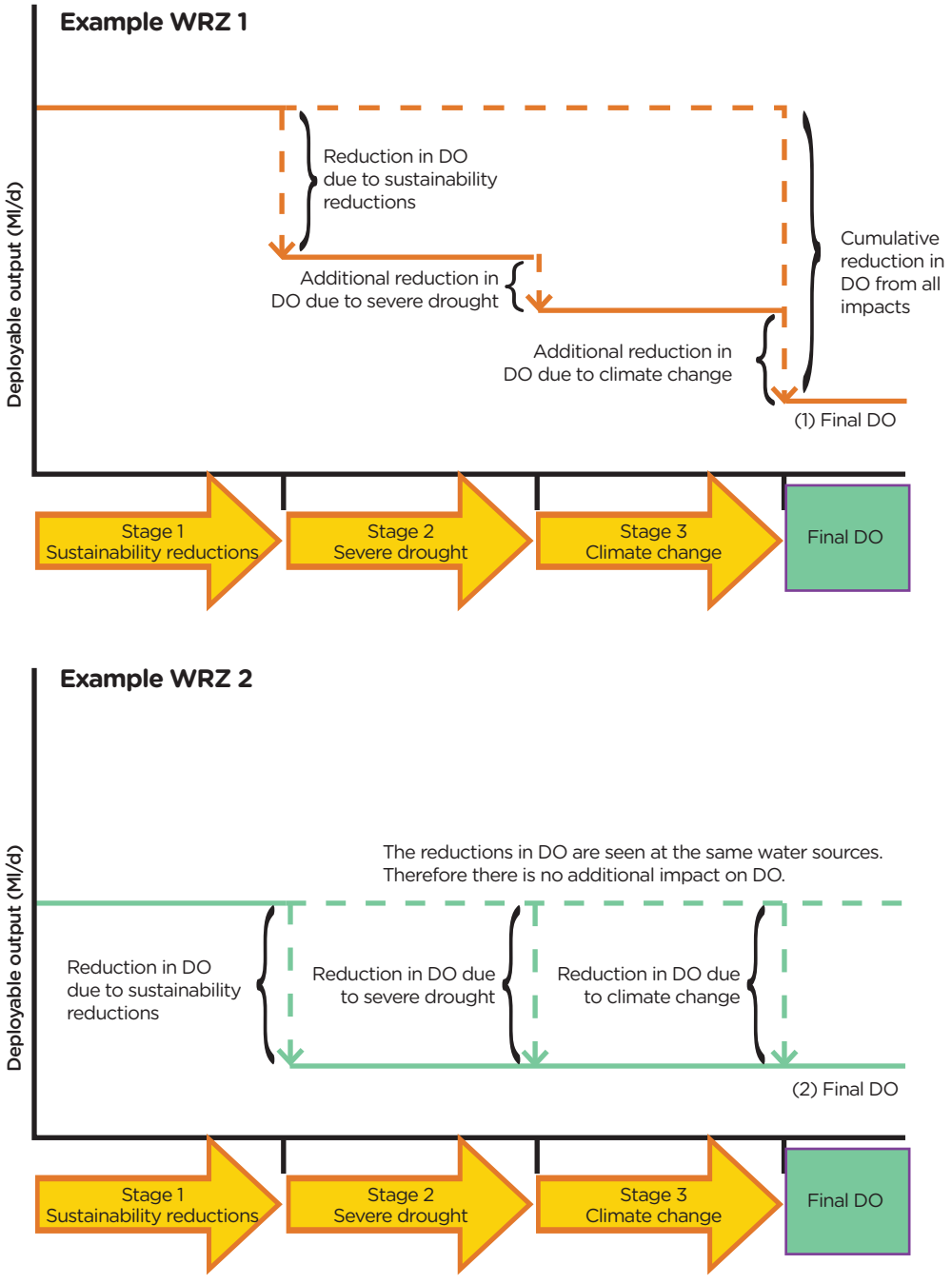
1. Sustainability reductions
2. Drought, and
3. Climate change.

The order of impact reflects changes to licences first, then Levels of Service, followed by other changes in deployable output.

The order of impact process ensures that WRZs which may be vulnerable to more than one impact do not see an unrealistically high deployable output impact in supply forecasting. Figure 2.1 explains the process using two representative theoretical WRZs. The impact maps in this section (figures 2.4 and 2.5) distinguish between WRZs where there is vulnerability, and where there is a resulting deployable output impact.

Further explanation of our deployable output assessment and how the impacts have been calculated is detailed in the Supply Forecast supporting technical document.

Figure 2.1: The effects of our adopted order of impact on deployable output (DO) on two representative theoretical WRZs with multiple supply impacts



In both examples, sustainability changes are applied to the deployable output model, resulting in a deployable output reduction. Drought inputs are subsequently run through the revised model, to identify additional drought impacts. This version of the model is then run again with climate change inputs. Modelling in this way allows each impact to be quantified and avoids double counting.

In example WRZ (1), there is both additional drought and then climate change deployable output reductions realised in the modelling, resulting in a cumulative total impact on the final deployable output. In example WRZ (2), no additional impact from either drought or climate change has been realised, and therefore there is only a sustainability reduction on the final deployable output.

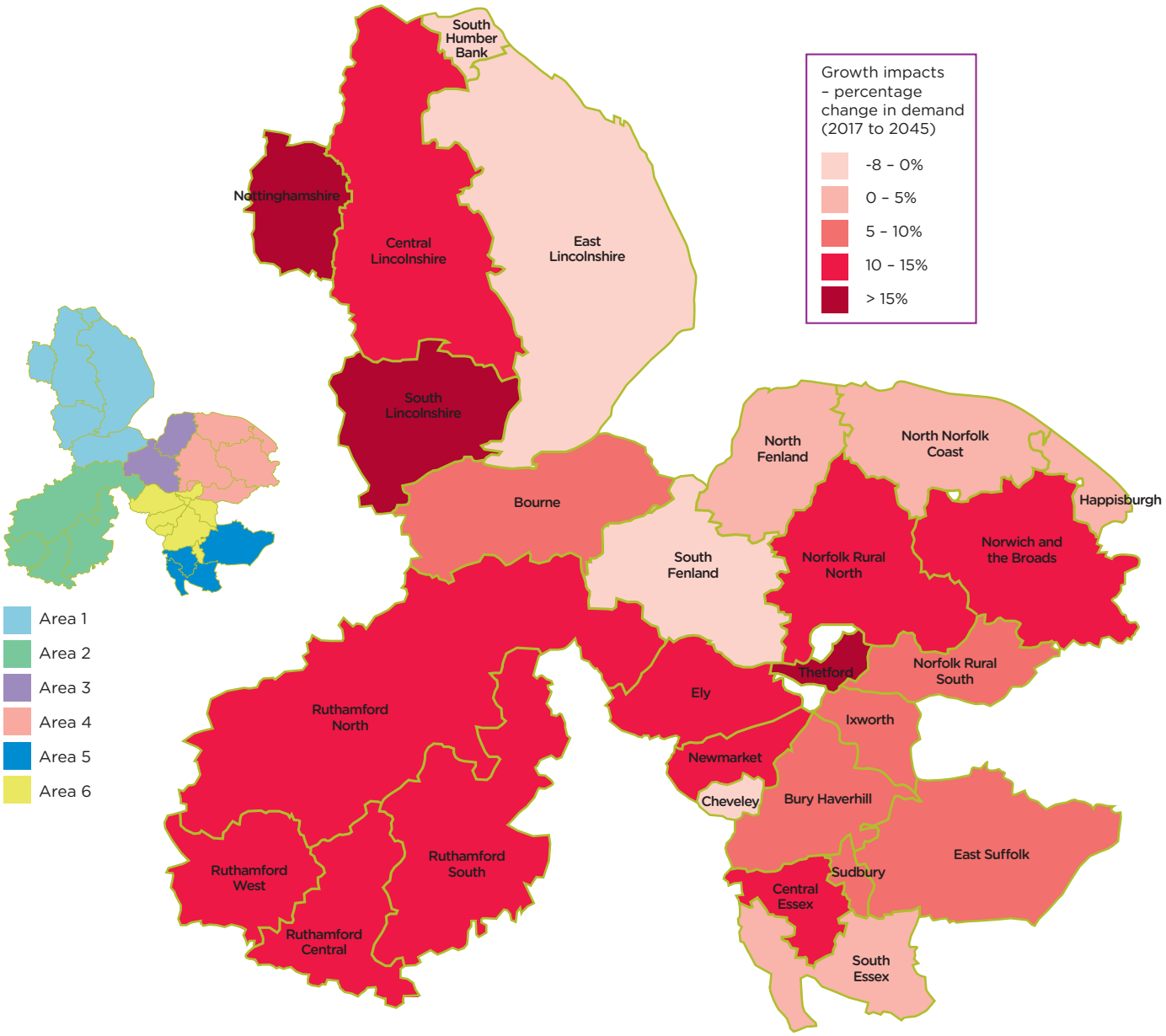
2.3.1 Population growth

We have used the latest local authority targets as the basis for forecasting population growth in our region, as these offer the most comprehensive source and are supported by significant analysis. Our baseline Dry Year Annual Average[3] (DYAA) forecast was also adjusted to account for forecast climate change impacts, population growth, changes in household size (occupancy for both measured and unmeasured customers), changes in property numbers, and the 'Business as usual water efficiency programme' (BUSWE).

Overall, total demand (household and non-household) is projected to increase by 109 Ml/d from 1,131 Ml/d to 1,240 Ml/d between the base year (2017-18) and 2045, assuming no further action is taken to manage demand. This increase is driven by population growth; our demand forecast projects the regional population will increase by over a million people and half a million properties between the base year and 2045. Non-household demand is projected to decrease slightly over the same period, from 275 Ml/d to 273 Ml/d.

The growth impacts in each WRZ are shown in figure 2.2 below and table 2.1 overleaf. We group our WRZs by area. These are the areas used in our problem characterisation assessment. There are a number of WRZs with particularly high levels of forecast growth. Nottinghamshire, South Lincolnshire and Thetford WRZs are particularly affected, with demand forecast to increase by more than 15 per cent between the base year and the end of the planning period in 2045.

Figure 2.2: Population growth impacts on demand between 2017 to 2045 (DYAA)



[3] *The dry year annual average represents a period of low rainfall and unrestricted demand and is used as the basis of a water company's WRMP.*

Table 2.1: Population growth impacts on demand between 2017 and 2045 (DYAA)

Area	Water Resource Zone	Growth impacts* (Ml/d)	Percentage change (%)
1	Bourne	3.56	8.57
	Central Lincolnshire	13.10	13.14
	East Lincolnshire	-2.21	-2.11
	Nottinghamshire	10.35	15.72
	South Humber Bank**	–	–
	South Lincolnshire	1.89	16.99
2	Ruthamford Central	28.92	13.18
	Ruthamford North	14.51	13.93
	Ruthamford South	2.94	13.03
	Ruthamford West	8.30	14.24
3	North Fenland	0.42	1.62
	South Fenland	-0.27	-1.02
4	Happisburgh	0.08	2.12
	North Norfolk Coast	1.08	4.98
	Norfolk Rural North	3.31	14.04
	Norfolk Rural South	6.02	9.08
	Norwich and the Broads	2.02	10.29
5	Central Essex	1.14	13.32
	East Suffolk	5.34	7.78
	South Essex	0.33	1.05
6	Bury Haverhill	1.65	5.87
	Cheveley	-0.11	-7.77
	Ely	2.30	11.41
	Ixworth	0.33	7.37
	Newmarket	1.36	12.48
	Sudbury	0.44	6.34
	Thetford	3.07	33.89
7	Hartlepool	-0.48	-1.85
TOTAL		109.39	9.67

*Forecast increase in Distribution Input, based on DYAA scenario

**The South Humber Bank Water Resource Zone is a non-potable WRZ and therefore has no household demand increases.

2.3.2 Sustainability reductions

We value the environment: our business depends on a healthy, flourishing environment to supply clean water and receive recycled water after treatment. Our area is home to important wetland ecosystems that need protecting.

We have been proactive in assessing the impact of our abstractions on the environment since AMP3 (2000-05), and have continued to work with the Environment Agency and Natural England to develop approaches that maintain the balance between environmental need and public water supply. This includes promoting investigations and options appraisals through the AMP3 National Environment Programme (NEP), the AMP4 Water Resources Environment Programme (WREP), the AMP5 NEP and the AMP6 NEP. This work is driven by the Water Framework Directive (WFD) 2000, Habitats Directive 1992, and the Wildlife and Countryside Act 1981.

We are required to take action where it is confirmed or likely that an abstraction is having a potential impact, and review options according to cost effectiveness, cost benefit, feasibility, affordability, and benefits. The solution could be either a reduction of the abstraction licence volume (also known as a sustainability change), or a mitigation option, or a combination of both.

Note that a reduction in licensed volume does not necessarily result in a reduction in deployable output. Reductions in deployable output that are caused by sustainability changes are referred to as 'sustainability reductions'.

The AMP6 NEP programme specified 28 waterbodies and designated sites where the Environment Agency suspected that our current abstractions were causing, or had the potential to cause, environmental harm. An extensive investigation and options appraisal process resulted in the development of solutions that will deliver environmental benefits and provide the best value for our customers. We have agreed the mitigation measures and sustainability changes that we need to deliver in collaboration with the Environment Agency and Natural England. These are set out in the AMP7 Water Industry National Environment Programme (WINEP).

In AMP7, we will be implementing a significant number of sustainability reduction schemes including schemes for the River Lark, River Nar, Catfield Fen, River Idle, River Poulter, and Bumpstead Brook. In some cases, we have agreed to implement mitigation schemes alongside smaller sustainability changes, rather than accept full sustainability changes. We call these the 'WINEP mitigation options', and they include options such as river restoration, river support, and adaptive management. We will deliver all of these obligations by March 2025.

We are also committed to delivering a scheme in the Happisburgh WRZ by March 2021 to mitigate any impacts that our groundwater abstraction may be having at Catfield Fen.

It is worth noting that the sustainability changes listed in the WINEP are based on the assumption that the selected WINEP mitigation options are implemented. If they were not delivered, the sustainability changes required would be much greater.

In addition to the AMP6 NEP investigation and options appraisal work, sustainability changes are also being driven by the need to prevent any potential deterioration. The Water Framework Directive (WFD) objective aims to 'prevent deterioration of the status of all bodies of surface water and groundwater' from the Environment Agency's 2015 'River Basin Management Plan' (RBMP) classifications. This is often referred to as WFD 'no deterioration'. As such, we are obligated to ensure that deterioration of the environment does not occur as a result of abstraction for public water supply.

In order to address this, and through collaboration with the Environment Agency, we assessed our abstractions and the risk they pose to waterbodies based on future forecast growth. We agreed a prioritised programme of investigations into the risk of deterioration as per Environment Agency guidance and planned to investigate all higher priority and time-limited licences in AMP7, in preparation for implementation of the AMP8 sustainability changes. This was reflected in the WINEP and fed into our Adaptive Plan in the dWRMP.

However, we recognise that we have a duty to ensure that deterioration of the environment does not occur in the meantime. This is particularly important due to the water stressed nature of our region. As such, we have committed to maintaining all of our groundwater abstractions below recent historical abstraction rates in order to eliminate the risk of deterioration. This is ahead of formal licence changes which are expected in 2022 (for time-limited licences) and AMP8 and beyond (for permanent licences). In order to address this change and take account of the uncertainties surrounding future abstraction licence volumes, we have assessed the impact of sustainability changes on all groundwater sources in 2022 in our supply forecast, and this is reflected in our revised dWRMP.

Surface water abstractions do not pose a significant deterioration risk due to existing licence constraints such as Hands Off Flow and Minimum Residual Flow conditions, and hence no sustainability changes related to WFD 'no deterioration' are expected.

Further detail is provided in the Sustainable Abstraction supporting technical document.

2.3.2.1 Impact on deployable output

The sustainability reduction impacts are outlined in figure 2.3 and table 2.2. The overall regional impact of sustainability reductions on deployable output is 83.5 Ml/d.

Figure 2.3: WRZs affected by sustainability reduction impacts

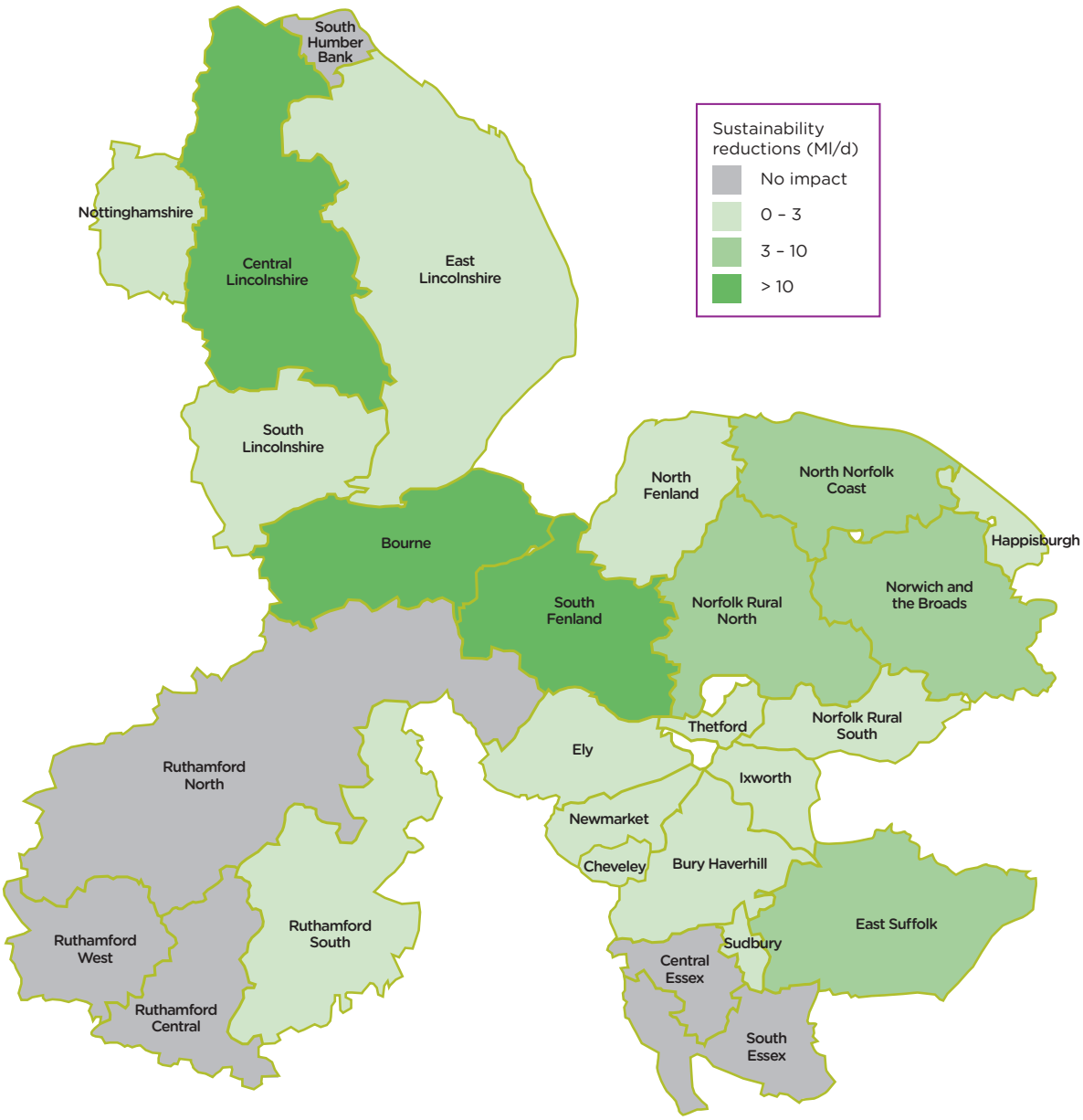


Table 2.2: WRZs affected by sustainability reduction impacts

Area	Water Resource Zone	2021 Impacts (Ml/d)	2022 Impacts (Ml/d)	2024 Impacts (Ml/d)	2025 Impacts (Ml/d)	Total Impacts (Ml/d)
1	Bourne	–	11.0	–	–	11.0
	Central Lincolnshire	–	12.0	1.0	–	13.0
	East Lincolnshire	–	3.0	–	–	3.0
	Nottinghamshire	–	2.0	–	–	2.0
	South Humber Bank	–	–	–	–	–
	South Lincolnshire	–	2.0	–	–	2.0
2	Ruthamford Central	–	–	–	–	–
	Ruthamford North	–	–	–	–	–
	Ruthamford South	–	2.0	1.0	–	3.0
	Ruthamford West	–	–	–	–	–
3	North Fenland	–	3.0	–	–	3.0
	South Fenland	–	–	–	13.0	13.0
4	Happisburgh	1.3	–	–	–	1.3
	North Norfolk Coast	–	4.0	–	–	4.0
	Norfolk Rural North	–	2.0	2.0	–	4.0
	Norfolk Rural South	–	1.0	–	–	1.0
	Norwich and the Broads	–	5.0	–	–	5.0
5	Central Essex	–	–	–	–	–
	East Suffolk	–	–	5.0	–	5.0
	South Essex	–	–	–	–	–
6	Bury Haverhill	–	0.0	3.0	–	3.0
	Cheveley	–	0.1	–	–	0.1
	Ely	–	1.0	2.0	–	3.0
	Ixworth	–	–	3.0	–	3.0
	Newmarket	–	1.0	–	–	1.0
	Sudbury	–	1.1	–	–	1.1
	Thetford	–	2.0	–	–	2.0
7	Hartlepool	–	–	–	–	–
TOTAL		1.3	52.2	17.0	13.0	83.5

2.3.3 Climate change

We have undertaken a vulnerability assessment for climate change, consistent with the Environment Agency's 2017 climate change assessment methodology[4]. The guidance states that companies must take account of the fact that the climate has changed and will continue to change, and the 2017 methodology is designed to better account for climate change impacts on current deployable output.

As part of the dWRMP consultation process, we sought views on a proposal to defer investment in climate change until AMP8 to reduce the immediate impact on customer bills. The consultation feedback from the Environment Agency was clear that deferring this investment was not considered to be appropriate. We have, therefore, included all climate change impacts immediately at the start of the planning period in 2020. This has been brought forward from 2024-25, as detailed in the dWRMP.

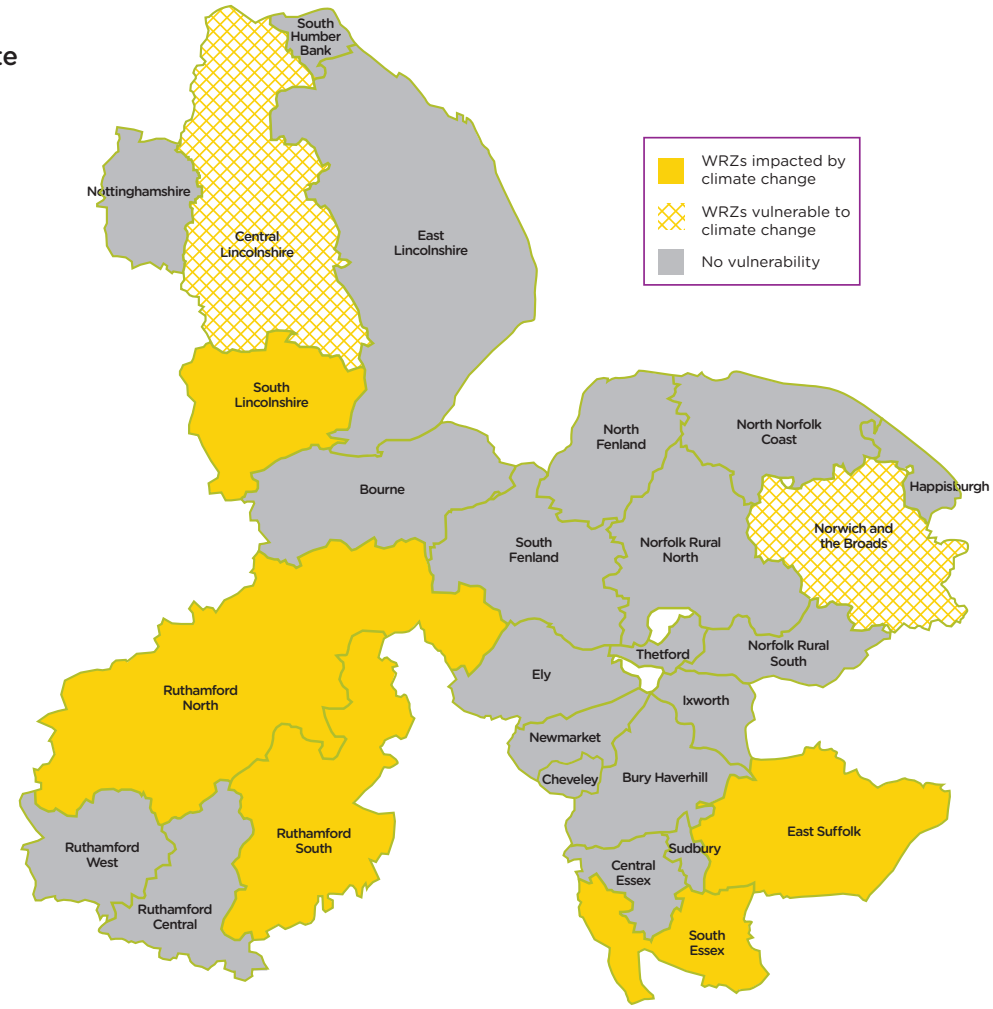
Adopting the new methodology and factoring in the consultation feedback has resulted in a large initial climate change impact in 2020 (which is the impact of historical climate change), which increases year on year throughout the planning period to 2045.

Our climate change impact assessment confirms that our most vulnerable sources are our winter storage reservoirs and direct abstraction river intakes. Material impacts (large enough to decrease deployable output) are experienced in:

- **South Lincolnshire,** due to groundwater vulnerability
- **Ruthamford North,** particularly vulnerable sources include the River Nene (which feeds Pitsford and Rutland reservoirs), the River Welland (which feeds Rutland reservoir), and Hollowell and Ravensthorpe reservoirs which refill naturally from local watercourses
- **Ruthamford South,** where the majority of the impacts results from vulnerability on the River Ouse, which feeds Clapham intake and Grafham Water, and
- **East Suffolk and South Essex,** where particularly vulnerable sources include the River Colne (which feeds Ardleigh Reservoir) and the River Gipping (which feeds Alton Water).

The climate change impacts are outlined in figure 2.4 and table 2.3. The overall regional impact of climate change on deployable output is 55.2 Ml/d.

Figure 2.4: WRZs affected by climate change impacts by 2045



[4] *Environment Agency (2017), 'Estimating impacts of climate change on water supply'*

Table 2.3: WRZs affected by climate change impacts

Area	Water Resource Zone	Climate change impacts (Ml/d)	
		Impact in 2020	Total impact by 2045
1	Bourne	–	–
	Central Lincolnshire	–	–
	East Lincolnshire	–	–
	Nottinghamshire	–	–
	South Humber Bank	–	–
	South Lincolnshire	1.2	1.9
2	Ruthamford Central	–	–
	Ruthamford North	18.1	27.8
	Ruthamford South	15.4	23.7
	Ruthamford West	–	–
3	North Fenland	–	–
	South Fenland	–	–
4	Happisburgh	–	–
	North Norfolk Coast	–	–
	Norfolk Rural North	–	–
	Norfolk Rural South	–	–
	Norwich and the Broads	–	–
5	Central Essex	-	–
	East Suffolk	0.8	1.3
	South Essex	0.4	0.6
6	Bury Haverhill	–	–
	Cheveley	–	–
	Ely	–	–
	Ixworth	–	–
	Newmarket	–	–
	Sudbury	–	–
	Thetford	–	–
7	Hartlepool	–	–
TOTAL		36.0	55.2

2.3.4 Severe drought

Since the 2011-12 drought, we have been concerned that parts of our system are vulnerable to drought and we would not be able to maintain supplies to customers without imposing severe restrictions, which include rota-cuts and standpipes.

What happened in the 2011-12 drought

2011

- On the 10 July 2011, the Secretary of State announced that the Environment Agency's Anglian region had moved to drought status, as a result of nearly six months of exceptionally low rainfall and the soil moisture deficit being at its highest recorded level.
- This exceptionally low rainfall in 2010 and 2011 had a significant impact on flows in the River Nene, and affected our ability to refill Pitsford Reservoir and Rutland Water.
- As a precautionary measure, we secured two drought permits on the River Nene.

2012

- By March 2012 it was being reported as the driest 18 months ever recorded.
- The low reservoir storage situation in March 2012 was compounded by low river flows across the Anglian region impeding refill opportunities. In addition, the drought area was starting to extend into our groundwater system.
- On 5 April 2012 we imposed Temporary Use Bans on our customers for the first time in 20 years, alongside six other water companies in the south and east of England.
- At that time, we were growing increasingly concerned about the potential impact of a third dry winter, and that we would not be able to maintain supplies to customers in our Ruthamford WRZs without imposing severe restrictions.
- We responded to this risk by:
  - Reducing our leakage to record low levels (189 Ml/d, 10% below our target of 211 Ml/d)
  - Launching Drop 20, our biggest ever water-saving campaign, where we asked every customer to reduce their daily use by 20 litres
  - Identifying and delivering a £47 million programme of capital investment to increase our resilience and protect customers' supplies, and
  - Leading the industry-wide response through the National Drought Management Team.
- The drought was brought to a rapid conclusion by six months of record-high rainfall between April and September 2012.
- We lifted the restrictions on 14 June 2012; just 10 weeks after they had started.

As a result of this experience, in preparing our dWRMP we thought carefully about what Levels of Service are appropriate for our customers and our region. We believe that our Levels of Service for Temporary Use Bans (10 per cent annual average risk) and Non-Essential Use Bans (2.5 per cent annual average risk) are appropriate and we do not propose to make any changes to them in our revised dWRMP 2019.

However, we do not believe that our current Level of Service for severe restrictions (one percent annual average risk) is appropriate or acceptable. We also believe that we should be planning for future droughts that may be worse than we have historically seen, and therefore our objective is to ensure that no customers are exposed to the risk of standpipes and rota-cuts in a severe drought event by the end of AMP7. We are therefore proposing to move to a new Level of Service for severe restrictions (less than 0.5 percent annual average risk).

Drought terminology

Historic drought – refers to the worst historic drought on record, which we planned for in our 2015 WRMP. This was previously assumed to be drought events with approximately a one in 100-year return period.

Severe drought – refers to drought events with approximately a one in 200-year return period. We describe these events as having a 12 per cent chance of occurring over a 25-year planning period.

Extreme drought – refers to drought events with approximately a one in 500-year return period. We describe these events as having a 5 per cent chance of occurring over a 25-year planning period.

In WRMP 2015, we estimated that improving the resilience of our Ruthamford system would have required an additional 150 Ml/d of new resource. We stated that a deficit of this size would need a large strategic raw-water transfer to support our Ruthamford reservoir system. Our 2014 Business Plan included the detailed assessment of this need and investment for preliminary planning and design work.

Subsequently, we have undertaken an extensive vulnerability analysis to understand and quantify the risk from severe droughts. This analysis showed that many of the historic drought events experienced in our region are more severe than previously understood and, due to significant investment in drought schemes, many of our systems are already resilient.

In several parts of the region a one in 200-year event does not result in drought vulnerability. Many sources are not vulnerable to drought because they are constrained by other factors, particularly their licences, rather than their yield, which is influenced by the hydrology or hydrogeology and more likely to be affected by drought. In some instances, the conjunctive nature of WRZs allows resources to be shared, lessening drought impacts.

In Ruthamford and most of Lincolnshire droughts of around one in 200-year return period did not impact baseline deployable output. Our technical evaluation of historical droughts shows that both Ruthamford and Lincolnshire have experienced droughts of at least a one in 200-year return period in the last century. The implication is that parts of our system have been designed to cope with severe drought; for example, the design drought for Grafham Water is 1933-34 which has been shown to have an approximate one in 200-year return period. Furthermore, investments made since privatisation have substantially improved our resilience. Following the 1988-92 groundwater drought (that affected Lincolnshire and parts of Norfolk and Suffolk) and the 2011-12 drought, we invested £37 million and £47 million respectively in new assets designed to improve resilience. We estimate the benefit of this investment to be 100 Ml/d in Lincolnshire and 44 Ml/d in Ruthamford.

However, there are some parts of our system where vulnerabilities remain and during a severe drought event there is a risk that we would have to implement rota-cuts and standpipes in order to maintain supplies. In Cheveley, Newmarket and South Fenland WRZs, there are modelled impacts on groundwater that reduce baseline deployable output at WRZ level. There is an impact in the Central Lincolnshire WRZ, which is a result of a combination of factors, including an assumption that a drought permit on the Trent would not be reliable in a one in 200-year event. There was also groundwater vulnerability identified in North Fenland, but this did not have a subsequent deployable output impact because sustainability reduction impacts already reduce the deployable output.

The total impact of severe drought on our supply-demand balance is 26.3 Ml/d. To ensure we can maintain supplies to all of our customers, without having to impose standpipes and rota-cuts, we need to develop an equivalent capacity from new supplies.

Figure 2.5: WRZs affected by severe drought impacts

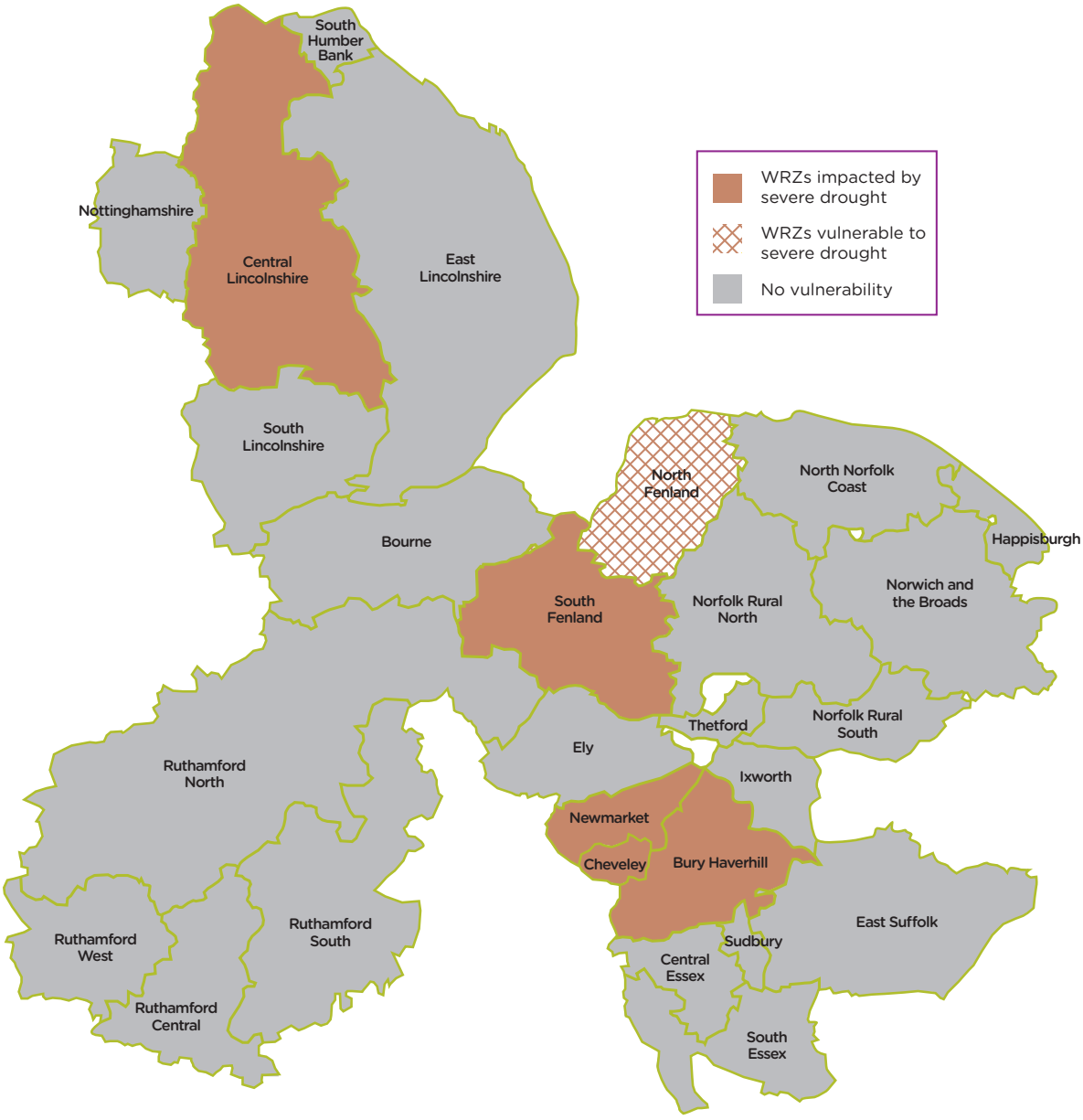


Table 2.4: WRZs affected by severe drought impacts

Area	Water Resource Zone	Severe drought impacts (Ml/d)
1	Bourne	–
	Central Lincolnshire	11.0
	East Lincolnshire	–
	Nottinghamshire	–
	South Humber Bank	–
	South Lincolnshire	–
2	Ruthamford Central	–
	Ruthamford North	–
	Ruthamford South	–
	Ruthamford West	–
3	North Fenland	–
	South Fenland	9.0
4	Happisburgh	–
	North Norfolk Coast	–
	Norfolk Rural North	–
	Norfolk Rural South	–
	Norwich and the Broads	–
5	Central Essex	–
	East Suffolk	–
	South Essex	–
6	Bury Haverhill	3.0
	Cheveley	0.3
	Ely	–
	Ixworth	–
	Newmarket	3.0
	Sudbury	–
	Thetford	–
7	Hartlepool	–
TOTAL		26.3

2.4 Baseline supply-demand balance

When these impacts are combined, this results in a reduction in our baseline supply-demand balance from 144 Ml/d in 2020 to -34 Ml/d by 2025 and -146 Ml/d by 2045.

The relative contributions of each driver are illustrated in figure 2.6. Figure 2.7 shows the spatial distribution of impacts across the WRZs. Figure 2.8 illustrates the evolution of the regional supply-demand balance over the 25-year planning time horizon.

Figure 2.6: Pressures on our supply-demand balance

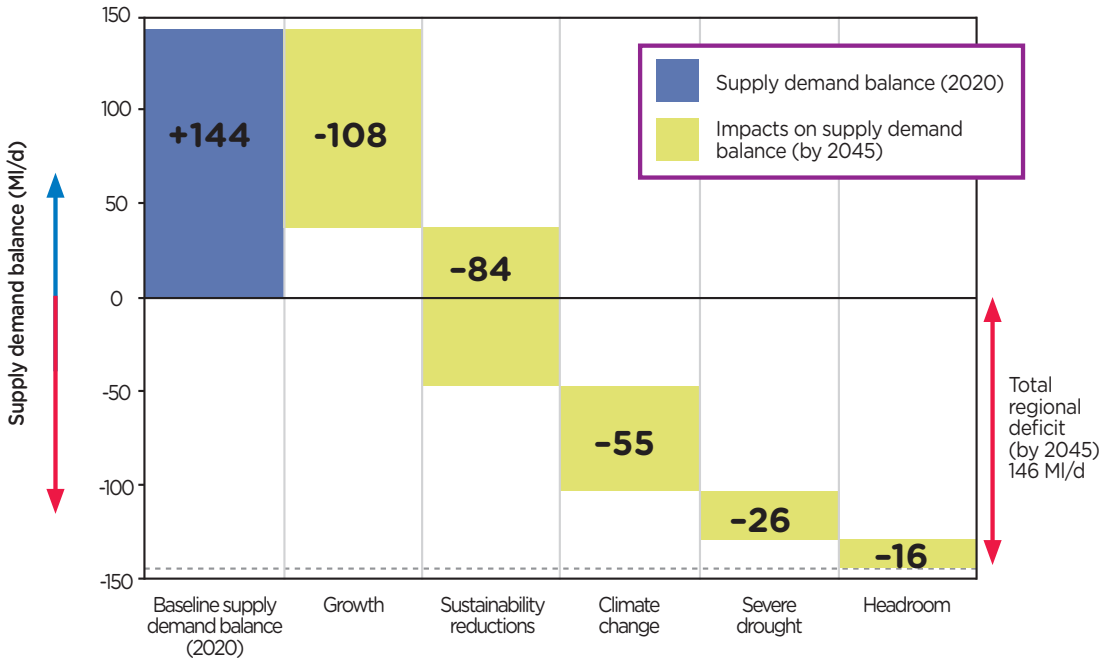


Figure 2.7: Baseline supply-demand balance in 2044-45 (DYAA scenario)

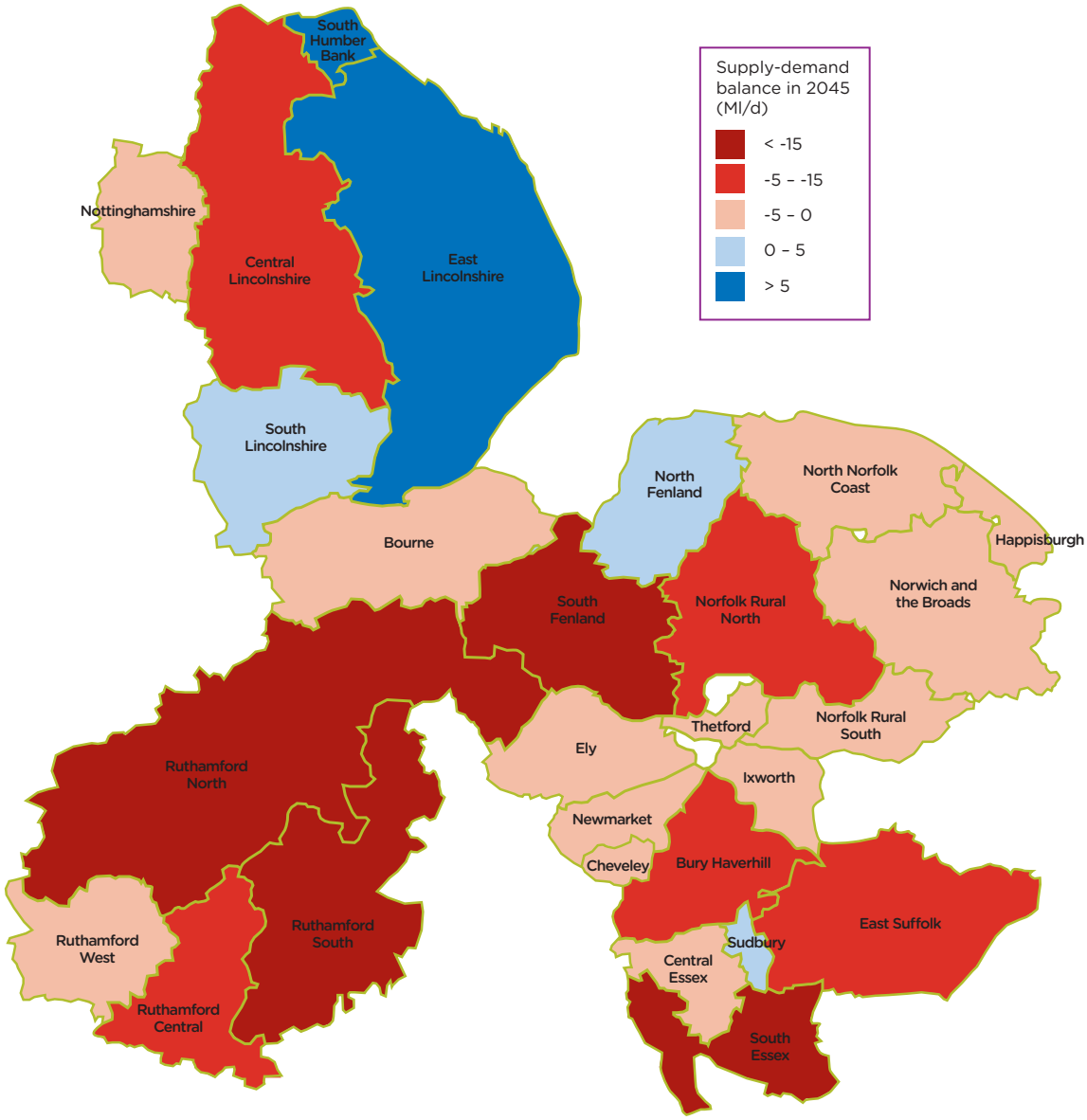
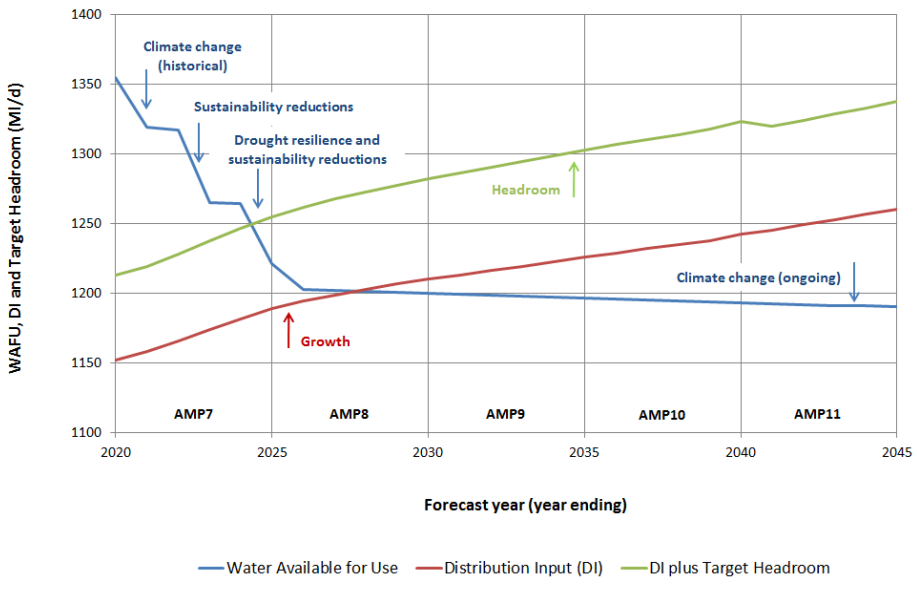


Figure 2.8: Regional baseline supply-demand balance (Ml/d) for dry year annual average (DYAA) conditions



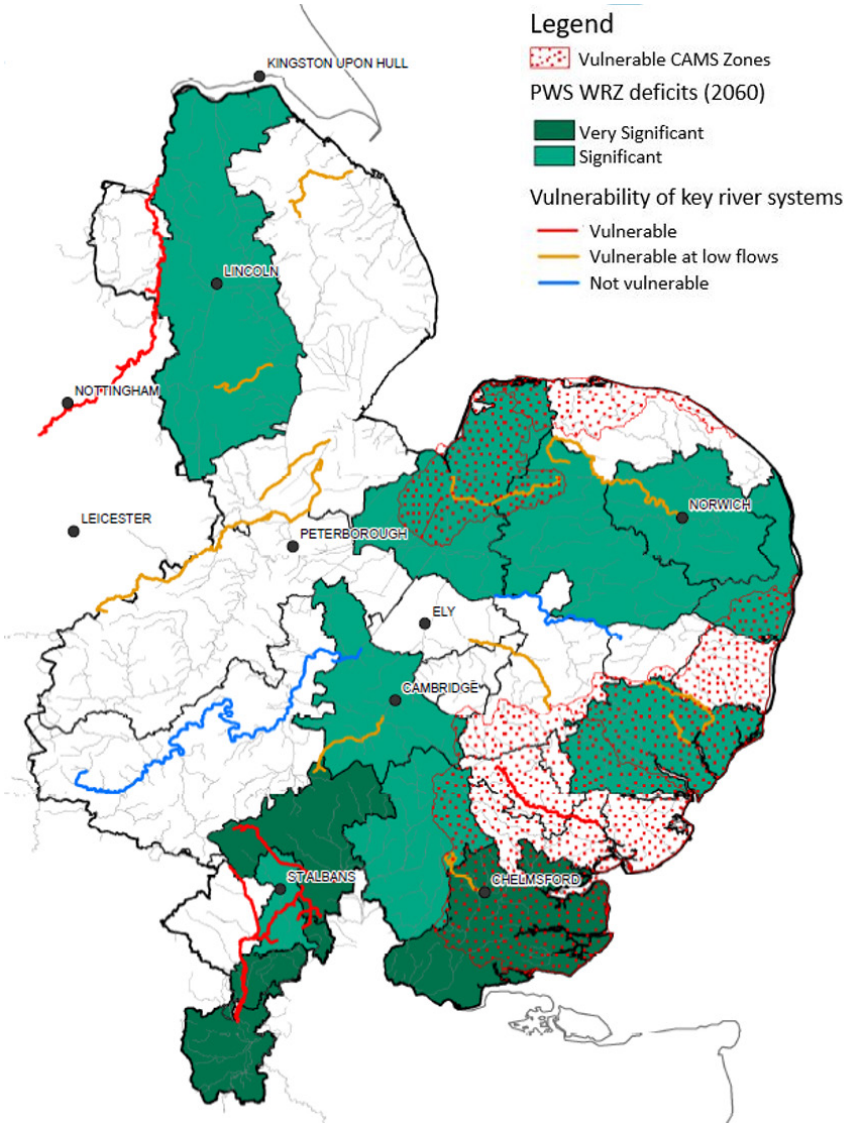
2.5 Regional challenges and Water Resources East

The regional vulnerabilities identified as part of the WRE project are consistent with the vulnerabilities and impact we describe in our supply area. Specifically the WRE identified:

- Vulnerabilities on the River Trent, where both the public water supply and power sectors are impacted. This is consistent with the findings from our deployable output modelling where we identify drought and climate change vulnerabilities at our River Trent intake
- Environmental vulnerabilities in North Norfolk, Suffolk and Essex and Cambridgeshire, which are consistent with our impact assessments
- By the 2060s, the gap between the supply and demand for water, at a multi-sector level, will be at least 750 Ml/d across the WRE region. In the more severe scenarios that have been modelled, it is bigger. These estimates assume that levels of household demand are sustainable. When this is apportioned to the Anglian Water supply area and scaled back to 2045, this is consistent with the scale of our revised dWRMP forecast supply-demand balance, and
- In scenarios with uncontrolled household demand, there is widespread, catastrophic, failure of the WRE water resource and water supply systems. This validates our approach to manage future demand to ensure it remains at a sustainable level.

Figure 2.9 summarises the regional vulnerabilities identified by WRE.

Figure 2.9: WRE Regional Vulnerabilities



2.6 Local challenges

We have assessed the supply-demand balance at a sub-WRZ level (Planning Zones). Five Planning Zones were identified where a small localised deficit was present, due to a reliance on a single groundwater source and the capping of the groundwater licence to ensure compliance with WFD 'no deterioration'. These Planning Zones are:

- Woburn
- Meppershall
- Didlington
- Wymondham, and
- Haverhill.

In agreement with the Environment Agency, these discreet deficits will not result in the creation of new WRZs, but do require investment to maintain the supply-demand balance.

3 WATER RESOURCE ZONE INTEGRITY

3.1 Introduction

This chapter provides further detail on the use of WRZs in water resources planning and describes our decision making process to determine the WRZs in our revised dWRMP.

During the supply-demand forecasting process (see chapter 2), we identified variations in risk within the WRZs. As a result, we decided to reconfigure our WRZs to ensure that all customers in each WRZ experience the same risk of supply failure. The total number of WRZs was increased from 19 in our WRMP 2015 to 28 in the revised dWRMP.

3.2 What is a Water Resource Zone?

As a water company we are responsible for dividing our region into Water Resource Zones (WRZ) . UKWIR/Environment Agency defines the WRZ as[1]:

'THE LARGEST POSSIBLE ZONE IN WHICH ALL RESOURCES, INCLUDING EXTERNAL TRANSFERS, CAN BE SHARED AND HENCE THE ZONE IN WHICH ALL CUSTOMERS WILL EXPERIENCE THE SAME RISK OF SUPPLY FAILURE FROM A RESOURCE SHORTFALL.'

The WRZ describes an area within which managing supply and demand for water is largely self-contained; where the resource units, supply infrastructure and demand centres are linked such that customers in the WRZ experience the same risk of supply failure. WRZs tend to have the following features:

- Represent the largest area in which all resources can be shared effectively
- Customers within the WRZ receive the same overall risk to public supply so there is no significant number of people at a higher risk of supply failure
- They are essentially self-contained – defined by infrastructure connectivity and geographic or physical boundaries
- They are built up from smaller water balance units used for supply management, and
- They contain an integrated supply network, providing secure supplies to meet demand under defined Levels of Service.

According to the Environment Agency, it is a water company's responsibility to make sure that their WRZs meet the definition. The Environment Agency has published a guidance report[2] to help in assessing proposed WRZs (see figure 3.1). The benefits of following the guidance are that a company can:

- Demonstrate that all customers within a WRZ experience the same risk of supply failure
- Benefit from a better understanding of the strengths and weaknesses of their supply network, and
- Present clearer evidence to regulators of the supply-demand investment needed for future investment.

3.3 Water Resource Zone integrity

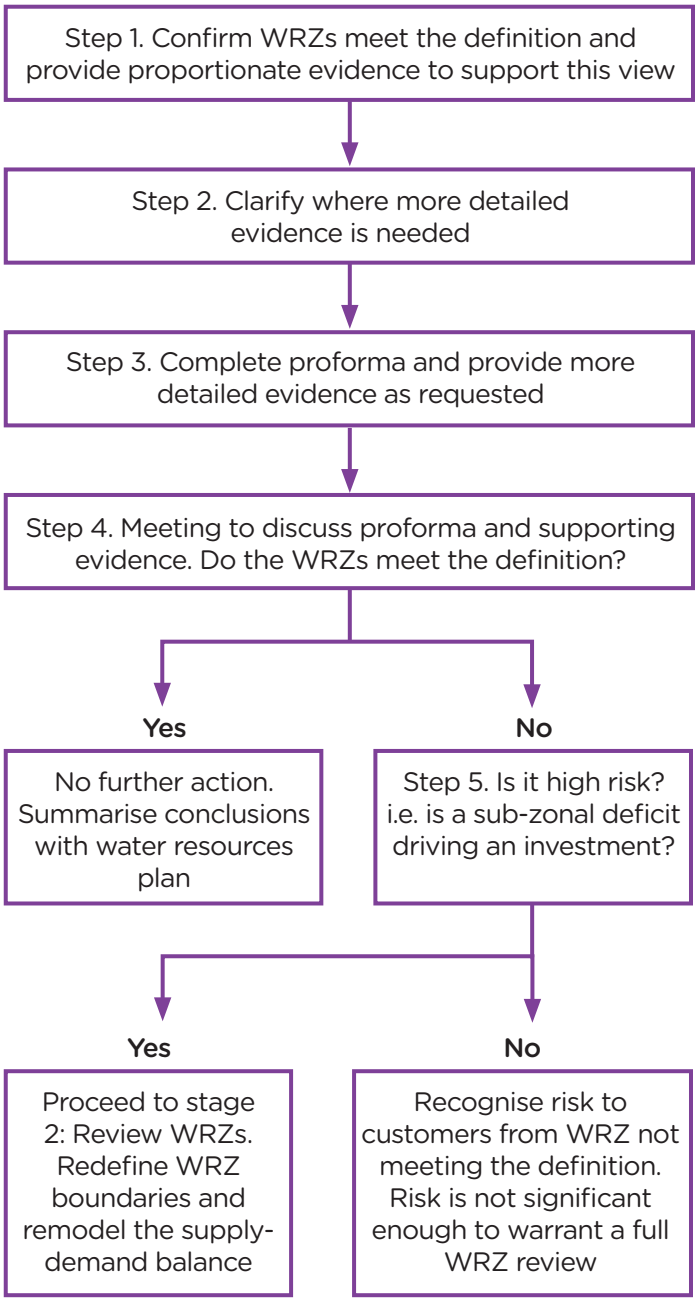
We have reassessed the integrity of our WRZs following the Environment Agency's 2016 guidelines[3]. These guidelines include decision trees to establish whether or not a WRZ complies with the Environment Agency's definition. The assessment process asks questions about the following aspects:

- Scale
- Connectivity and the ability to share resources across the zone
- Sources, and
- Transfers.

[1] *UKWIR/Environment Agency definitions (2012), WR27, Page 14*
[2] *Environment Agency (July, 2016), Water resource zone Integrity – Supporting document for the water resource management plan guidelines*
[3] *Environment Agency (July, 2016), Water Resource Zone integrity – Supporting document for the water resource management plan guidelines*

The flow diagram below (figure 3.1) summarises the key steps outlined by Environment Agency for the WRZ assessment and review process.

Figure 3.1: WRZ integrity guidance diagram[4]



Our WRZs were assessed following the above guidance diagram with its staged approach as follows:

- **Stage 1:** We assessed the integrity of existing WRZs. For this stage we assessed the WRZs against Environment Agency's definition.
- **Stage 2:** We identified new and potentially reconfigured WRZs. This stage considered where reconfigured or additional WRZs should be defined. The proposed changes to WRZ boundaries were discussed with our Water Operations and Asset Planning teams to derive a final set of WRZs.
- **Stage 3:** We assessed the final set of WRZs against the Environment Agency's pro forma[5]. A summary of the assessment for each WRZ is provided in the Resource Zone Integrity technical report (2017).
- **Stage 4:** We met with the Environment Agency in January 2017 to discuss and provide evidence for the WRZs.

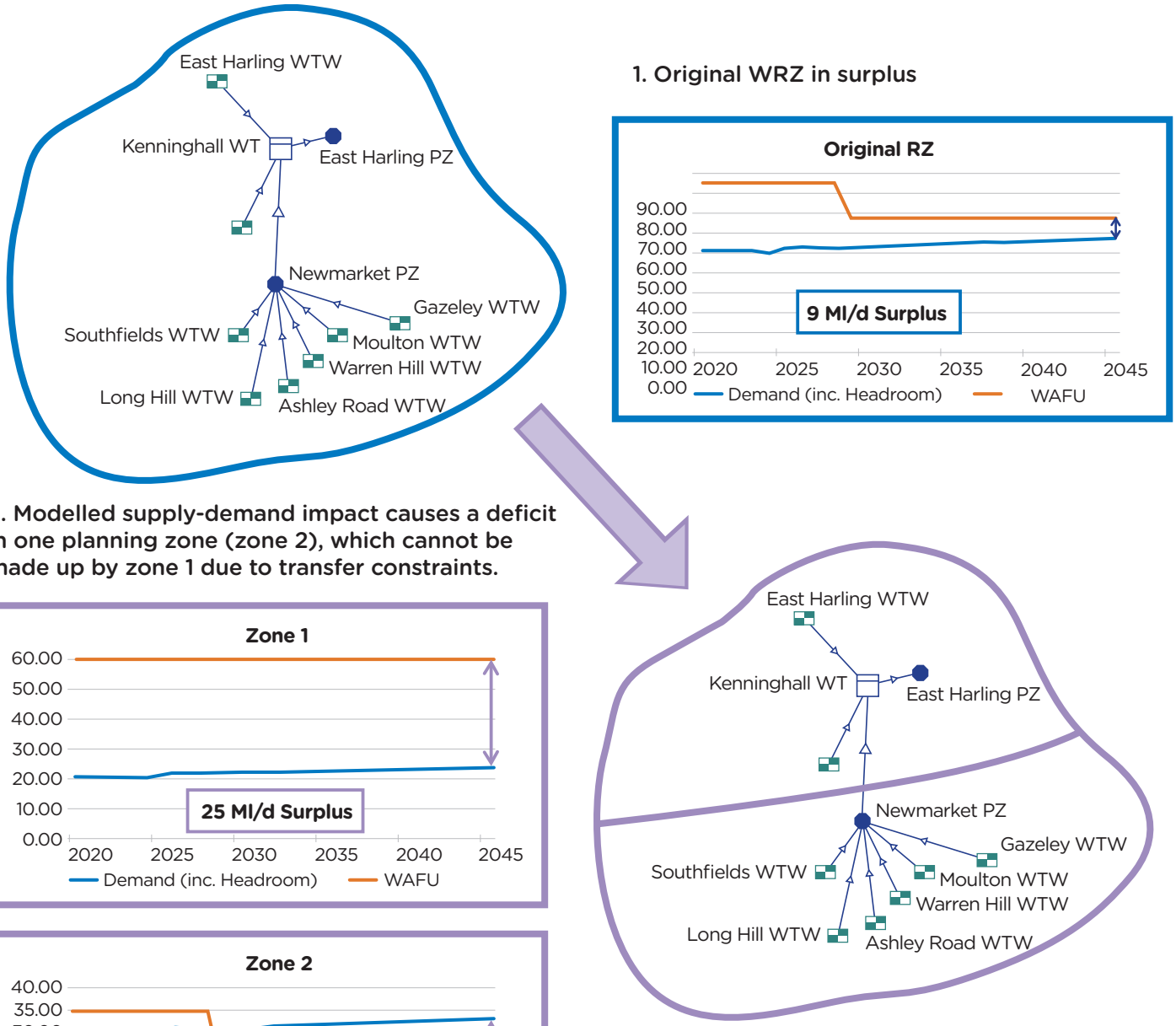
Following the methodology set out in the technical note, we utilised a model of our water resources system called MISER to inform the review process of the initial 18 WRZs (excluding Hartlepool which is a simple, stand-alone WRZ). The MISER model gave details of forecast surpluses or deficits at Planning Zone (PZ) level which make up a WRZ.

This takes into account changes in demand and supplies, including often large reductions in supplies due to the impact of climate change, drought risk and sustainability reductions. MISER showed that at the PZ level there were surpluses and deficits in the same WRZ, as illustrated in figure 3.2.

The process informed the decision to split some WRZs because with differences across the WRZ, this meant that they no longer met the Environment Agency's 'WRZ' definition; by having surpluses and deficits across the same WRZ, this meant that customers did not have shared risk of failure of supply.

[4] *Environment Agency (July, 2016), Water Resource Zone integrity – Supporting document for the water resource management plan guidelines, Page 7*
[5] *Atkins (February 2017), RZ Integrity Assessment, Appendix A*

Figure 3.2: A MISER-derived example of PZ level surpluses and deficits within the same WRZ



The main changes to WRZ integrity were driven by:

- Growth
- Sustainability reductions
- Drought risk, and
- Climate change.

These changes alter the supply-demand balances and Levels of Service provided to customers.

Initially, there were 19 WRZs (including Hartlepool) and out of these, 11 WRZs remained unaltered. Changes were proposed for the remaining eight WRZs (see table 3.1). Hunstanton has been merged back into Fenland following an AMP6 supply-demand scheme, which has improved connectivity and resilience.

The remaining seven WRZs had PZs which went into deficit for one or more of the drivers listed above, whilst surpluses existed elsewhere in the WRZ.

Table 3.1 and figure 3.3 demonstrate that these WRZs have been split into two or three to maintain compatibility with the WRZ definition. The dotted lines in figure 3.3 show the boundaries of the new sub-divisions of the original WRZs. This typically occurred in WRZs served by groundwater where there are discrete local supply systems, although in Ruthamford and Fenland there were other limits to existing connectivity. In addition, a non-potable WRZ, South Humber Bank, has been created to aid transparency regarding the non-potable system in the northern part of Lincolnshire and the associated options at Elsham and Pyewipe.

A full description of the WRZs and their supply-demand balance information is provided in the updated WRZ summaries report.

We anticipate that the number of WRZs will decrease significantly once we have implemented our Preferred Plan.

Figure 3.3: Changes to WRZs

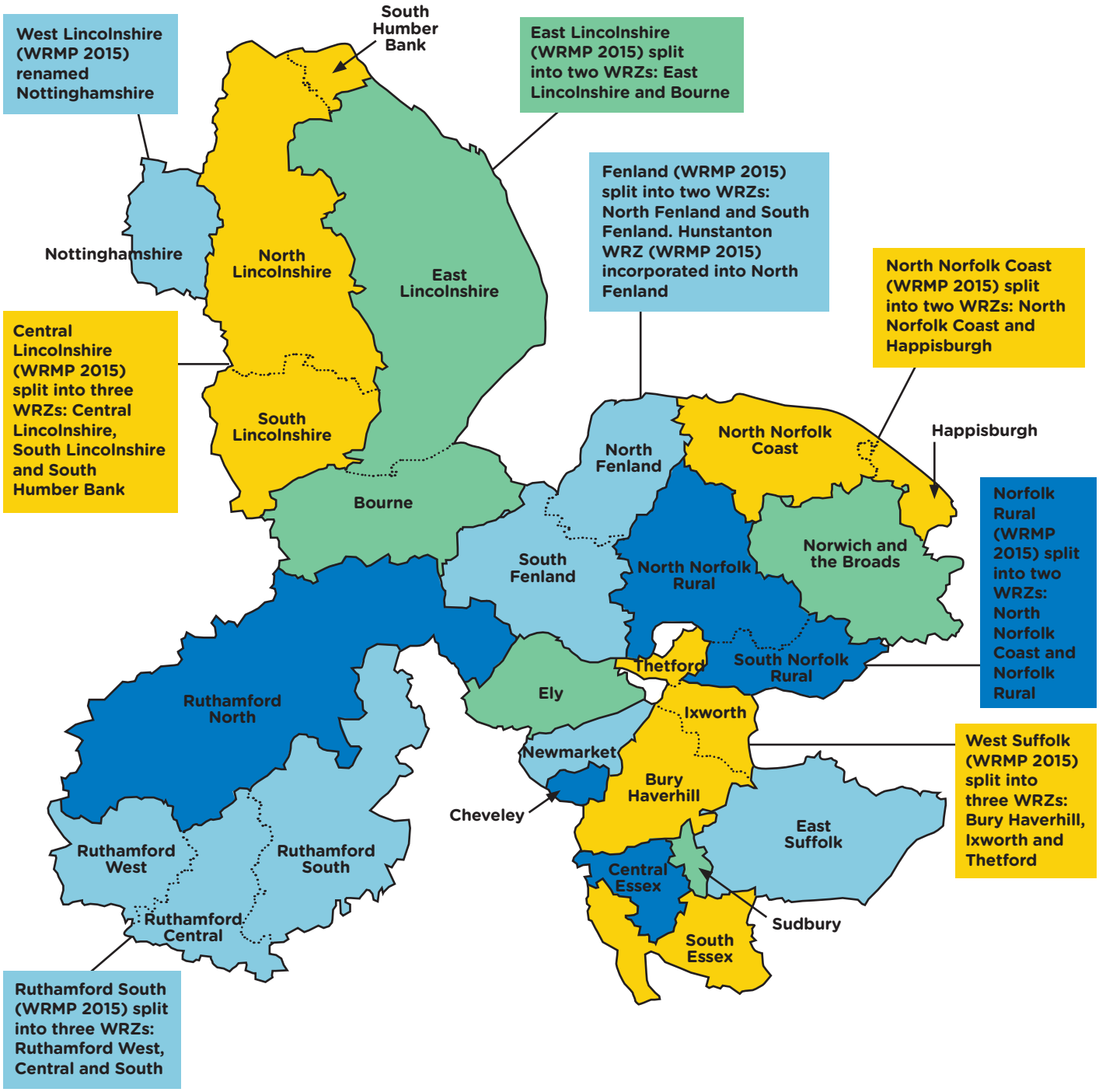


Table 3.1: Changes to WRZs

Existing WRZ	Changes (Y/N)	Reconfigured WRZ	Description
West Lincolnshire	No (only name has changed)	Nottinghamshire	n/a.
Central Lincolnshire	Yes	Central Lincolnshire	Large sustainability reductions and drought risk especially in retained Central Lincolnshire WRZ; limited connectivity (via Central Lincolnshire Trunk Main).
		South Lincolnshire	
East Lincolnshire	Yes	East Lincolnshire	Large sustainability reductions in Bourne and limited connectivity.
		Bourne	
Hunstanton	Yes	North Fenland	Hunstanton rejoins (North) Fenland following supply-demand scheme.
Fenland	Yes		Large sustainability reductions and drought risk especially in new South Fenland WRZ; limited connectivity.
		South Fenland	
North Norfolk Coast	Yes	North Norfolk Coast	Sustainability reduction in Happisburgh and limited connectivity across WRZ.
		Happisburgh	
Norwich and The Broads	No	Norwich and The Broads	n/a.
Norfolk Rural	Yes	Norfolk Rural North	Growth and sustainability reduction impacts in new Norfolk Rural North; limited connectivity.
		Norfolk Rural South	
Ely	No	Ely	n/a.
Newmarket	No	Newmarket	n/a.
Cheveley	No	Cheveley	n/a.
West Suffolk	Yes	Thetford	Large sustainability reductions as well as drought and growth impacts; limited connectivity.
		Ixworth	
		Bury Haverhill	
Sudbury	No	Sudbury	n/a.
East Suffolk	No	East Suffolk	n/a.
Central Essex	Yes	Central Essex	Bures Planning Zone moved to South Essex.
South Essex	Yes	South Essex	Bures Planning Zone gained from Central Essex.
Ruthamford North	No	Ruthamford North	n/a.
Ruthamford South	Yes	Ruthamford South	Large growth and climate change impacts; limits to connectivity.
		Ruthamford Central	
		Ruthamford West	
Hartlepool	No	Hartlepool	n/a.
New	Yes	South Humber Bank	A new non-potable WRZ, which sits within the northern part of Central Lincolnshire WRZ.

4 DEMAND MANAGEMENT STRATEGY

4.1 Introduction

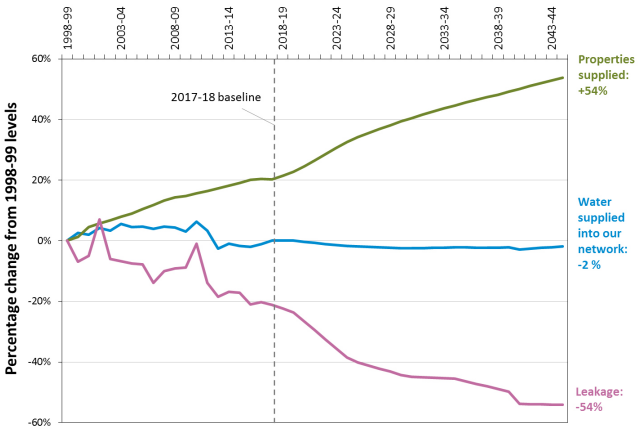
This chapter sets out our approach to developing and selecting our demand management strategy. It then goes on to describe our preferred strategy in detail.

4.1.1 Demand management: A proven track record

Since privatisation, demand management has been at the heart of our strategy to balance supply and demand.

We believe demand management to be especially important given that our region is classified as an area of 'serious water stress' by the Environment Agency, environmentally sensitive and experiencing fast growth.

Figure 4.1: Percentage change in properties supplied, water supplied into our network and leakage against 1998-99 baseline

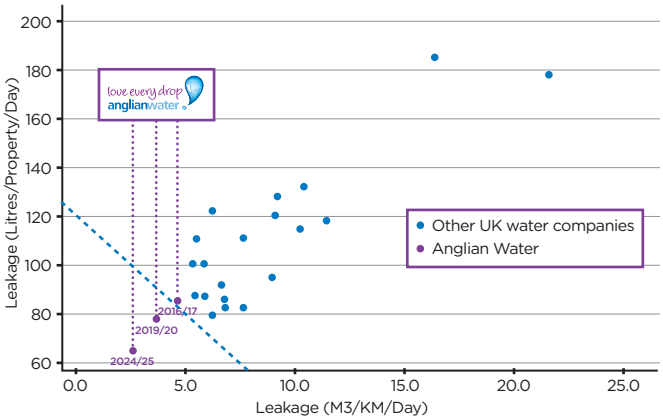


We have proven our ability to manage demand for water supplies: we put less water into our network today than we did in 1998, even though the number of properties supplied has increased by 20 per cent (figure 4.1). This has been achieved by moving water around the region to where it is needed most, increasing the number of customers who are metered, reducing our leakage and encouraging and supporting our customers to become more water efficient.

This is a significant achievement. For example, the National Rivers Authority's (NRA) strategy for the Anglian Region (published in 1994) showed that demand for public water supplies doubled between 1964 and 1994. The NRA emphasised that the majority of the reliably available water resources in the region were already allocated, and that developing new resources would be both expensive and environmentally damaging. As a result, the NRA advocated that all users of water had to reduce their demand, to the extent that it is economically justified[1]. Through our commitment to demand management we have risen to this challenge.

Our leakage performance is industry leading: when assessed using a composite measure of both per property and per kilometre of pipe we are the frontier company in England and Wales. We also have one of the highest levels of household metering in the industry and our customer base is close to being fully metered. By the end of AMP6, we aim to have 93 per cent of households metered and 86 per cent paying measures charges[2]. And our average per capita consumption is below the England and Wales average.

Figure 4.2: Water company leakage performance in 2016-17 (Ofwat data[3], analysis by AWS)



[1] *NRA (1994), 'A sustainable strategy for secure water supplies and a better water environment'*
[2] *The difference results from our Enhanced metering programme, where we compulsorily install meters, but then encourage the customer to switch to paying measured charges voluntarily*
[3] *Ofwat Security of supply, leakage and the efficient use of water report*

4.1.2 Demand management continues to be our priority

In developing our revised dWRMP 2019, we have looked first to see what risk could be offset from demand management, before seeking to develop supply-side options. Demand management continues to be our priority because it:

- Meets customer and stakeholder expectations for continued reductions in leakage and other initiatives to manage demand
- Saves water that would otherwise be abstracted from the environment, allowing us to manage growth and mitigate deterioration risk
- Reduces pumping and chemical costs
- Reduces the need to develop additional supply-side capacity, and
- Is required to ensure the reliability, sustainability and affordability of water resources over the long term.

Customer expectations

We have undertaken an extensive programme of customer engagement. The conclusions relevant to demand management are set out below.

- Customers do not want a deterioration in service, and all water resource options (including both demand management and supply-side) were preferable to an increase in restrictions.
- Generally, customers prefer options that make best use of existing resource and infrastructure, as opposed to options that involve developing new resources. This explains a clear preference for demand management, particularly leakage reduction. Even when customers understood that our leakage performance is industry leading, and that reducing leakage does not reduce bills, it remains a key issue and a priority for investment.
- Customers were clear that we must fulfil our responsibilities and take steps to conserve water before we can ask customers to save more water themselves.
- Customers showed spontaneous interest in using smart meters to help them save money by reducing their consumption. Smart meters were seen as central to behavioural change and expected to be the norm in the future.
- Multiple results showed that, generally, customers are much more supportive of compulsory metering than has been the case previously. However, customers who pay measured charges tend to support compulsory metering, whereas those who pay unmeasured charges do not. We believe the higher levels of support for compulsory metering reflect the larger proportion of customers paying measured charges compared to previously.
- The reliability[4] of water resources options is an important consideration to customers. Generally customers prefer options described as having 'higher' reliability, as opposed to 'medium' or 'lower' reliability. In a stated preference survey, leakage reduction was the highest ranked option. However, when leakage was described as 'lower' reliability, it was less preferable to some supply-side options described as 'medium' or 'higher' reliability (including water reuse and reservoir extensions).
- Although customers express a preference for demand management, they also want to see a cost-effective balance of supply and demand options. When it was explained to customers that there are cheaper alternatives to leakage reduction, many felt that while leakage reduction is important, affordability should also be a key consideration.
- Many customers recognise our expertise and trust us to make complex investment decisions, and choose the mix of solutions that will be most efficient and cost effective.

[4] The term 'reliability' refers to the certainty over option yield or saving. For example, how confident we are that a reservoir option will achieve the expected 100Ml/d yield, or a water efficiency option will deliver 10 Ml/d of water savings.

Customers said...

'JUST LIKE FOLKS NOW USING SMART METERS ARE LESS INCLINED TO LEAVE A MYRIAD OF APPLIANCES ON STANDBY, IT WILL, THROUGH EDUCATION AND INDIVIDUAL CUSTOMER COST SAVINGS, BECOME THE NORM TO USE WATER SPARINGLY.'[5]

'IT IS BLINDINGLY OBVIOUS THAT AW NEEDS TO BOTH INCREASE WATER AVAILABILITY AND REDUCE WATER USAGE PER PERSON. A TWO-PRONGED ATTACK IS NEEDED IN CASE ONE OR THE OTHER FAILS.'[6]

'THE APPROACH NEEDS TO BE BALANCED AND COSTS VS. BENEFITS OF EVERYTHING NEED TO BE CONSIDERED. LEAKS ARE IMPORTANT TO THE END USER AND ARE VISIBLE FOR DOMESTIC CONSUMERS - BUT IT'S NOT THE ONLY WAY WATER IS WASTED AND NOT THE ONLY THING THAT MONEY CAN BE SPENT ON.'[7]

Stakeholder expectations

The importance of demand management is emphasised in Defra's Guiding Principles:

> *'We expect you to choose demand-side options as part of the preferred programme wherever it is reasonably likely that the benefits will outweigh the costs.'*[8]

> *'WRMPs are expected to continue to ensure the reduction of the overall demand for water through demand management activities; including the reduction of leakage and increasing water efficiency through metering programmes.'*[9]

Ofwat has also emphasised the importance of leakage reduction and has set an expectation that companies continue to drive down leakage. Between 2020 and 2025 companies will need to achieve either: at least a 15 per cent reduction in leakage, or more than the largest leakage reduction achieved in the 2015 to 2020 period by any company.[10] There is also an expectation that we will prioritise demand management in the Government's Strategic Policy Statement (SPS) to Ofwat.

Furthermore, in our consultation on our dWRMP, all respondents but one[11] agreed that we should prioritise demand management strategies. Some respondents emphasised the importance of continuing to develop supply-side options to mitigate forecast deficits, particularly in the longer term.

As a result, we have not made any changes to our selected demand management strategy between our dWRMP and our revised dWRMP.

Highlights from the dWRMP consultation responses...

Bedfordshire County Council:

'AWS is right to prioritise demand management.'

Buckinghamshire County Council:

'The demand management strategy ... should be a key priority going forward. The introduction of smart metering is a good way forward in this area.'

Central Bedfordshire Council:

'Central Bedfordshire Council support ... the prioritisation of demand management through the installation of smart meters and the reduction in leakage over increasing supply.'

[5] *Incling (August 2017), 'Drought resilience: Exploring customer acceptance and buy-in', Page 27*
[6] *Incling (August 2017), 'Drought resilience: Exploring customer acceptance and buy-in', Page 25*
[7] *Incling (August 2017), 'Drought resilience: Exploring customer acceptance and buy-in', Page 20*
[8] *Defra (May 2017), 'Guiding principles for water resources planning', Page 6*
[9] *Defra (May 2017), 'Guiding principles for water resources planning', Page 6*
[10] *Ofwat (July 2017), 'Delivering Water 2020: Our final methodology for the 2019 price review', Page 5*
[11] *Huntingdonshire District Council commented that supply and demand options should be given equal priority.*

CPRE Norfolk:

'CPRE Norfolk strongly supports Anglian Water in their approach to prioritise demand management of water resource.'

Environment Agency:

'We welcome Anglian Water's proposals to reduce leakage in both the short term ... and longer term. It is also good to see a high level of demand management.'

Natural England:

'We strongly support the demand management options in the dWRMP...'

NFU:

'We agree that demand management must continue to be Anglian Water's priority...'

Ofwat:

'The draft plan has demonstrated good practice through the focus on demand management to achieve the supply-demand balance, including the setting of ambitious leakage reduction targets across the planning period.'

RSPB:

'We are pleased to see Anglian Water's evident commitment to [demand management].'

Although stakeholders agreed that we should prioritise demand management, the Environment Agency and Ofwat also raised concerns about the scale of our ambition, deliverability, and the risk of not achieving the expected water savings. We have addressed these concerns in 4.4 below, and in the Demand Management Strategy supporting technical document.

Environmental benefits

Demand management is essential to mitigating short-term environmental risks. As already noted, the Water Framework Directive is driving sustainability reductions in AMP7. Increasing our current abstractions to meet growth related requirements would represent a serious deterioration risk. We are using demand management to offset any growth in demand, mitigating this risk.

Demand management also has wider environmental benefits. It directly benefits our local environment as water that would otherwise have to be abstracted is saved, increasing the well-being and resilience of aquatic habitats.

Benefits to efficiency and operational carbon usage are also provided, as the need for additional power and chemical consumption associated with abstraction, treatment and distribution is avoided.

Reduced need for supply-side capacity

Reducing demand for water supplies not only reduces operating costs, but will defer or even avoid capital investment in supply-side schemes. Where there is a forecast deficit in the baseline supply-demand balance, a reduction in demand can reduce, defer or even eliminate that deficit. This can have a significant impact on the selection of supply-side options.

Long-term sustainability of water resources

Analysis from WRE suggests that demand management is an essential component of any long-term, sustainable water resource strategy for the region. Where demand is left to grow unchecked, it results in widespread deficits and service failures (including rota-cuts and standpipes) by the 2060s. WRE's options appraisal process shows that a reliable, sustainable and affordable strategy depends upon a combination of demand management and supply-side solutions.

4.2 The development and selection of our options

We have sought to develop an ambitious, integrated, multi-AMP demand management strategy that:

- Recognises the value of demand management to our customers and the environment
- Develops demand management programmes holistically
- Recognises the role demand management can play in managing future uncertainty, and
- Challenges us and our customers to push the boundaries of what is achievable.

In order to do this, we have developed three strategic demand management options, each of which consists of a combination of smart metering, leakage reduction and water efficiency activity. The methodology for developing these strategic options and our decision-making process is summarised below, but more detail can be found in the Demand Management Strategy supporting technical document.

4.2.1 Identifying innovative options

In order to consider the widest possible range of options, we developed a long-list of options that drew on:

- Our current business practices and how we could improve them
- Current practices and plans of other UK water companies
- Practices in other sectors (for example, gas and electricity) to encourage demand management and behaviour change
- Practices in other countries or localities that experience water stress
- Opportunities provided by technology and innovation, and
- Latest academic research.

We then assessed the long list to identify feasible option-types using the screening criteria set out in EBSD methodology.As a result of this process, a number of option-types were screened out, including use of tariffs and price signals, compulsory dumb metering and the widespread roll-out of Automatic Meter Reading (AMR) meters. More details can be found in the Demand Management Strategy supporting technical document. The output of this process was a short-list of feasible option types.

Using this shortlist, we went through a 'definition process' to develop the detail of each option (for example, for smart metering options this included roll-out trajectories, meter technology, customer interaction and supporting technologies), understand dependencies and exclusivities, and to create options that are specific to WRZs.

4.2.2 Developing strategic options

There are significant synergies between leakage reduction, smart metering and water efficiency activity. For example, before we can ask our customers to conserve water resources we must show that we are taking the lead as a water company to reduce leakage further.

The frequent meter readings provided by smart meters allow us to identify customer supply pipe leakage (CPSL) and internal losses. We can then proactively contact customers so that they can repair those leaks. We have strong evidence to suggest that the majority of customers will fix a leak at their own expense upon notification. Smart metering data will also allow us to identify leaks on our network more efficiently. Many potential water efficiency initiatives are dependent upon the installation of smart meters, including the introduction of targeted behavioural change initiatives, tariffs, and the installation of smart appliances.

Smart metering

Smart meters are an essential part of our future strategy. As already noted, we have a proven track record on demand management. Our success, however, means that there is limited potential to achieve further savings through tried and tested demand management activity as these have effectively been 'locked-in'. The next step-change in demand management will be achieved through technological innovation and initiatives that are relatively untested in a UK water industry context.

The main benefit of smart meters[12] is the frequent consumption data that they allow us to collect. Dumb meters are expensive to read, and consequently are only read once a year on average. However, smart meters can take meter readings every 15 minutes, and this data will be essential to delivering the next step-change in demand reduction.

Firstly, smart metering is an integral part of our leakage strategy. Using smart meter data, we can analyse individual customer's consumption patterns and identify customer supply pipe leaks (CSPL)[13] and internal plumbing losses. We can then notify customers proactively of the leak so that they can fix it, saving both water and money. It also improves our understanding of our network and will allow us to identify network leakage more efficiently.

In addition, smart metering data will help our customers to reduce their consumption. On average, customers with a smart meter save three per cent more water than those with a dumb meter, but the savings can be much greater if the smart meters are introduced alongside behaviour change initiatives.

Finally, smart meters make possible a range of future water efficiency initiatives, such as non-price behavioural change incentives, financial incentives, and rising block tariffs.

[12] *Specifically, Advanced Meter Infrastructure (AMI)*
[13] *CPSL is included in our reported leakage performance, and represents a sizable portion of our total leakage. For example, in 2015-16 CSPL accounted for 25 per cent of our total leakage.*

Given these synergies, it was essential to consider demand management programmes holistically through the development of strategic options. Each strategic option includes smart metering, leakage reduction and water efficiency activity, and has been built from the bottom-up by combining WRZ options. Decisions regarding the geographical focus of each strategic option were informed by:

- Final problem characterisation scores and WRZ strategic needs
- Current levels of leakage and metering, and the opportunities for further reductions, and
- The practicalities of implementation, including any potential barriers (such as household distribution and density).

The three strategic options are described in the table below and figures overleaf.

Table 4.1: The strategic demand management options

	Baseline demand forecast	Extended	Extended Plus	Aspirational
Smart Metering	Continued 'dumb meter' rollout to practical limit of meter penetration (95%)	3 AMP AMI roll-out 15 Year roll-out to practical limit of meter penetration (95%) 50 Ml/d savings in 2045 including: • 22 Ml/d savings from behavioural change • 22 Ml/d CSPL savings • 6 Ml/d distribution loss savings.	2 AMP AMI roll-out 10 Year roll-out to practical limit of meter penetration (95%) 51 Ml/d savings in 2045 including: • 23 Ml/d savings from reduced consumption • 22 Ml/d CSPL savings • 6 Ml/d distribution loss savings	2 AMP AMI roll-out 10 Year roll-out to practical limit of meter penetration (95%) 51 Ml/d savings in 2045 including: • 23 Ml/d savings from behavioural change • 22 Ml/d CSPL savings, • 6 Ml/d distribution loss savings.
Leakage reduction	Leakage held at 172 Ml/d (the company commitment)	10 Ml/d reduction by 2045 (excludes 28 Ml/d CSPL and distribution loss reductions from smart metering described above)	42 Ml/d reduction by 2045 (excludes 28 Ml/d CSPL and distribution loss reductions from smart metering described above)	77 Ml/d reduction by 2045 (excludes 28 Ml/d CSPL and distribution loss reductions from smart metering described above)
Water efficiency	Continuation of current activity, including: • 'Business as usual' water effiency activity • The Potting Shed initiative • Communications campaigns on discretionary use including events, education, and use of Broadcast Beacons.	11 Ml/d savings by 2045 In addition to the baseline activity: • Multi-utility consumption portal[14] • Leaky Loos campaign • A rewards scheme for customers who sign-up on the portal • A base Bits and Bobs campaign (up to 15,000 audits) • Free installation of water butts (when purchased by a customer).	30 Ml/d savings by 2045 In addition to the Extended option: • Provide and install water butts to certain customers • Rebate to replace old toilets • Retrofit 'smart devices' (such as taps) that can send data to the customer portal.	40 Ml/d savings by 2045 In addition to the Extended Plus option: • Provide and install water butts to all customers • Use satellite technology to advise customers when to water their gardens.
TOTAL SAVINGS		• End of AMP7: 26 Ml/d • 2045: 71 Ml/d	• End of AMP7: 43 Ml/d • 2045: 123 Ml/d	• End of AMP7: 60 Ml/d • 2045: 164 Ml/d

[14] *The multi-utility portal will be trialled in Newmarket during AMP7, then rolled out to all WRZs from AMP8.*

Figure 4.3: Extended Plus demand management strategy

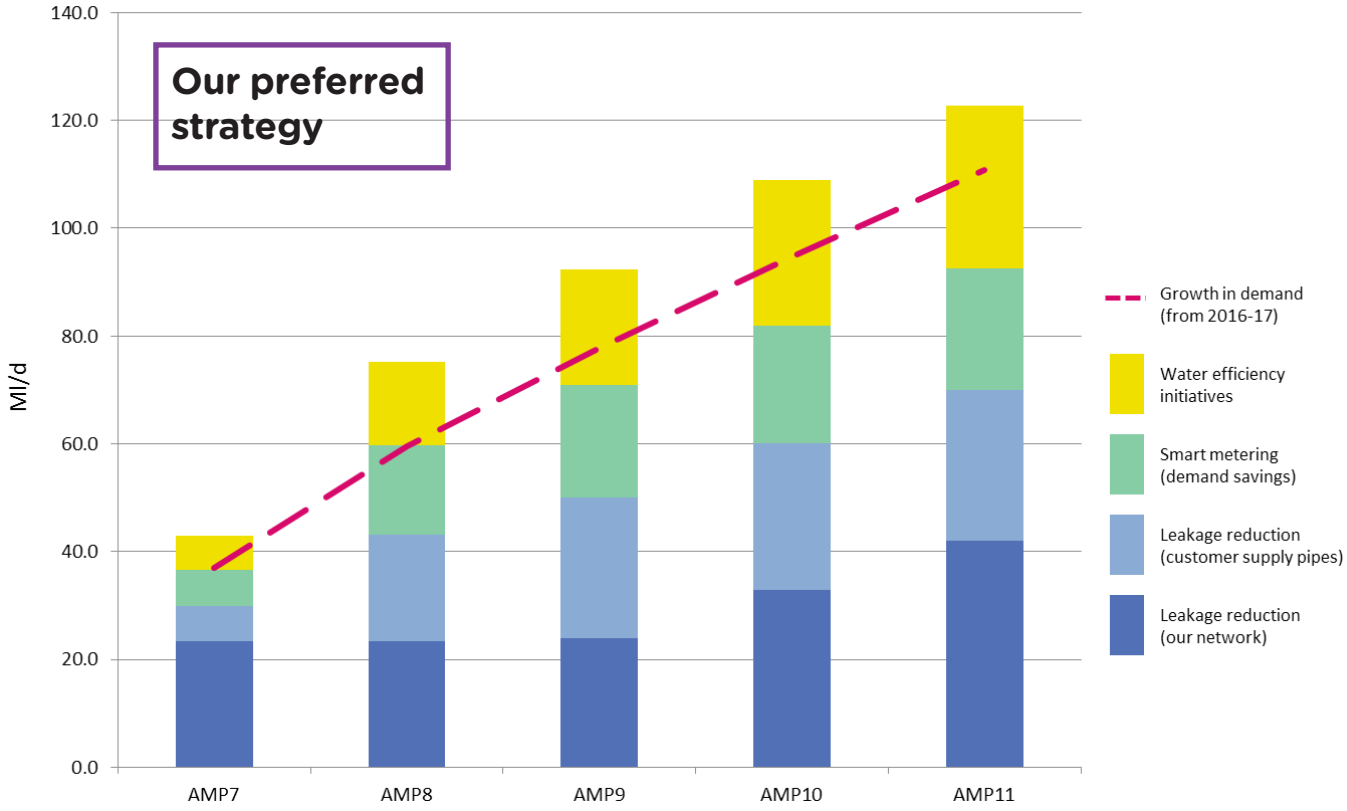


Figure 4.4: Extended demand management strategy

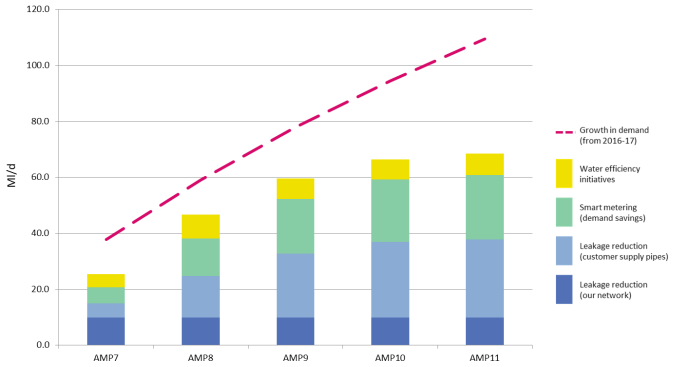
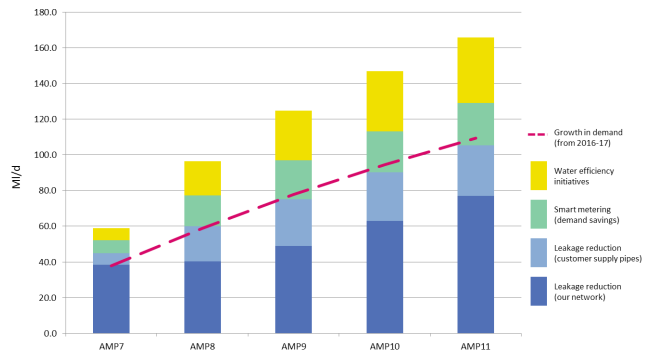


Figure 4.5: Aspirational demand management



NOTE: The savings presented our cumulative.

4.2.3 Cost benefit analysis

In order to inform our decision making, we have undertaken a cost benefit analysis (CBA) of the three strategic options.

To develop our CBA models, we identified a comprehensive list of quantitative costs and benefits, known as building blocks. In order to monetise these building blocks, we have developed assumptions about the costs, take-up and water savings, using the best information available to us at this point in time. This includes our own experiences of costs and benefits from our extensive demand management activity to date, including learning from our innovative trials.

Our analysis also included a range of sensitivity tests, including:

- Increased costs (+ten per cent capex and +five per cent opex)
- Using the lower range of the societal valuation
- Reduced water savings (-15 per cent)
- Reduced water savings (-30 per cent), and
- Combined scenario (increased costs, lower societal valuation and reduced water savings (-15 per cent)).

Value of deferred supply-side investment

The consideration of deferred supply-side capital investment in setting demand management policy is established industry practice.[15] In our CBA, we have quantified the impact of each of the strategic demand management options on the supply-side investment required to mitigate supply-demand deficits. We have done this by running different scenarios in our EBSD model and then comparing the scheme selection and associated totex requirements.

Societal valuation

As already noted, customers have a preference for demand management activity and leakage reduction is a particular priority. We have accounted for this preference in our CBA through the use of societal valuation.

In order to develop values, we undertook two stated preference surveys:

- Main survey: a stated preference study covering a broad range of service attributes including leakage reduction and water restrictions
- Second stage water resources study: focusing on customer preferences and valuations for water resource options and water restrictions.

We then triangulated the results of these surveys to produce a range of values, including a lower, central and upper estimate. We developed values for the following activities:

- Leakage reduction (£/Ml/d water saved)
- Water efficiency – retrofitting (£/Ml/d water saved)
- Water efficiency – behaviour change (£/Ml/d water saved)
- Optional dumb metering (£/Ml/d water saved)
- Compulsory dumb metering (£/Ml/d water saved)
- Smart metering (£/property with a meter fitted).

We have used the central estimate in our main analysis, and the lower estimate in sensitivity testing.

For more details on societal valuation and the triangulation process please refer to the Demand Management Strategy supporting technical document.

4.2.4 Decision making

There are, of course, there are important non-economic benefits associated with demand management, and it was important to consider the qualitative benefits (that cannot be easily monetised) associated with each strategic option. As a result, we complemented our cost benefit analysis with an assessment of the best value criteria listed below.

- **Cost –** how much does the strategy cost to deliver?
- **Performance in CBA –** is the strategy cost beneficial?
- **Mitigate growth –** does the strategy mitigate growth?
- **Risk and resilience –** if the strategy fails to deliver the expected savings, what is the risk? Is it deliverable?
- **Customer preferences –** how well does the strategy align to customer preferences?
- **Regulatory and stakeholder expectations –** does the strategy fulfil regulatory and stakeholder expectations?
- **Environmental and social impacts –** what are the environmental and social impacts?

[15] *There are several examples. The WRC report 'Leakage Policy and Practice' (1985) states that the benefit of leakage reduction to the water undertaker should be thought of in terms of: i) a reduction in annual operating costs; and, ii) deferment of capital schemes. The Environment Agency, Ofwat and Defra review of the sustainable economic level of leakage (SELL) states that, in determining leakage targets, companies should consider the impact of leakage upon the capital programme and the potential for the deferment of expenditure. The UKWIR report 'Smart metering in the water sector – making the case' states that companies should consider the impact of smart meters on demand (particularly seasonal peak demand) and the requirement for the development of new water resources. In 2011 Ofwat assessed the costs and benefits of faster metering in England and Wales, compared with the then current approach ('Exploring the costs and benefits of faster, more systematic water metering in England and Wales'). The assessment includes the impact of reduced demand on both operating costs and capital investment.*

4.3 Our preferred strategy

We have selected the 'Extended Plus' strategy. Not only does this option have the strongest economic business case, it strikes the right balance between ambition and deliverability, affordability and the environment. As a result, it also best meets customer expectations.

4.3.1 Summary of results

The results of our assessment against best value criteria are summarised in Table 4.2 below.

Table 4.2: Best value assessment of our demand management strategy

Criteria	Extended	Extended Plus (preferred strategy)	Aspirational	Comments
Cost				Aspirational is the most expensive strategy, while Extended has the lowest overall cost.
Performance in CBA				The Extended Plus option has the strongest economic business case and the Extended option has the weakest.
Does it mitigate growth?				Growth is mitigated by the Extended Plus and Aspirational strategies, but not by the Extended strategy.
Risk and resilience				There is increased delivery risk associated with the Aspirational option as it relies on more extreme activities where there is less certainty over the water savings. The Extended strategy does not deliver sufficient savings to ensure the sustainability of water resources over the long term.
Customer expectations				While customers have a preference for demand management, they also want a cost effective and reliable mix of supply and demand options. This is best met by the Extended Plus strategy, which provides the best balance between cost, water savings, aspiration and deliverability. The Extended strategy does not go far enough to meet expectations for continued demand savings. The Aspirational option is too expensive and there is too much uncertainty associated with it.
Environmental and social impacts				All strategic options benefit the environment. The Extended strategy provides less benefit than the other strategies, and does not mitigate growth and therefore some deterioration risk remains. The Aspirational option delivers the most environmental benefit, assuming the savings can be achieved in full.

4.3.2 Strongest economic business case

The Extended Plus option has the strongest business case of the three strategic options. It is the most cost beneficial option of the three strategic options as shown in Figure 4.6.

The Extended Plus option remains also cost beneficial when subjected to sensitivity testing. In a sensitivity testing scenario which combined a higher cost of capital and operational expenditure, with lower consumption reduction scenarios (15 per cent), and a lower estimate of societal valuation, Extended Plus was the only strategic option to remain cost beneficial.

Figure 4.6: Total costs and benefits (25 year NPV)

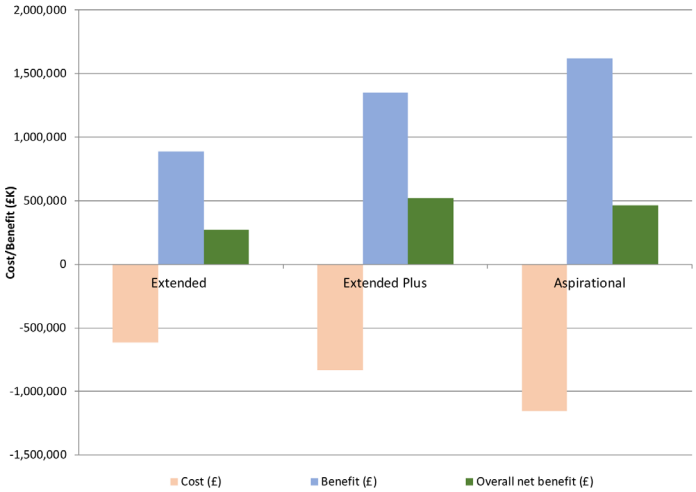
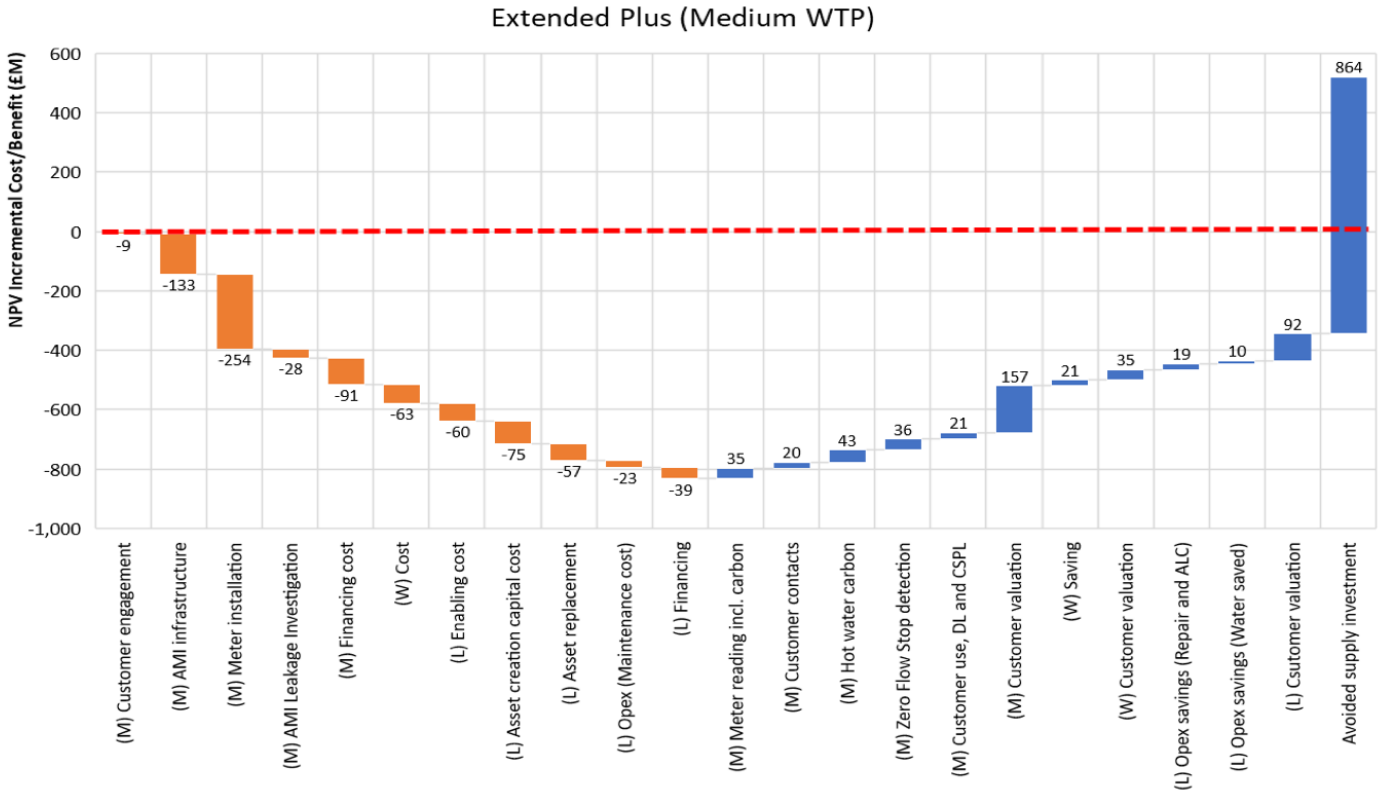


Figure 4.7: Costs and benefits of the Extended Plus option (25 year incremental NPV)



4.3.3 Ambitious but achievable

Our Extended Plus strategy represents an ambitious extension to our existing demand management activities; incorporating innovative initiatives to deliver further water savings. It will facilitate further leakage reduction, driving the performance frontier in the UK, and utilise smart meters which unlock a host of other activities to deliver water savings that can offset projected demand growth.

The water savings associated with the Aspirational strategy option rely on more extreme and less well understood activities, and consequently these savings are less certain. Furthermore, the risks associated with lower than estimated water savings are greater than those associated with the other options.

4.3.4 Balancing affordability and sustainability

All the strategic options directly benefit the environment, by saving water that would otherwise need to be abstracted, treated and pumped through our network. They also all helped to mitigate water body deterioration risk. The extent to which they benefit the environment is directly related to the water savings they deliver, therefore, the Aspirational strategy delivers the most environmental benefit, whereas the Extended strategy delivers the least.

The Aspirational strategy, however, is also the most expensive and the most uncertain. The environmental benefits will only be realised if the estimated savings are achieved. Given this, we do not believe it strikes the right balance between affordability and sustainability.

While the Extended strategy is the cheapest, we do not feel it delivers sufficient environmental benefit to ensure the long-term sustainability of water resources in the region. Furthermore, it does not mitigate growth resulting is a residual deterioration risk in the short term.

The balance between affordability and sustainability is best achieved by the Extended Plus strategy, which more than mitigates growth, whilst being achievable and less expensive than the Aspirational strategy.

4.3.5 Customer expectations

While customers have a preference for demand management, they also want a cost-effective and reliable mix of supply and demand options. They do not support demand management at any cost, especially where there is significant uncertainty over water savings and there are cheaper supply-side alternatives.

The Extended Plus strategy provides the best balance between cost, water savings, aspiration and deliverability, for the reasons set out above. Therefore, it best meets customer expectations.

4.4 Extended Plus

4.4.1 Strategy overview

Our preferred demand management strategy will deliver estimated total savings of up to 43 Ml/d by the end of AMP7, and 123 Ml/d by 2045. These savings will more than offset the projected growth in household demand from the base year (2017-18), as shown in the figure 4.8 overleaf.

Table 4.3: Extended Plus

	Extended Plus
Smart Metering	2 AMP AMI roll-out 10 Year roll-out to practical limit of meter penetration (95%) 51 Ml/d savings in 2045 including: • 23 Ml/d savings from reduced consumption • 22 Ml/d CSPL savings • 6 Ml/d distribution loss savings
Leakage reduction	Leakage reduced to 142 Ml/d by 2025 and 106 Ml/d by 2045 (this includes cspl and distribution loss reductions from smart metering described above)
Water efficiency	30 Ml/d savings by 2045 In addition to the Extended option: • Provide and install water butts to certain customers • Rebate to replace old toilets • Retrofit 'smart devices' (such as taps) that can send data to the customer portal.
TOTAL SAVINGs	• End of AMP7: 43Ml/d • 2045: 123Ml/d

Figure 4.9 overleaf shows the percentage change in the number of properties supplied, the water we put into our network and leakage since 1998. This clearly demonstrates how ambitious our selected strategy is.

The impact of our strategy on baseline demand and PCC are set out in figures 4.10 and 4.11 overleaf.

Figure 4.8: The cumulative savings of our selected demand management strategy

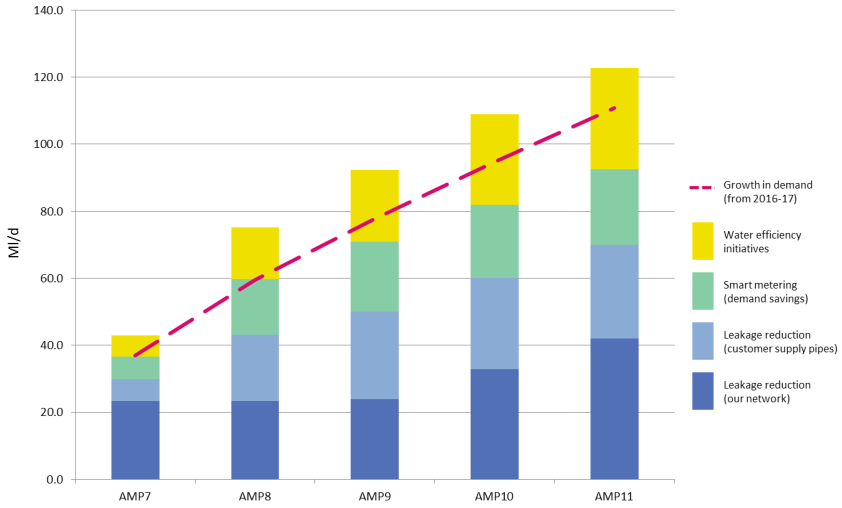


Figure 4.9: Demand management: past achievements and future ambition

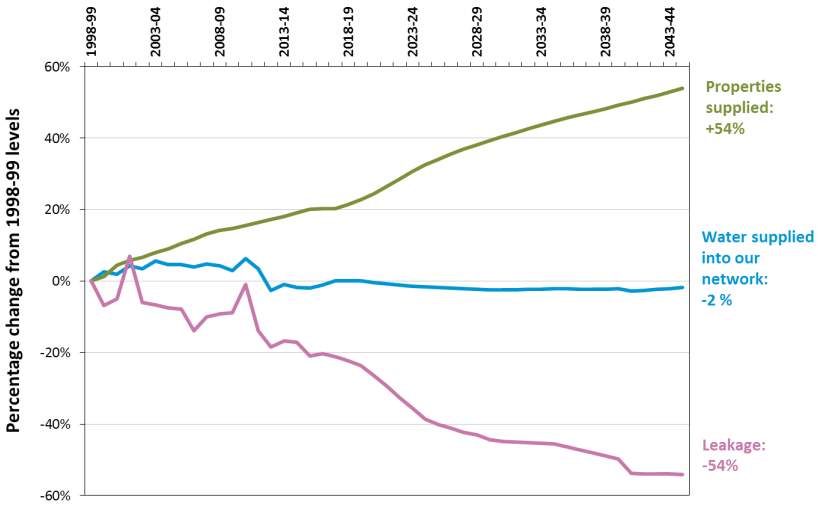


Figure 4.10: The impact of our selected demand management strategy on baseline demand

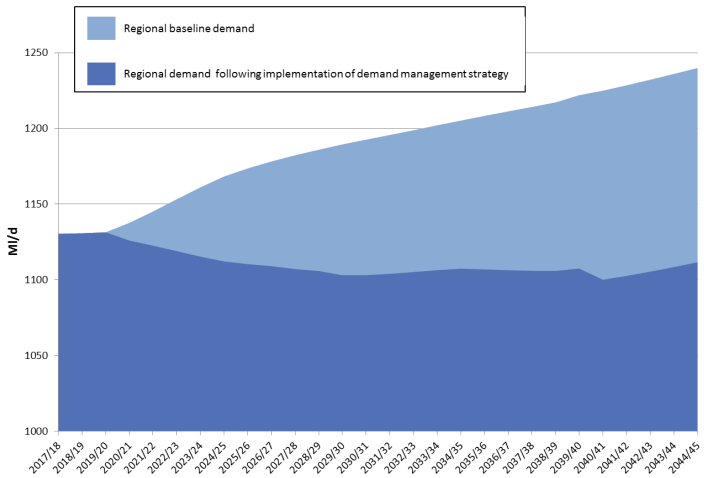
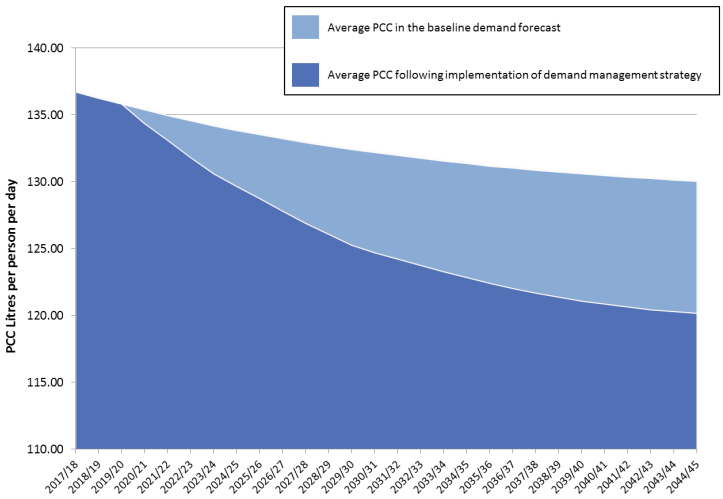


Figure 4.11: The impact of our demand management strategy on average PCC



4.4.2 Deliverability

Our preferred strategy is ambitious and depends upon technological innovation and initiatives that are relatively untested in a UK context. We are, however, confident that we can deliver the programme and achieve the estimated water savings.

To inform our decision making process, we are currently conducting a number of smart meter trials in Newmarket, Norwich and Colchester. We have tested different types of technologies, methods of data collection and methods of communicating with our customers. This has informed our assumptions about the potential reductions that can be achieved in CSPL and household demand.

Through these trials we have also developed our understanding of potential issues associated with installation and data integrity. This learning has directly informed the development of our strategic options.

One of the main risks identified to the successful delivery of smart metering is the increase in meter installation resources compared to AMP6. A geographical roll-out of smart meters supports this transition as the meter readers will be able to switch over cleanly. This, together with some targeted trainee schemes, will deliver the required levels of resource.

Installing meters internally has also been identified as a risk to delivery. However, the majority (87 per cent) of our meter stock is located in a boundary boxes external to the property, making the replacement of these a simple and quick operation.

We will continue to monitor the success of individual initiatives and the overall success of our strategy going forward. For more information on how we have ensured our Preferred Plan is robust to lower than expected demand savings please refer to chapter 6.

4.5 Cost of our demand management strategy

The costs of our demand management strategy are presented in table 4.4.

Table 4.4: Costs and Opex savings for the demand management strategy between 2020-2045

	Demand Management Strategy (2020-2045)	
	Capex £m	Opex £m/yr
Smart metering	343	10.1
Water efficiency	-	3.7
Leakage	292	1.4
TOTALS	**635**	**15.2**

We have included £270m Totex in our PR19 Business Plan to deliver the AMP7 strategy. The costs presented here do not include productivity assumptions.

5 SUPPLY-SIDE STRATEGY

5.1 Introduction

This chapter sets out our approach to supply-side option development and the selection of the preferred supply-side strategy. The process we have undertaken in developing a feasible option set is described, including our approach to third party options.

The chapter will then describe our final programme of supply-side options included in the Preferred Plan, and the associated costs.

What is a supply-side option?

A supply-side 'option' refers to a series of investments which together increase deployable output. Component parts can include the development of raw water assets, raw and treated water pumping stations, treatment processes, raw and potable water mains as well as connectivity into the existing potable or non-potable supply system.

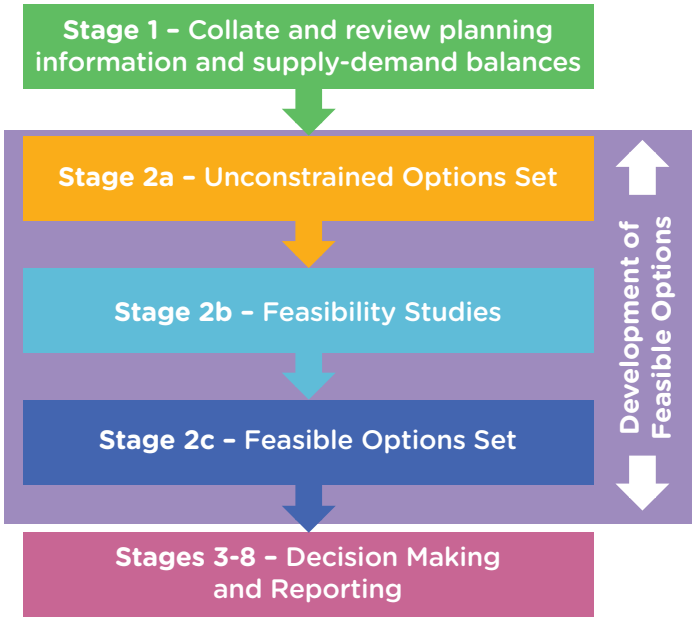
5.2 Supply-side option development process

The supply-side options considered for inclusion in our dWRMP have been developed following UKWIR guidance and the WRPG. This guidance sets out an eight stage process, as described in figure 5.1.

There are three stages to the development of the feasible options:

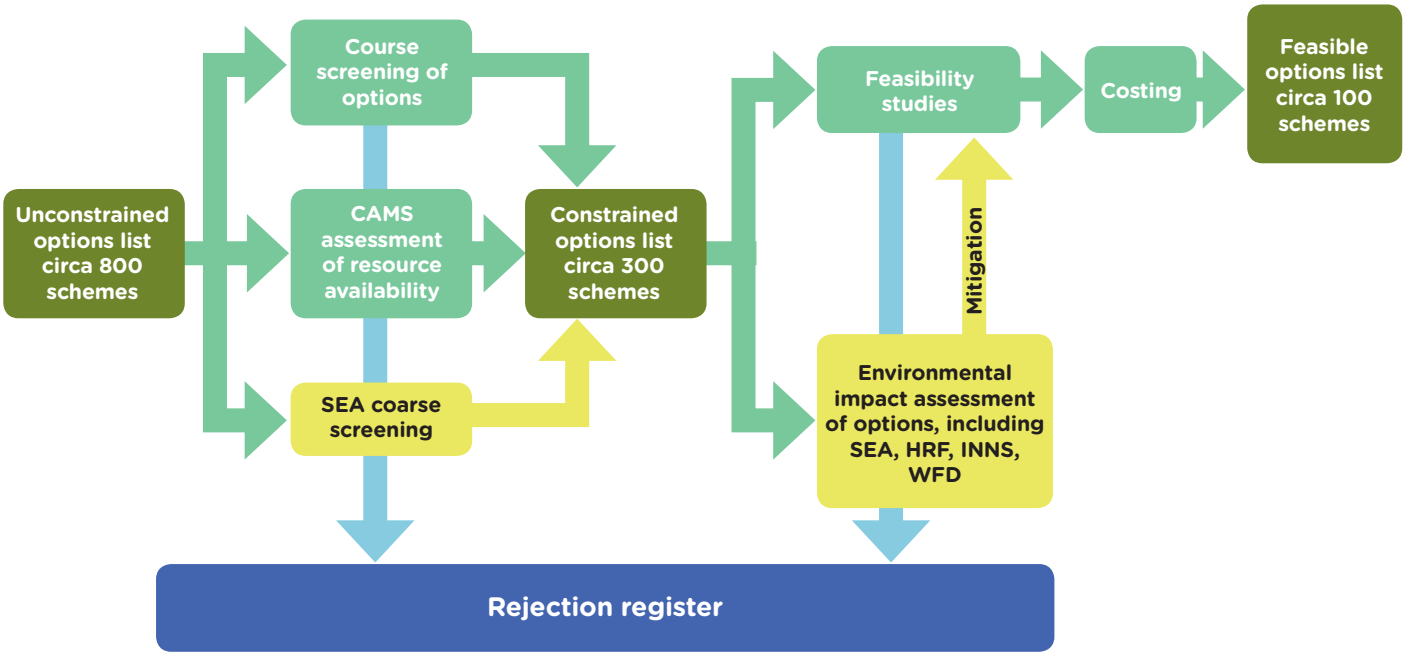
- Stage 2a – Unconstrained Option Set
- Stage 2b - Feasibility Studies, and
- Stage 2c – Feasible Option Set.

Figure 5.1: Supply-side option appraisal process



The three stage process described above, taking us from an unconstrained option set to feasible option list, is outlined in figure 5.2.

Figure 5.2: Development of feasible option set



In stage one, developing the unconstrained options set, we compiled a list of all technically feasible options that could reasonably be used in the plan. At this stage, there was no consideration of environmental or planning issues. Our unconstrained option set included c. 800 options. A series of screening stages were used to refine the unconstrained list to a set of constrained options to take forward to feasibility study stage. The screening criteria included factors such as deliverability and environmental risks.

The second stage involved undertaking feasibility studies for c. 300 constrained options. The outputs from environmental assessments were considered, resulting in mitigation measures being added to the options or some options being moved to the rejection register.

The third stage of the process resulted in the finalisation of the feasible options set, with consideration of the following factors:

- Climate change and drought impacts
- Water quality
- Invasive non-native species, and
- Environmental assessment including SEA, HRA, WFD 'no deterioration' obligation and a Qualitative Ecosystems Services Assessment.

This either resulted in further options being screened out or, in the majority of cases, additional scope being included in the option – such as environmental mitigation or treatment to address water quality risks.

As part of the development of the feasible option set, we also worked with other water users via the Trent and Ouse working groups. These groups were established to support the dWRMP process, with the purpose of identifying potential future demands on the Trent and Ouse systems and considering options to share resources, whilst minimising impacts on existing users and the environment.

The output of this process was a set of feasible options (c. 100), which were taken forward to costing stage using our C55 Asset Investment Planning and Management tool. Further information on the costing process, as well as a more detailed description of the option development stages, is included in the Supply-side Option Development supporting technical document, and the efficiency and innovation chapter of our PR19 Business Plan.

5.3 Types of supply-side options

A number of different types of supply-side options were considered in the development of the feasible option set. A high level description of each of the option types is provided in table 5.1.

Table 5.1: Types of options considered in the development of the feasible option set

Option Type	Description	Included in Final Feasible Option Set
Potable water transfer	The potable transfers are conduits for transferring water between WRZs rather than new water resources. They can either transfer existing surpluses from one zone to another, or transfer water from new resource development in one zone to another zone in deficit.	Yes
Raw water transfer	The raw water transfers are moving resource into the Anglian Water region, for example from the River Trent.	Yes
Desalination	Abstraction of water from coastal or estuarine locations and treatment capacity.	Yes
Water reuse	Indirect use of recycled water through river augmentation.	Yes
Groundwater development	Development of new groundwater abstraction assets.	No – screened out due to environmental and licensing constraints.
Surface water development	Development of new direct surface water abstraction assets.	No – screened out due to environmental and licensing constraints.
New reservoir	Creating new reservoir storage capacity to maximise the use of winter flows.	Yes
Dam raising	Increasing the capacity of existing reservoir storage to maximise the use of winter flows.	No – screened out due to short term impact on deployable output and operation of existing reservoir systems during delivery. Will be considered as longer term options for WRMP 2024.

The majority of the options taken forward to the supply-side programme appraisal process were potable water transfers, moving water between WRZs. There are only a limited number of feasible new resource options in our region. All of the new resource options included in our supply-side programme appraisal process are outlined in table 5.2.

Table 5.2: New resource options included in the feasible options set

Problem characterisation area	Water Resource Zone	Option ref.	Option name	Average capacity per option (Ml/d)	Maximum available new resource average capacity per area (Ml/d)
Area 1 – North	Central Lincolnshire WRZ	CLN11a	South Humber Bank WRZ to Central Lincolnshire WRZ Transfer (10 Ml/d) – treatment only.	10	50
		CLN12a	South Humber Bank WRZ to Central Lincolnshire WRZ Transfer (50 Ml/d) – treatment only.	50	
		CLN13a	South Humber Bank WRZ to Central Lincolnshire WRZ Transfer (31 Ml/d) - treatment only.	31	
	South Humber Bank WRZ	SHB1	South Humber Bank Desalination.	23	
		SHB2	Pyewipe water reuse for non-potable use.	20.4	
Area 2 – West	Ruthamford North WRZ	RTN1	South Lincolnshire Reservoir (unsupported by the Trent).	76.7	184.8
		RTN2	South Lincolnshire Reservoir (supported 160 Ml/d from the Trent).	116	
		RTN3	Peterborough water reuse.	20	
		RTN4	Raw water transfer from Trent to Rutland WTW.	18	
		RTN5	Raw water transfer from Trent to Rutland Reservoir.	18	
		RTN14	South Lincolnshire Reservoir (supported 300 Ml/d Trent).	147.6	
	Ruthamford South WRZ	RTS1	New Ruthamford South WRZ reservoir.	17.2	

NOTE: The 'maximum available new resource average capacity per area (Ml/d)' column takes into account option exclusivity (i.e. CLN12a and CLN13a on mutually exclusive options)

Problem characterisation area	Water Resource Zone	Option ref.	Option name	Average capacity per option (Ml/d)	Maximum available new resource average capacity per area (Ml/d)
Area 3 – Central	North Fenland WRZ	NFN1	Kings Lynn desalination.	11	68.4
		NFN2	Kings Lynn water reuse.	15.8	
		NFN3	Fenland Reservoir.	41.6	
Area 4 – Norfolk	Norwich & the Boards WRZ	NTB2	Norwich water reuse (22 Ml/d).	22	93.3
		NTB3	Lowestoft water reuse.	10	
		NTB4	Great Yarmouth water reuse.	15.3	
		NTB5	Bacton Desalination.	46	
		NTB7	Norwich water reuse (11 Ml/d).	11	
Area 5 – Essex and East Suffolk	East Suffolk WRZ	ESU1	Felixstowe Desalination.	25	54.2
		ESU2	Ipswich water reuse.	10.7	
	South Essex WRZ	SEX1	Colchester water reuse.	15.1	
		SEX2	Ardleigh reservoir extension.	3.4	
Area 6 – Cambridgeshire and West Suffolk		No resource options.			0

5.3.1 Water Company Trading and Third Party Options

In addition to the option types described above, we also included a number of trading and third party options in our feasible option set. We have engaged in detailed discussions with our neighbouring water companies (Affinity Water, Severn Trent Water (STW), Cambridge Water, Essex and Suffolk Water), as well as water management organisations in our region such as the Environment Agency and the Canal and River Trust (CRT). We have also held discussions with third party suppliers and other large industrial users in our region to explore trading opportunities.

We considered trading and third party options identified through:

- Unconstrained options workshops
- Collaborative water resource planning projects/ groups, and
- Market information platform.

Table 5.3 describes the details of the process undertaken to identify third party options, and the number of options we took forward to the final programme appraisal stage.

Table 5.3: Trading and third party option identification process

	Process for developing options	Number of options taken through to revised dWRMP programme appraisal modelling
Unconstrained options workshops	• For each WRZ identified the major water users/ industries that may have supplies to trade. • These would be further assessed if third parties chose to bid via the Market Information Platform.	None
Collaborative water resource planning projects/groups	• These groups included WRLTPF[1], WRE and the Trent and Ouse working groups. • Options were developed with Severn Trent Water (STW), Affinity Water, Canal and River Trust (CRT) and other third parties. • Option data was requested to ensure that the trading and third party options were assessed using the same methodology as our own supply-side options. • For some third party options, the risks associated with invasive non native species and water quality were considered too great to be included in the feasible options set without further investigation and so were not included in the dWRMP programme appraisal modelling. • There are risks associated with water quality, resource availability and drought reliability of the Canal and River Trust options. For the dWRMP we included these in the feasible option set to test their economic value but they were not selected and subsequently not included in the final option set for the revised dWRMP modelling.	5 Severn Trent Water 1 Affinity
Market Information Platform	• Our market information tables were published on our website with our dWRMP to allow third parties to bid against our supply-side and demand management options. • The bidders were required to complete the same assessment criteria as the water companies and third parties identified through the collaborative water resource planning projects/groups. • No third parties submitted bids via the Market Information Platform.	None

[1] *Water Resources Long Term Planning Framework (WRLTPF)*

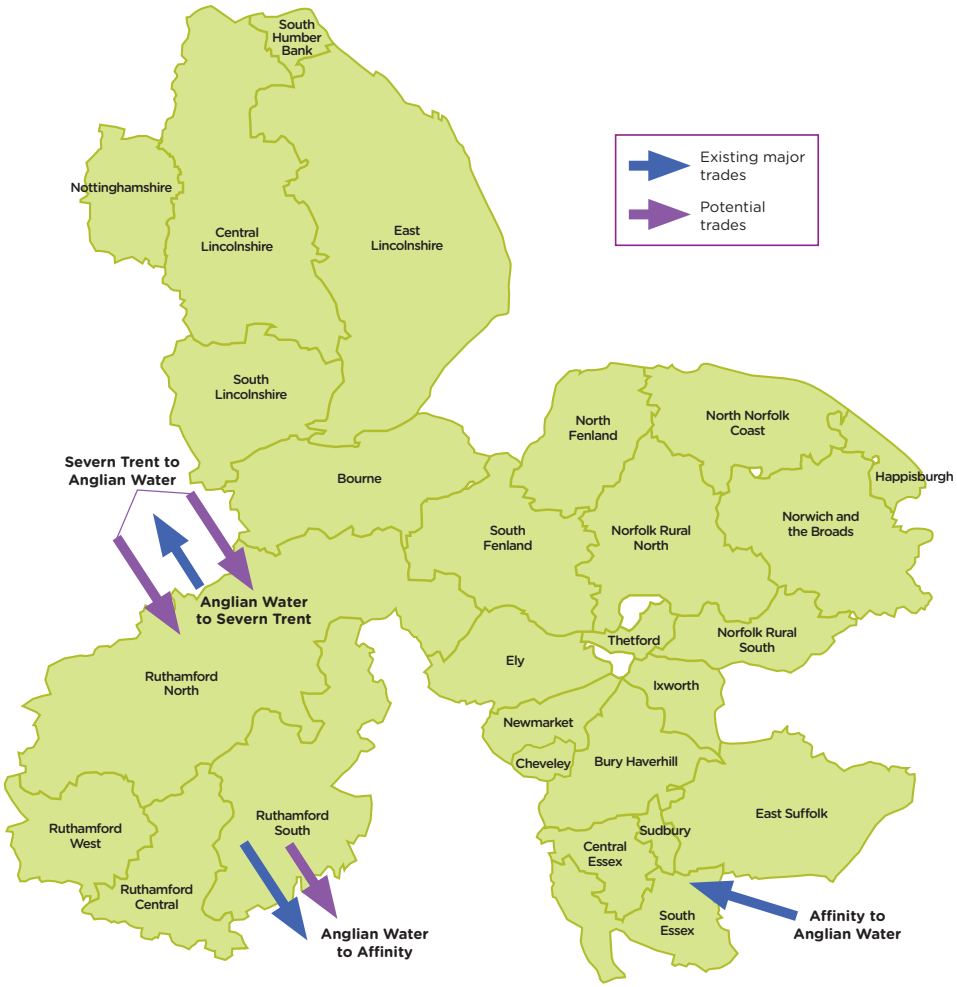
Inter water company treated and raw water trading formed the basis of numerous discussions during the development of the dWRMP and revised dWRMP. Certainty over the reliability and availability of the options emerged during collaborative planning sessions. Some of the options were dependent on the delivery of other water resource schemes in the 'donor' company areas and, in one case, one variation or revocation of a supply agreement. These issues resulted in options not being reliable, or with the timing of availability not matching the dates when deficits need to be addressed.

Details of the third party options included in the final feasible options set are described below. All of the options identified were assessed using the same method for in-house options, and any discounted options are recorded in the rejection register (see Supply-side Option Development supporting technical document).

Table 5.4: Third Party Options considered in revised dWRMP

Transfer of water between water companies	Severn Trent Water	RTN6	Severn Trent Water Import (18 Ml/d)
		RTN7	Severn Trent Water Import (36 Ml/d)
		RTN26	Severn Trent Water Raw Water Import (115 Ml/d)
		RTN29	Severn Trent Water Leicester Water Reuse Transfer (36 Ml/d)
		RTN30	Severn Trent Water Leicester Water Reuse Transfer (50 Ml/d)
	Affinity Water	RTS13	Affinity Water Ruthamford South WRZ Reverse Trade

Figure 5.3: Existing and Potential Future Trades



We are committed to the analysis and evaluation of third party options, including trading, and will continue to collaborate with others as we move into the delivery phase of our WRMP 2019 and towards WRMP 2024.

The map in figure 5.3 shows our major existing and potential future trades with our neighbouring water companies. We will continue to collaborate through WRE and the Trent and Ouse Working Groups. We will also continue to assess bidding activity through the Market Information Platform. For further information on our future plans, please refer to chapter 7.

5.4 Supply-side programme appraisal

Traditionally, companies have used the EBSD approach to guide decision making. EBSD allows planners to meet a supply-demand deficit with the lowest overall cost, or 'least cost' solution. Our WRMP 2010 and WRMP 2015 were both based on least cost option appraisal.

The limitations of least cost planning approach are now widely recognised, and there is support from regulators, stakeholders and our customers, to develop Best Value Plans . Such plans must consider more than cost and include issues such as the environmental impact, resilience and customer preferences. Defra's own Guiding Principles state: 'We expect to see evidence that you have taken a strategic approach to water resources planning that represents best value to customers over the long term.'

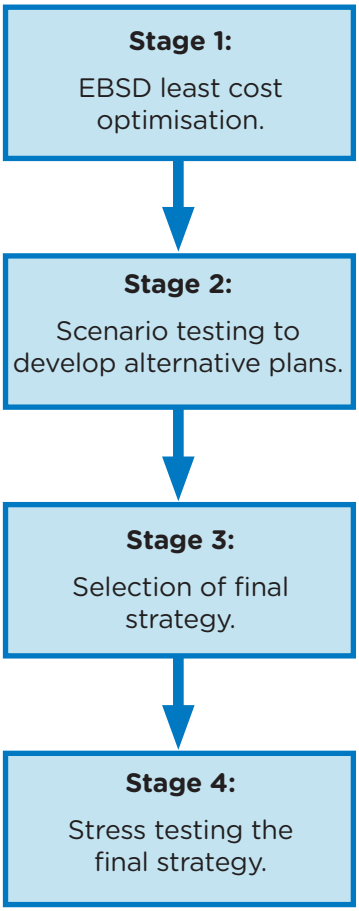
We have assessed a number of factors in developing our Preferred Plan, including:

- **Cost –** how much does the plan cost to build and operate?
- **Adaptability and flexibility –** is the plan flexible enough to cope with uncertain future needs? Does it include potentially 'high regret' options, or limit future choices?
- **Alignment to WRE –** how well does the plan align to the regional strategy?
- **Risk and resilience –** how resilient is the plan to more extreme drought scenarios and other hazards, and what are the residual risks associated with each?
- **Customer preferences –** how well does the plan align to customer preferences?
- **Environmental and social impact –** what are the environmental and social effects associated with each plan?

The remainder of this chapter will describe the steps we have taken in developing our Preferred Plan. A full description of the Preferred Plan is presented in chapter 6.

5.5 Development of the supply-side strategy

Our Preferred Plan is underpinned by a four stage appraisal process, as outlined below:



The approach we have undertaken is aligned with the outcomes of our problem characterisation assessment as described in chapter 3.

Stage 1 – EBSD and Least Cost Optimisation

During the first stage, we used the industry-standard EBSD methodology that is based on least-cost optimisation, to determine the Least Cost Plan (LCP). Our Least Cost Plan was the starting point for the development of our Preferred Plan, and any decision to move away from this has been clearly explained and documented.

Stage 2 – Scenario testing to develop alternative strategies

During this phase we ran a number of scenarios through the EBSD process using the Least Cost Plan as a basis to create a set of alternative plans. The scenarios included testing which options would be selected if we maximised use of existing resources between WRZs and to understand how plans would change if a strategic resource (e.g. a winter storage reservoir) was developed in preference to other smaller new resources. At this stage we also tested sets of options under different future scenarios, such as extreme droughts and additional future exports to neighbouring water companies.

Stage 3 – Selection of final strategy

Once we had a set of plans, we used performance criteria to assess the alternative plans against the Least Cost Plan. An example of this performance criteria assessment is provided in table 5.5 below. This is an example of 'multi-criteria analysis', rather than standard Cost Benefit Analysis, as some of the performance criteria we have assessed are difficult to monetise. The plans were compared with each other and scored on the basis of best performance; in the table below green shading means the strategy (Least Cost Plan or Best Value Plan) for that criterion performs better than the other strategy (shaded red). The outputs from this process, were used to inform the recommendation to our Strategic Priorities Board as part of the PR19 governance process. Once our Board signed off the strategy, we refined the capacities of the options through the stress testing process.

Table 5.5: Performance criteria assessment for final strategy selection

Performance criteria	Least Cost Plan	Preferred Plan (Best Value Plan)	Description of analysis (quantitative or qualitative)	Justification for score
Cost			Quantitative – using cost outputs from EBSD modelling.	The Least Cost Plan performs better as it has a lower overall capital and operating costs.
Adaptability and flexibility			Quantitative – using EBSD scenario model runs.	The Preferred Plan performs better as it allows greater flexibility for development and sharing of new resource options beyond 2025.
Risk and resilience			Quantitative – using proportion of single supply population and performance in stress testing.	Both plans perform equally when considering the reduction of single supply population but the Preferred Plan performs better in stress testing (stage 4).
Alignment with WRE			Qualitative – comparison with WRE regional strategy.	The Preferred Plan delivers better alignment with the WRE strategy due to an increase in the capacity of strategic transfers across the region.
Alignment with customer preferences			Qualitative – comparison with outputs from customer preference surveys.	The Preferred Plan performs better when compared with customer preferences as it makes best use of existing resources and defers the development of desalination which is less favourable to customers than transfers.
Environmental and social impacts			Both quantitative and qualitative analysis undertaken using the outputs from the SEA, HRA and Ecosystem Services Assessment	Both plans perform equally when compared against all SEA objectives.

Stage 4 – Stress testing the final strategy

We stress-tested the final set of schemes to ensure that the strategy was robust to future uncertainties and that we understood how the plan would operate in a 'business as usual' scenario. The strategy was tested under four future scenarios:

- The need to provide resilience to extreme drought (with an approximate 1 in 500 year return period)
- Drier climate change scenarios
- The possibility that our demand management strategy achieves lower water savings than estimated, and
- Possible future trades with neighbouring water companies.

The stress testing helped us to find the balance between adequate capacity to be future proof with actual utilisation in a business as usual scenario. Determining the capacity of the transfer options is critical as they are all required to be installed in AMP7. By delaying the new resource option development, this gives us choices in the future for more strategic sustainable resources if required.

Details of the outputs from the stress testing of our final Preferred Plan are presented in chapter 6. This phase of stress testing was designed to support the final scheme costing, refining details such as capacity.

5.6 Comparison of the Preferred Plan with the Least Cost Plan

In completing the four step process described above, there were a number of specific schemes where the recommended Preferred Plan is different from the Least Cost Plan. These differences are described in table 5.6 and figure 5.3. A full description of the schemes can be found in the Supply-side Option Development supporting technical document.

Table 5.6: Differences between Preferred Plan and Least Cost Plan

Water Resource Zone	Option reference	Option type	Comments	Justification
East Suffolk	ESU1	Desalination	Deferred from AMP7 (2024-25) in LCP to AMP9 (2033-34) in Best Value Plan (BVP). Replaced by Water Reuse scheme early in the planning period.	By maximising the use of existing resources, we have delayed the development of new resources. This gives us future choices to develop smaller localised resources or larger strategic resources such as winter storage reservoirs.
South Humber Bank	SHB2	Water reuse	New resource option only selected in BVP, replacing the development of desalination in early in the planning period in the LCP.	Pyewipe water reuse option would supply non-potable customers, offsetting the need to abstract and treat river water for non-potable demand. This offset existing river source could be treated to potable standards and put into supply.
Central Lincolnshire	CLN13a	Treatment	Upsized from 10 Ml/d in LCP to 31 Ml/d in BVP.	In the LCP, the option only treats (to potable standards) the surplus non-potable resource (10 Ml/d) from the South Humber Bank WRZ. The selection of the Pyewipe water reuse option in the BVP means that a larger surplus is available (31 Ml/d) for treatment.
South Fenland	SFN4	Potable water transfer	Upsized from 22 Ml/d in LCP to 40 Ml/d in BVP.	The stress testing showed that increasing the capacity of the transfer would allow existing/new resources to be fully utilised and transferred east towards Norfolk in more severe drought scenarios.
Bury Haverhill	BHV5	Potable water transfer	Upsized 10 Ml/d in LCP to 20 Ml/d in BVP.	The LCP selected new resource development in East Suffolk. This led to a strategy of transfers going from South East to North West with diminishing capacity. The BVP utilises existing resources in the north which reverses the direction and increases the required capacity of the transfers.
Newmarket	NWM6	Potable water transfer	Upsized from 10 Ml/d in LCP to 20 Ml/d in BVP.	As described above for Bury Haverhill, this gives the greatest flexibility to meet future uncertainties. These transfers in the east to move supplies to areas where there are no new resource options cover considerable distance. The option of laying a duplicate main later on in the plan to meet future uncertainties would not be economical.
Ely	ELY9	Potable water transfer	Upsized form 4 Ml/d in LCP to 20 Ml/d in BVP.	As described above with Newmarket, this gives the greatest flexibility to meet future uncertainties.

5.7 Supply-side strategy

5.7.1 Description of our supply-side strategy

Here we present the scheme details of our supply-side strategy. Table 5.7 provides a high level summary of the final supply-demand balance for each WRZ, with the benefits of demand management, and the selected supply-side schemes. The table demonstrates that in 11 zones, even after we have implemented our demand management strategy, there is a still a supply-demand deficit. These remaining deficits can only be addressed by investing in supply-side options.

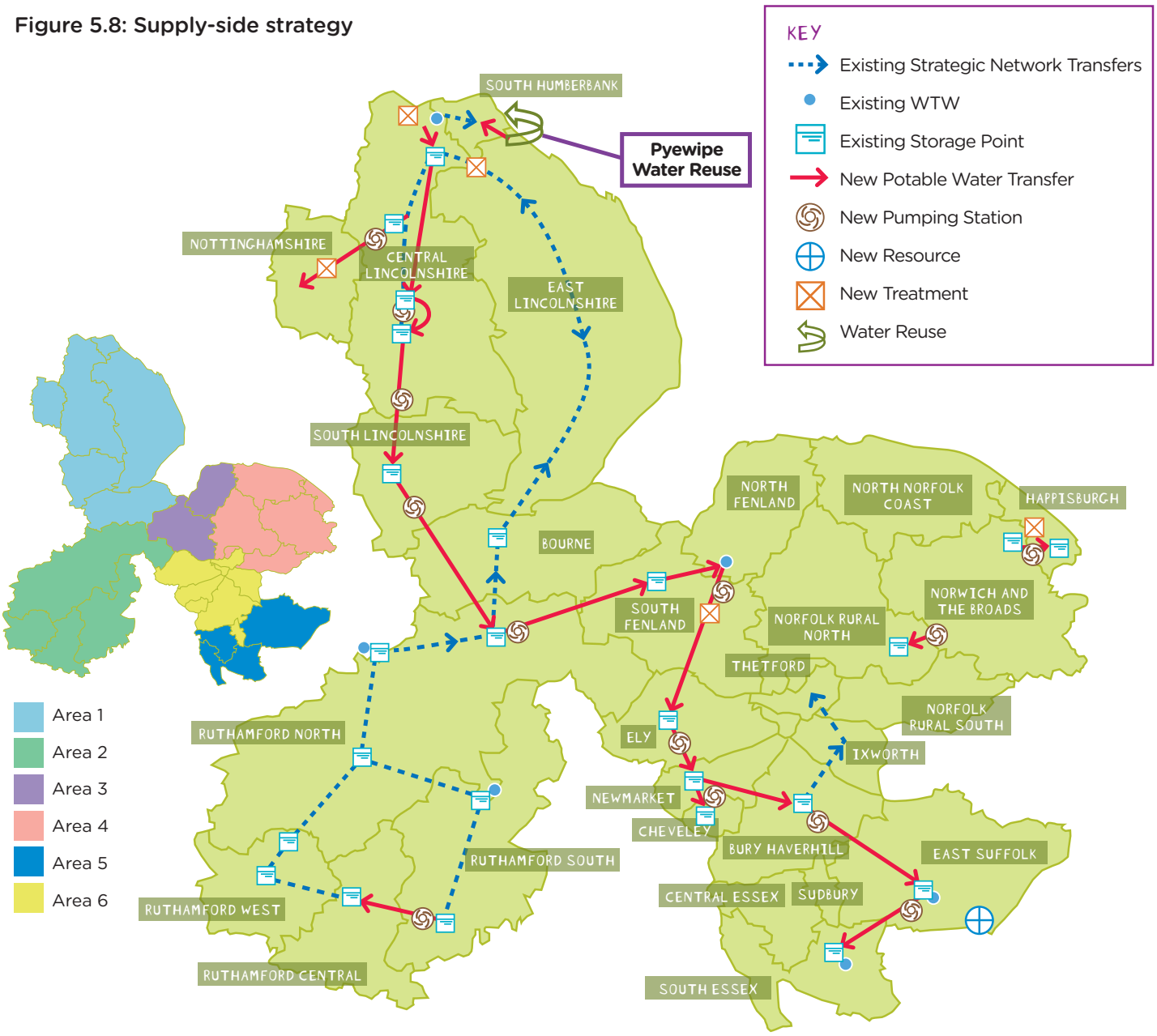
The strategy is also presented in the map in figure 5.8.

Table 5.7: Water Resource Zone supply-demand balances

Area	Water Resource Zone	Baseline supply-demand balance at 2045 (Ml/d)	Supply-demand balance with demand management at 2045 (Ml/d)	Supply-demand balance with demand management and supply-side scheme at 2045 (Ml/d)	Supply-side scheme description
1	Bourne	-3.82	0.50	0.00	Potable water transfer between Ruthamford North WRZ and Bourne WRZ via existing transfer
	Central Lincolnshire	-9.55	0.89	0.00	Potable water treatment and transfer between South Humber Bank WRZ plus East Lincolnshire WRZ to Central Lincolnshire WRZ. Metaldehyde treatment for existing transfer from East Lincolnshire WRZ to Central Lincolnshire WRZ.
	East Lincolnshire	19.51	32.67	7.67	N/A
	Nottinghamshire	-3.32	-1.58	0.00	Potable water transfer between Central Lincolnshire WRZ and Nottinghamshire WRZ
	South Humber Bank	11.00	11.00	1.55	Pyewipe water reuse for non-potable use
	South Lincolnshire	1.67	4.20	0.00	Potable water transfer between Central Lincolnshire WRZ and South Lincolnshire WRZ
2	Ruthamford Central	-7.00	0.82	0.00	Potable water transfer between Ruthamford South WRZ and Ruthamford Central WRZ
	Ruthamford North	-36.17	-10.18	0.00	Potable water transfer between South Lincolnshire WRZ and Ruthamford North WRZ
	Ruthamford South	-44.98	-33.39	0.00	Potable water transfer between Ruthamford North WRZ and Ruthamford South WRZ
	Ruthamford West	-1.23	1.46	0.00	N/A

Area	Water Resource Zone	Baseline supply-demand balance at 2045 (Ml/d)	Supply-demand balance with demand management at 2045 (Ml/d)	Supply-demand balance with demand management and supply-side scheme at 2045 (Ml/d)	Supply-side scheme description
3	North Fenland	2.01	4.41	0.00	Potable water transfer between South Fenland WRZ and North Fenland WRZ
	South Fenland	-19.53	-16.13	0.00	Potable water transfer between Ruthamford North WRZ and South Fenland WRZ
4	Happisburgh	-1.50	-1.10	0.00	Potable water transfer between Norwich and the Broads WRZ and Happisburgh WRZ
	North Norfolk Coast	-1.30	1.39	0.69	N/A
	North Norfolk Rural	-5.85	-2.71	0.00	N/A
	Norfolk Rural South	-0.09	1.21	1.21	N/A
	Norwich and the Broads	-1.28	7.27	4.16	N/A
5	Central Essex	-0.83	0.81	0.81	N/A
	East Suffolk	-8.05	-0.22	15.68	Felixstowe desalination plantPotable water transfer between Bury Haverhill WRZ and East Suffolk WRZ
	South Essex	-17.41	-11.54	0.00	Potable water transfer between East Suffolk WRZ and South Essex WRZ
6	Bury Haverhill	-10.24	-7.05	0.00	Potable water transfer between Newmarket WRZ and Bury Haverhill WRZ
	Cheveley	-0.16	-0.01	0.10	Potable water transfer between Newmarket WRZ and Cheveley WRZ
	Ely	-3.20	0.57	0.00	Potable water transfer between North Fenland WRZ and Ely WRZ
	Ixworth	-2.05	-1.45	0.00	Potable water transfer between Bury Haverhill WRZ and Ixworth WRZ
	Newmarket	-1.20	0.14	0.00	Potable water transfer between Ely WRZ and Newmarket WRZ
	Sudbury	1.38	2.19	2.19	N/A
	Thetford	-2.33	-1.53	0.00	Potable water transfer between Bury Haverhill WRZ and Thetford WRZ via existing transfer
7	Hartlepool	9.97	10.06	10.06	N/A

Figure 5.8: Supply-side strategy



We have limited options for new local water resources in many parts of our region. This is largely due to constraints on the amount of new water we can abstract from the environment as well as planning constraints. The only feasible new supply options for 14 out of 22 WRZs in deficit are transfers, which are also the cheapest option in the majority of cases. The following section describes the strategy in each of the areas defined in our problem characterisation assessment.

Area 1 – North

In the north of our region we can utilise surpluses in Lincolnshire, with the largest surplus being in East Lincolnshire. Our strategy also includes the development of a new resource option in our South Humber Bank WRZ. Specifically the strategy includes:

- New treatment and transfer capacity to fully maximise resources in our East Lincolnshire WRZ
- A new water treatment works to treat water from our Pyewipe Water Recycling Centre to supply our non-household customers on the South Humber Bank, and
- A new water treatment works to treat the water we currently supply to our South Humber Bank customers (from a surface water intake) to a potable standard.

These three schemes create resources which are transferred south via new strategic potable transfers, to support deficits our Ruthamford WRZs and WRZs in the east.

Area 2 – West

The deficits in the Ruthamford WRZs are met by the transfer into Ruthamford North WRZ from the Lincolnshire system. The transfer comes into an existing storage facility in the Peterborough area. This key location could form a hub in the future, where strategic resource options could connect into, with transfers out to other water companies.

Operationally, this will provide the flexibility to supply Peterborough from the north, off-setting resources from our Rutland WTW which could be deployed south to support Ruthamford South WRZ.

Area 3 – Central

In the central area of our region we are developing a key strategic transfer between our Ruthamford North and Fenland WRZs. This scheme has two drivers. Firstly, it supports deficits in our South Fenland WRZ, which are driven by environmental and severe drought resilience needs. Secondly, this link allows resources to be 'bumped' across to North Fenland and transferred into the East of our region where we have further deficits.

Area 4 – Norfolk

The Norfolk area is mainly in surplus for the entire plan with the exception of Happisbugh WRZ and South Norfolk Rural WRZ where small deficits occur. These are deficits driven by environmental needs. There is adequate surplus resource to allow a local transfer between neighbouring WRZs.

In future scenarios we have a choice to develop local resources in Norfolk (mainly water reuse) and distribute locally or to connect up the area via the West to Central link in North Fenland WRZ, which in turn could be supported by a strategic resource.

There are some discrete areas of our Norfolk rural WRZ where we forecast deficits, specifically Didlington and High Oak. This is addressed by a transfer within the zone, rather than a strategic option.

Area 5 – Essex and East Suffolk

A transfer linking the East Suffolk WRZ to the South Essex WRZ allows resources to be shared between these two WRZs. The Preferred Plan has the transfer flowing from east to west initially supported by transferred/'bumped' resource from the north and central areas and then later in the plan from a new desalination plant.

In the longer term, the need for new resources could be met by a large strategic option such as a reservoir or a local scheme developed in either East Suffolk WRZ or South Essex WRZ.

Area 6 – Cambridgeshire and West Suffolk

The WRZs within the Cambridgeshire and West Suffolk area are small discrete groundwater systems. This is an environmentally sensitive area where environmental needs are the main drivers for deficits. As a consequence, there are no new resource options available and the area has to be supported by transfers. The BVP transfers from north to south allow transfer of the small surpluses in Ely and Newmarket to meet demand in Bury Haverhill WRZ and onto the Essex and East Suffolk area.

The BVP allows for the best use of existing resources in the short term but provides the flexibility to develop new resources (strategic or local) in a number of locations. Our plan currently includes the development of a desalination scheme in AMP9 to support resources in the east of our region. We will continue to assess whether this is the best value option as we work towards WRMP 2024. For further details on our future plans, please refer to chapter 7.

5.8 Costs of our supply-side strategy

The costs of our supply-side strategy are presented in table 5.8, along with the embodied and operational carbon.

We have included £594m Totex in our PR19 Business Plan to deliver the AMP7 strategy. The costs presented here do not include productivity assumptions.

Table 5.8: Costs and carbon for the preferred supply-side strategy between 2020-2045

Problem characterisation area	Preferred supply-side strategy (2020-2045)			
	Capex £m	Opex £m/yr	Embodied carbon TC02e	Operational carbon TC02e/yr
Area 1 – North	272	9	116,498	15,193
Area 2 – West	66	1	42,583	3,801
Area 3 – Central	64	0.9	39,594	2,711
Area 4 – Norfolk	12	0.1	2,970	130
Area 5 – Essex and East Suffolk	111	5	33,319	14,693
Area 6 – Cambridgeshire and West Suffolk	99	2	45,086	3,934
Total	**624**	**17**	**280,050**	**40,462**

5.9 WINEP mitigation options

We have worked collaboratively with the Environment Agency to agree a programme of mitigation options which will support the delivery of the WINEP. These mitigation options provide a more cost effective solution further supply side investment. In order to fulfil our WFD 'No Deterioration' requirements, sustainability changes still apply in addition to the mitigation measure in the majority of cases. All mitigation options will be implemented in AMP7 (by 2025) according to the timescales agreed with the Environment Agency and set out in WINEP. The selected NEP mitigation options include:

- River support
- River restoration
- Recirculation
- Adaptive management
- Pond support
- Source relocation

Further details of these mitigation options can be found in the Sustainable Abstraction supporting technical document.

5.10 Further information on supply-side programme development

The results presented in this chapter summarise the work we have undertaken to develop the supply-side strategy included in our Preferred Plan. Further information can be found in the Supply-side Option Development supporting technical document. This includes further details of the technical approach to programme appraisal described in Section 6.3, and also details of our decision making approach for the environmental mitigation options we have included as part of WINEP.

In the next chapter of this summary report, chapter 6, the benefits of the supply-side options selected in the Preferred Plan are described, as well as the alignment with WRE, the Resilience Programme and the National Water Resources Policy.

6 PREFERRED PLAN

6.1 Introduction

In chapters 4 and 5 we have described our approach to decision making and option development, as well as outlining our demand management and supply-side strategies. In this chapter we present the rationale for and benefits of our Preferred Plan. A summary of our Preferred Plan is presented in the graphic overleaf which illustrates the benefits of our strategy.

The chapter will provide a high level overview of how our strategy meets our planning objectives, residual risk and uncertainty and stress testing. Finally, we describe the alignment between our Preferred Plan, other investment programme areas and regional and national water resources planning policy.

Our Preferred Plan meets our statutory objectives, complies with the Environment Agency guidelines and crucially:

- Supports population and housing growth in our region to 2045 and beyond
- Provides resilience against severe drought by 2025
- Provides resilience against climate change immediately in 2020 and beyond
- Delivers all sustainability reductions included in WINEP by 2025, and goes further by capping all groundwater licences in 2022 to ensure no further environmental deterioration, and
- Has strong customer support.

6.2 Planning objectives

We have adopted a twin track approach to deliver these planning objectives. Managing demand is our priority. We want to reduce the need to develop costly supply-side schemes and lower the risks associated with potential future regret or stranded assets. Our demand management strategy has been designed to more than offset the impact of growth across our region. Our customers and stakeholders strongly support demand management, especially leakage reduction.

Even with our ambitious demand management strategy, by the end of 2024-25, the majority of our WRZs are forecast to be in deficit or only have very small surpluses. Therefore, we must also invest in supply-side enhancements to secure a positive supply-demand balance. In many parts of our region we have limited options for developing new sources of water and the only way for us to secure additional supplies is to transfer water into zones in deficit. Our Preferred Plan includes the development of a large number of strategic transfers across our region. These transfers maximise the use of existing resources, as the most sustainable source of supply, and provide flexibility over the location and type of future new resource inputs.

In addition to this, we have worked with the Environment Agency to agree a programme of environmental mitigation measures that will be delivered as part of our Preferred Plan. These measures are described in more detail in the Sustainable Abstraction supporting technical document.

Our plan will deliver the best value for our customers and the environment and secure enhanced levels of resilience in our region over the next 25 years and beyond.

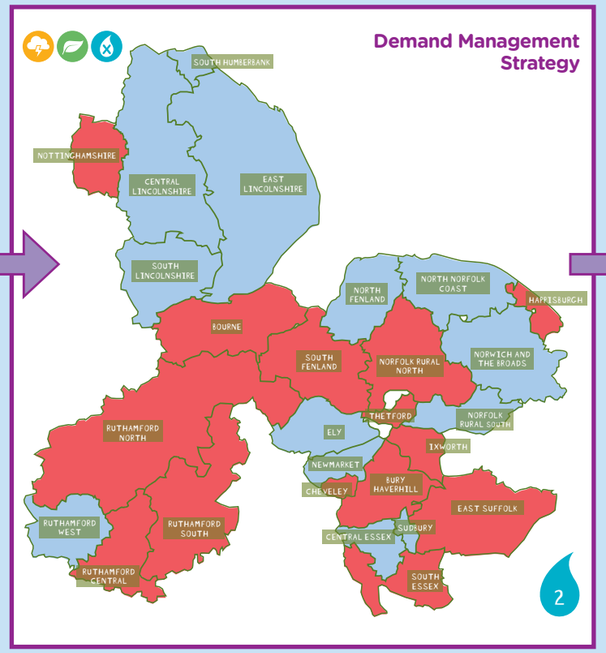
6.3 Benefits of our Preferred Plan

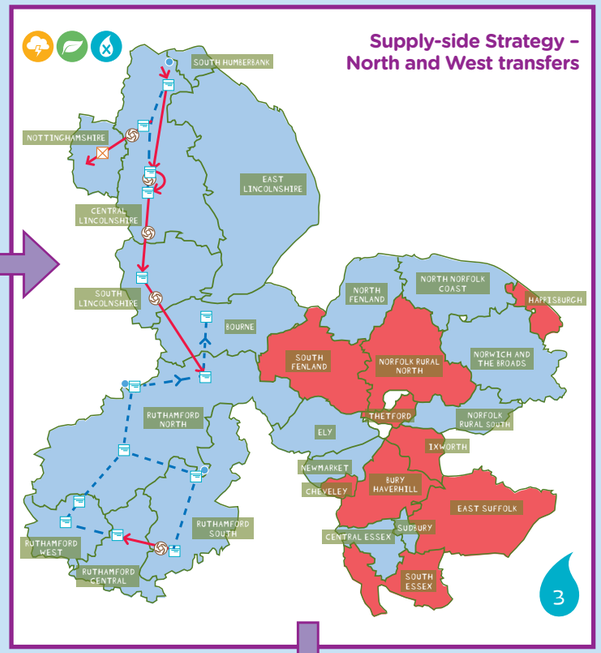
Our Preferred Plan provides the best value for customers in the long term. The strategy:

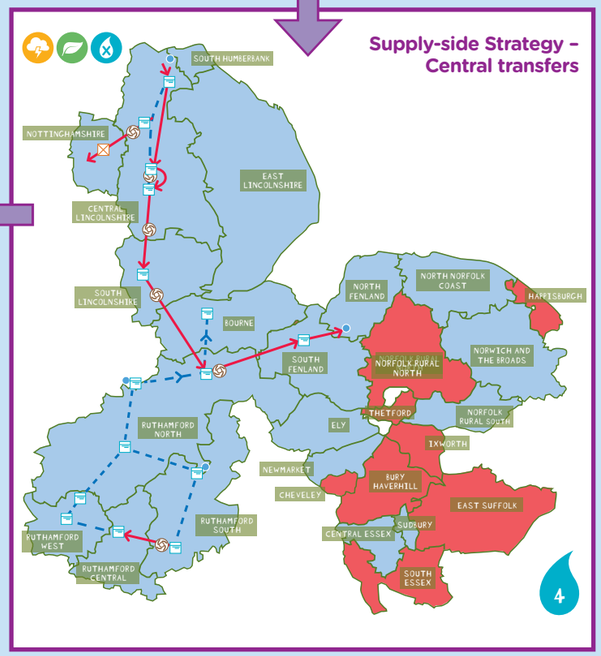
- Prioritises demand management, which aligns with customers' expectations
- Recognises the environmental benefits of demand management, such as offsetting treatment and pumping costs and carbon
- Challenges us and our customers to push the boundaries of what is achievable, with respect to levels of future consumption
- Maximises the use of existing resources before developing new ones
- Provides future flexibility over the location and type of new water resources
- Delivers significant additional resilience across our region both to drought and non-drought events (e.g. freeze-thaw and hot weather)
- Delivers environmental benefits, by reducing abstraction from the environment and ensuring no deterioration in the ecological status of waterbodies in our region, and
- Is consistent with the national water resources policy position, as developed by the Water UK Water Resources Long Term Planning framework and the NIC's 'Preparing for a drier future' report, and the preliminary outputs from the WRE regional strategy.

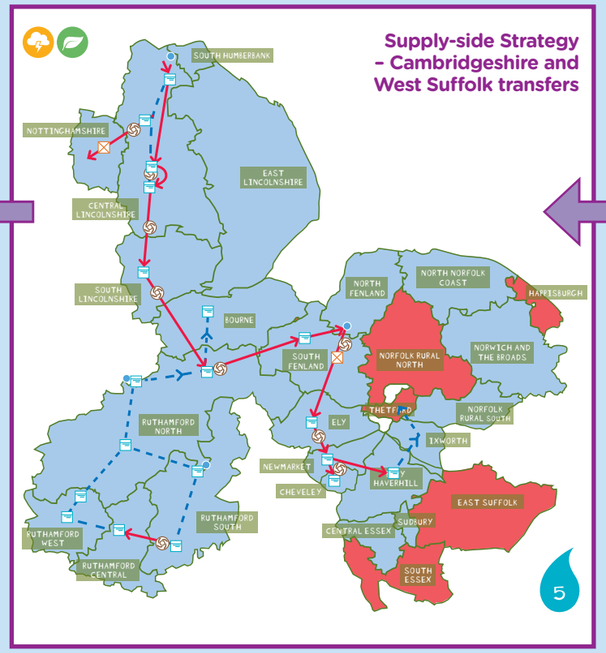
OUR WRMP STRATEGY

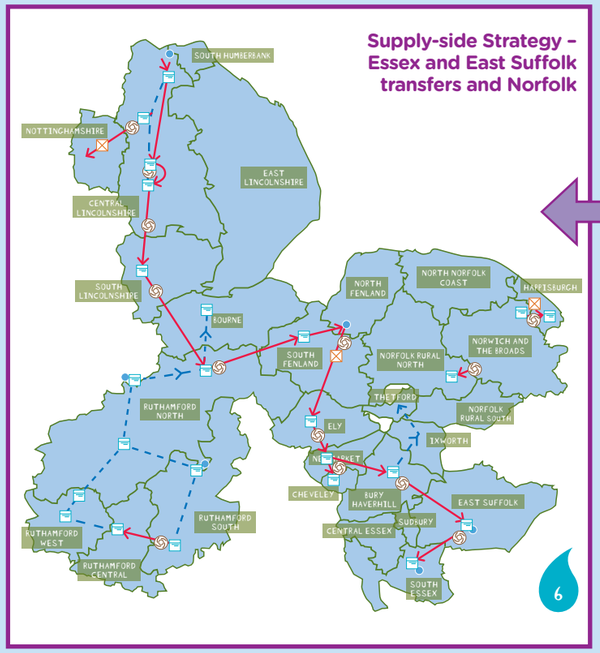
love every drop
anglianwater











1. WRZs in surplus/deficit by 2044-45 (baseline).

2. WRZs in surplus/deficit by 2044-45, after Demand Management schemes implemented.

3. New treatment capacity to create new resource (Pyewipe) and maximise existing resource in our East Lincolnshire zone.
   Transfer south, utilising new capacity, to address deficits in our Central Lincolnshire WRZ, driven by drought and sustainability reduction impacts.
   Deficits driven by climate change and sustainability reductions in Ruthamford WRZs addressed by transfer into Ruthamford North. Using existing infrastructure, this water is distributed to Ruthamford South and Bourne WRZ.

4. Key strategic transfer between our Ruthamford North and Fenland WRZs. Scheme supports deficits in our South Fenland WRZ, which are driven by sustainability reductions and drought impacts.
   Allows resources to be "bumped" across to North Fenland and transferred into the East of our region where we have further deficits.

5. Transfers utilising resource from the west of our region, and surplus from North Fenland WRZ address sustainability reduction and drought impacts in discrete groundwater systems, where there are no other resource options available.

6. A transfer linking the East Suffolk WRZ to the South Essex WRZ allows resources to be shared between these two WRZs, supported by transferred/'bumped' resource from the north and central areas.
   The Norfolk area is mainly in surplus for the entire plan with the exception of Happisbugh WRZ and North Norfolk Rural, where deficits are driven by environmental needs. There is adequate surplus resource to allow a local transfer between neighbouring WRZs.

Surplus
Deficit
Population growth
Climate change
Environmental needs
Drought resilience

6.4 Customer support for our Preferred Plan

We have engaged extensively with household and non-household customers (via the retailer) to understand their views of the risks and impacts associated with investment in resilient water supplies. We focussed the conversation with our customers on three areas:

- Views on resilience and severe restrictions (such as rota cuts and standpipes)
- Views on the choices of solution (i.e. demand management, new resource options), and
- Impacts on bills and what customers are willing to pay for.

We have explored in detail the acceptability of severe restrictions with our customers. We have worked hard to ensure that engagement is as meaningful as possible, by testing the language and materials used to communicate risk, and by ensuring that the descriptions used can be readily understood. This was done partly through our co-creation process and partly through the testing of materials used for each initiative. We have also provided customers with a range of information to ensure informed engagement, including:

- Alternative Levels of Service
- The options required to improve resilience
- How our current performance compares with that of other companies, and
- The associated bill impacts.

The results of this research were central to the development of our dWRMP and particularly informed the following decisions:

- The prioritisation of demand management, including further ambitious leakage reductions and the installation of smart meters across our region
- Investment in drought resilience, to ensure that no customers are vulnerable to severe restrictions in a severe drought event, and
- The development of the strategic grid, which seeks to make best use of existing resources before developing new ones.

We then consulted on the dWRMP both as part of our business plan consultation, and as a separate activity in March 2018 with our online community. This phase of engagement considered the acceptability of the proposed plan, and the associated bill impacts.

6.4.1 Our customers' views on the resilience of their water supplies

Customers said...

'I THINK THAT OUR WATER COMPANY SHOULD REGARD HAVING TO PUT WATER-RESTRICTING MEASURES IN PLACE AS A FAILURE ON THEIR PART TO PLAN ADEQUATELY FOR THE FUTURE.'

'LOTS OF COUNTRIES DRINK ENTIRELY FROM BOTTLED WATER. BUT NOT BEING ABLE TO WASH OR FLUSH TOILETS SOUNDS HORRIBLE. I THINK THAT IS WHERE I WOULD DRAW THE LINE.'

'IN THE 21ST CENTURY IT IS UNACCEPTABLE TO HAVE ANY OF THESE MEASURES IMPLEMENTED. WE ARE PAYING CUSTOMERS AND WATER COMPANIES HAVE A CONTRACTUAL OBLIGATION TO SUPPLY US. I WOULD FORGO HAVING A BATH AS I SELDOM DO ANYWAY, BUT OTHER MEASURES WOULD BE UNACCEPTABLE.'

'THIS IS NOT JUST CLIMATE CHANGE PLANNING, IT'S ACTUALLY JUST CALLED "PROPER PLANNING"!'

Our customers consistently tell us that ensuring that supply meets demand is one of our most important 'core' services. We should be planning for the long term and taking preventative action to build resilience to future challenges. Once customers understood that we have a long-term plan to balance supply and demand, they placed more responsibility on us to maintain supplies. They do not feel we should ignore a known risk, especially when we have a range of solutions to mitigate it.

Many customers were surprised to learn about current drought risk and were not aware of the severe restrictions that could be implemented during a drought. They were particularly concerned about standpipes, which they view as a gross failure and completely unacceptable in a modern country like Britain. For example, in the Water Resources Second Stage Research (stated preference survey), the percentage of household customers who had previously heard of rota cuts and standpipes was 21 per cent and 45 per cent respectively. Many of the customers who participated in the online community research on drought resilience were 'shocked' to learn about the current drought risk and were particularly concerned about severe restrictions which could drastically affect their quality of life and potentially their safety.

Customers are, however, satisfied with the current Levels of Service for temporary use bans (TUBS, known formerly as hosepipe bans), at not more than one in 10 years, and non-essential use bans, at not more than one in 40 years. Customers do not see reducing the frequency of these restrictions as a priority area for investment.

However, customers will not support bill increases to reduce drought risk unless they can see that we are fulfilling our responsibilities. This includes doing everything we can to save water, such as reducing leakage, giving customers the tools to save water (and therefore money) and investing in additional supply where required.

We have also asked customers about their views on investment to ensure resilience to climate change, and to future proof our water supplies against future needs. Following the submission of the dWRMP, we undertook further deliberative research with customers via our online community to discuss the acceptability of our plan. We presented customers with three alternative options:

- Investing in drought resilience (but not climate change), which would add £2.20 p.a. to the average bill by 2025
- Investing in drought resilience and climate change, which would add a total of £8.30 p.a. to the average bill by 2025, and
- Future proofing our network by building additional capacity now, which would add a total of £10 p.a. to the average bill by 2025.

The majority of customers supported the future proofing option (71 per cent) as it carries the least risk and was felt to be the most proactive.

More detail is provided in the Customer and Stakeholder Engagement Technical Report.

6.4.2 Our customers' views about water resources options

Customers said...

'JUST LIKE FOLKS NOW USING SMART METERS ARE LESS INCLINED TO LEAVE A MYRIAD OF APPLIANCES ON STANDBY IT WILL, THROUGH EDUCATION AND INDIVIDUAL CUSTOMER COST SAVINGS, BECOME THE NORM TO USE WATER SPARINGLY.'

'IT IS BLINDINGLY OBVIOUS THAT AW NEEDS TO BOTH INCREASE WATER AVAILABILITY AND REDUCE WATER USAGE PER PERSON. A TWO PRONGED ATTACK IS NEEDED IN CASE ONE OR THE OTHER FAILS.'

'THE APPROACH NEEDS TO BE BALANCED AND COSTS VS. BENEFITS OF EVERYTHING NEED TO BE CONSIDERED. LEAKS ARE IMPORTANT TO THE END USER AND ARE VISIBLE FOR DOMESTIC CONSUMERS - BUT IT'S NOT THE ONLY WAY WATER IS WASTED AND NOT THE ONLY THING THAT MONEY CAN BE SPENT ON.'

Our customers view all water resource options (including both demand management and supply-side) as preferable to an increase in the frequency of restrictions. The one exception being sea-tankering, which our customers do not perceive to be a credible option.

Customers expressed a clear preference for demand management, particularly leakage reduction. Even when customers understood that our leakage performance is industry leading, and that reducing leakage does not reduce bills, it remains a key issue and therefore is seen as a priority for investment. For example, in the Water Resources Second Stage Research (stated preference survey) leakage reduction was the highest ranked option by both

household and non-household customers. We also asked customers in the consultation on our outline plan whether we should continue to drive leakage down or to allow it to remain at current levels. Seventy-eight per cent voted to continue to reduce leakage, even though the incremental costs are increasing.

There was a lot of spontaneous interest from customers in using smart meters to help them to save money by reducing their consumption. Smart meters were seen as central to encouraging behavioural change and expected to be the norm in the future.

There were high levels of support for our demand management strategy during the dWRMP consultation and our business plan. Customers who joined in with our online community research were particularly positive, expressing 'delight' over our ambitious leakage targets and feeling that our industry-leading performance is something 'to be proud of'.

Although customers have a preference for demand management, they also want to see a cost-effective balance of supply and demand options. When customers learned that there are cheaper alternatives to leakage reduction, many felt that while leakage reduction is important, affordability should also be a key consideration. When asked to prioritise supply-side options, customers prefer options that are reliable, and make best use of existing resource and infrastructure.

Finally, many customers also recognise our expertise and trust us to make complex investment decisions, and choose the mix of solutions that will be most efficient and cost effective.

6.4.3 Our customers' views about bills

Customers said...

'SOMETIMES YOU FEEL, "I'VE WORKED ALL MONTH AND I HAVE NOTHING LEFT".'

'THOUGH ALREADY ON A TIGHT BUDGET I WOULD PAY UP TO 10 PER CENT MORE ON MY BILL IF IT MEANT NO INTERRUPTION TO MY HOME SUPPLY SHOULD THERE BE A DROUGHT SITUATION.'

'I WOULD SUGGEST A GOOD QUALITY "MONEY SAVER" GUIDE, WHICH COULD BE SENT OUT. THIS SHOULD INCLUDE THINGS LIKE "WOULD YOU BE INTERESTED IN A WATER BUTT OR A POLY BRICK FOR THE CISTERN? DO YOU WANT TO SAVE MONEY?" THIS COULD FOLLOW UP WITH LOCAL MEETINGS AND A KNOWLEDGEABLE ATTENDANCE AT LOCAL EVENT.'

'IF AW RECKON IT WOULD ONLY COST CONSUMERS £10 A YEAR IN TOTAL TO FUTURE PROOF THEIR SUPPLY, I WOULD PREFER TO PAY £10 THAN SAVE A PALTRY £7-£8 BY CHOOSING EITHER OF THE OTHER TWO OPTIONS!'

Many of our customers are feeling under financial pressure and are very concerned about money in general. However, there is evidence that suggests rent and other utility bills tend to be much more of a concern than water bills because they are higher and tend to fluctuate more.

The results from our societal valuation work indicate that customers are prepared to accept bill increases for service improvements that they value. However, this work also shows that there is a big difference between the attitudes of more affluent customers and less well-off customers.

We discussed the potential bill impacts of increasing Levels of Service with customers at various points of the consultation. For example, after completing the Second Stage Stated Preference Study that focussed on drought resilience and water resource options, we conducted four follow-up focus groups to explore the results in more detail. We told customers that the investment required to ensure resilience to severe drought could increase average bills by £2 p.a. The customers in the focus groups were prepared to pay this.

As part of the deliberative research with our online community that focussed on drought resilience and water resource options (Drought resilience: exploring customer acceptance and buy-in, Aug 2017), we informed customers that we were considering investing to increase our resilience to drought, and that this would require additional investment in both supply-side and demand-side options. We also asked customers what would be a reasonable bill increase, and the most common suggestion was a 10 per cent price rise (but other suggestions ranged from £5 - £20 per month).

As already mentioned, the majority (71 per cent) of customers who participated in the deliberative research on our dWRMP selected the most expensive option to invest in drought, climate change and future proof our network now. This option had a bill impact of £10 p.a. on the average bill by 2025.

In our consultation on the outline business plan, in order to test affordability and acceptability we created investment scenarios linked to corresponding bill increases over the period 2019-20 to 2024-25 (flat bills, a +2.5 per cent rise and a +5 per cent rise). The scenario with a +5 per cent rise in bills included investment in drought and climate change resilience, and investment to future proof our network against future uncertainty. Over 80 per cent of customers, across a range of channels, supported an increase of at least +2.5 per cent to deliver these investments.

6.5 Residual risk and uncertainty

All risks and uncertainties have been included in our revised dWRMP from 2020 as they materialise. This includes those relating to:

- Population growth and associated uncertainties in timing and location
- Per capita consumption levels
- Impact of climate change (commencing in 2020)
- Sustainability reductions (throughout AMP7), and
- Drought risk relating to improved level of service (2024).

We used our headroom model to quantify uncertainties, as set out in our Managing Uncertainty and Risk report.

We have two WRZs with residual deficits: South Essex and Ruthamford South. There is a small deficit (<2 Ml/d, limited to headroom) in South Essex commencing in 2020, largely caused by growth, which will be resolved by the transfer from East Suffolk in 2024; we are in discussion with Affinity Water regarding an adjustment to our respective share of Ardleigh to ensure the supply-demand balance (including target headroom) remains positive. Ruthamford South has a much larger deficit (>10 Ml/d) starting in 2020, mainly due to climate change, which is resolved in 2024 by the transfer of additional resource from Lincolnshire into the Ruthamford system; we intend to manage this risk by being prepared to request a Drought Permit at Offord, which would provide sufficient temporary resource in the event of a severe drought.

In our revised dWRMP we continue to implement low regret options up front. Principally these are demand management options including metering, leakage reduction and water efficiency measures. Such options ensure the prudent use of natural resources and reduce the need for supply-side options even with a rising population. Demand management measures are also strongly supported by our customers and stakeholders.

The strategic transfers have been selected as the least cost way of meeting future deficits and we have adjusted the capacity of the transfers as described in chapter 5. This enables us to avoid stranded assets whilst maintaining security of supply over the whole WRMP planning horizon. The adjustment takes into account the following residual risks and uncertainties:

- Further drought resilience, e.g. potential in future to move to <0.2 per cent annual probability of severe restrictions
- Future sustainability reductions, including the potential for the impact of climate change to be incorporated in this process, as described in one of the dWRMP consultation responses
- Uncertainties about demand management savings
- The potential for future transfers to neighbouring water companies, and
- Pre-planning considerations for strategic options.

We will be working to better understand these uncertainties and risks in the next two to three years (see chapter 7) and how they relate to the need for strategic supply options.

6.6 Stress testing and long-term assessment

For the stress testing of our current plan, we adopted a number of scenarios and tested these against key elements of our Preferred Plan. The main scenarios were:

- Higher level of service relating to 0.2 per cent annual probability of severe restrictions (rota cuts and /or stand pipes), to provide resilience to extreme (1 in 500) drought events
- High climate change scenario applied within deployable output, rather than headroom
- Demand management reduced by 15 per cent in terms of volumetric savings
- Demand management reduced by 30 per cent in terms of volumetric savings, and
- Additional export to Affinity Water via Ruthamford South, in short term and post-2032.

We also considered alternatives to the Preferred Plan and additional resources that could be required. An important factor is the location of options; most of our feasible strategic options, and generally the most cost effective, are in the central-west of our region (e.g. reservoirs) or at or close to the coast (e.g. recirculation and desalination schemes). This means that transfers are required to bring water inland and to locations where we could have significant additional supply-demand deficits in future.

In all of the problem characterisation areas the transfers within the Preferred Plan provide adequate capacity for meeting the stress test scenarios. In the West, Norfolk, and Cambridgeshire and West Suffolk areas additional transfers (e.g. into Norfolk) would be required to address new deficits. This additional investment would further enhance the strategic grid and could be delivered at a later date without impacting the Preferred Plan schemes. To meet the deficits created by the scenarios additional resources would also be required. The stress testing shows that these could be a number of smaller options (e.g. water company imports, desalination or raw water transfers) or a larger single strategic option such as a winter storage reservoir. In both cases water would be moved between areas by the Preferred Plan and additional transfers described above. Further detail is provided in the Managing Uncertainty and Risk supporting technical document.

In all areas the transfers within the preferred plan provide adequate capacity for meeting the demand of future scenarios. In the West, Norfolk and Cambridgeshire and West Suffolk areas additional transfers would be required to address new deficits generated by the stress testing scenarios. This additional investment would enhance the strategic grid in the preferred plan and could be delivered at a later date without impacting the preferred plan schemes. To meet the higher demands of the scenarios tested additional resources would also be required. The stress testing shows that these demands could be met by a number of smaller options (e.g. Water company imports, desalination or raw water transfers) or a larger single strategic option such as a winter storage reservoir moved between areas by the transfer options.

We have assessed our preferred plan over two extended durations 45 years (up to 2065) and 65 years (up to 2085) and for two supply forecast scenarios (with and without Affinity Water trade). The results are shown in the matrix above.

In addition to the resource options in the preferred plan the South Lincolnshire reservoir option RTN1 (maximum deployable output 76Ml/d) was selected along with a number of other smaller resource options in all scenarios. We then tested if a single larger reservoir (up to 200Ml/d) would meet demand as an alternative to the least cost selection of smaller options.

The trade with Affinity Water impacted the timing of when new resource options would be required.

Table 6.1: Long-term assessment

Duration	Supply forecast Scenario	Resource options required in scenario in addition to Preferred Plan	Resource options required in addition to Preferred Plan if a strategic supply-side option was developed
45 years up to 2065	Without trade to Affinity Water	• South Lincolnshire reservoir (RTN1) in 2042	• South Lincolnshire reservoir in 2038
65 years up to 2085		• STW import 2044 • South Lincolnshire reservoir (RTN1) 2058 • Water reuse 2068 • Fenland Reservoir 2080	• South Lincolnshire reservoir 2038
45 years up to 2065	With 50Ml/d trade to Affinity Water	• STW import 2032 • Water reuse 2032 • South Lincolnshire reservoir (RTN1) in 2037	• South Lincolnshire reservoir in 2032
65 years up to 2085		• STW imports 2032, 2037 • Water reuse 2032, 2062, 2068 • South Lincolnshire reservoir (RTN1) in 2055	• South Lincolnshire reservoir in 2032 • Water reuse 2067

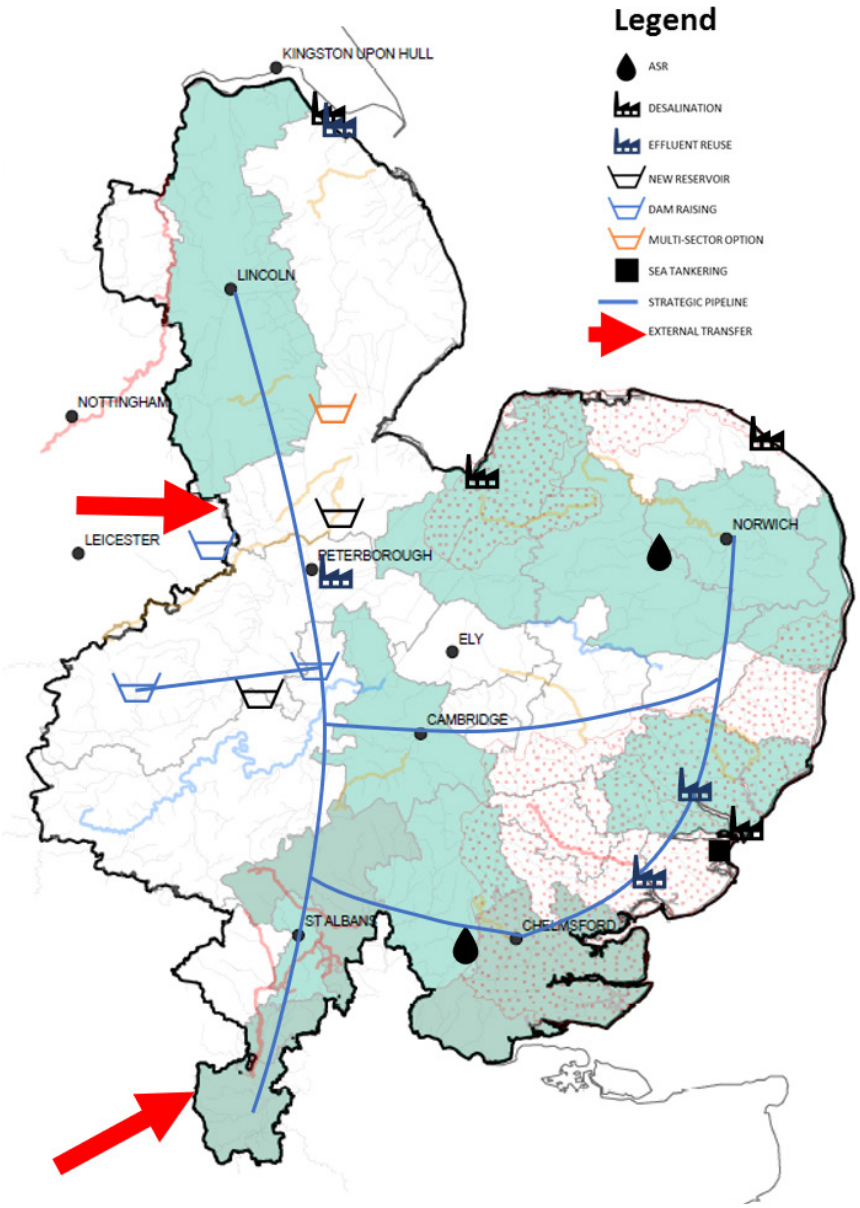
6.7 Alignment of plans

6.7.1 Water Resource East (WRE)

Our Preferred Plan is aligned with the WRE preliminary regional strategy, as shown in figure 6.1. The WRE strategy includes:

- New reservoir storage capacity, capturing high winter flows – our strategy provides the flexibility to deliver new reservoir storage capacity in our region in the future, and distribute resources across the region
- Treated water imports – we have considered import options in our decision-making approach, and will continue to assess these as we work towards WRMP 2024
- A network of strategic transfers, to share resources between companies and across sectors – our plan delivers a network of strategic transfers across our region, and
- Desalination and water reuse at key locations on the east coast – our plan includes water reuse in AMP7 and the development of desalination in AMP9. We will continue to assess these options as we work towards WRMP 2024.

Figure 6.1: WRE preliminary regional strategy



6.7.2 PR19 Business Plan

Our revised dWRMP is consistent with our PR19 Business Plan. We describe the AMP7 investment required to deliver our Preferred Plan in the Resilient Water Supplies chapter of our Business Plan submission, published on our website. Our PR19 Business Plan includes a number of AMP7 performance commitments which are related to the WRMP. These include:

- Risk of severe restrictions in a drought (1-in-200 year drought)
- Percentage of population supplied by single supply system
- Per capita consumption (three year average)
- Leakage (three year average)
- Abstraction Incentive Mechanism, and
- Water Industry National Environment Programme.

The successful delivery our revised dWRMP Preferred Plan is essential to achieving the committed performance levels set out in our PR19 Business Plan.

6.7.3 Supply system resilience programme

Within our region we have a number of discrete supply networks resulting in some customers being supplied by a single water treatment works. If there was a catastrophic failure at the water treatment works, these customers would be at risk of losing their supply. Our PR19 Supply System Resilience Programme will reduce the number of customers provided by a single source of supply following our strategy to connect up discrete systems to provide dual sources of supply.

The WRMP transfer options have been developed to be consistent with the resilience requirements of our network i.e. connecting into key existing assets. The transfers within the Preferred Plan will connect up some of these discrete systems enabling the use of multiple sources of supply to be moved around the region providing supply system resilience to customers. In some locations local infrastructure is required in addition to the transfers in the preferred plan. These local infrastructure requirements connect discrete areas of the network to the WRMP transfer options. The PR19 resilience programme includes the investment required for the local infrastructure to maximise the benefits of the Preferred Plan.

6.7.4 National water resources policy

Our preferred strategy is aligned with the national water resources policy position as outlined in the Water UK National Water Resources Planning Framework and the NIC's 'Preparing for a drier future'. Specifically, our plan prioritises demand management ahead of developing new resources which is a key recommendation in both of these reports. Our strategy also promotes transfers across our region from areas of surplus to areas of deficit. In addition, by deferring the development of new resources to later in the planning period, our strategy provides flexibility to support the development of winter storage reservoirs in our region.

6.7.5 Defra climate change adaptation programme

In July 2018 Defra published The National Adaptation Programme and the third strategy for climate adaptation reporting. This report sets out what government and others will be doing over the next five years to be ready for the challenges of climate change. Our revised dWRMP and PR19 Business Plan supports the actions identified in this report.

6.7.6 Catchment management

Our plan includes the development of metaldehyde treatment to address the water quality risks associated with moving water between WRZs. This is consistent with the relevant Drinking Water Inspectorate (DWI) guidance and regulations, to ensure that we do not deteriorate the water quality received by our customers.

However, we are committed to working with Environment Agency to deliver our wider catchment management strategy by:

- Assessing pollution risk for all our groundwater and surface water sources
- Delivering a comprehensive monitoring programme, and
- Implementing catchment modelling.

Our catchment risk assessment procedures align fully with the DWI's requirement to implement a Drinking Water Safety Planning approach. We have developed and successfully implemented a Catchment Management Strategy, including the Slug It Out initiative, to subsidise farmers to use alternative products in priority catchments. We continue to work with the Environment Agency on Safeguard Zone Action Plans and the development of Source Protection Zones. Further details can be found in our PR19 business plan.

7 FORWARD LOOK

7.1 Introduction

We have presented the scale of the challenge that we face and our ambitious Preferred Plan, in the previous chapters. This chapter focuses on the next steps we need to take, following the publication of our final plan. Specifically in this chapter we describe:

- The work we are undertaking to improve some of the technical elements of our WRMP process
- Our proposals to deliver the schemes in our Preferred Plan by 2025 (the end of AMP7), or earlier where required
- Our adaptive planning approach, which we are using to manage future risk and uncertainty, and
- The future of national and regional water resources planning, the role we will play, and how we will factor this in as we work towards WRMP 2024.

7.2 Work to improve our WRMP process

WRMP 2019 has marked a step change in the scale of the challenge we face. In response to this challenge, and in factoring learning from WRMP 2015, we have advanced our technical approaches. However, there is still more work to do to refine our processes and this was clear in the representation we received from the Environment Agency in response to our dWRMP. We are in the process of developing a detailed programme of work, in conjunction with the Environment Agency, which will deliver the required improvements over the coming months and years. The key focus areas for this programme of work are described in table 7.1

Table 7.1: Programme of Work to Improve our WRMP Process

Focus Area	Description
Supply Forecast Modelling	There is work required to refine our modelling approach to calculating our supply forecast, including the impacts of climate change, drought and sustainability reductions (as presented in chapter 2). In the development of our dWRMP we built a new water resource system model (AQUATOR) to support our technical process. There is still work required to ensure we are maximising the benefits of this new modelling approach. Please refer to the Supply Forecast supporting technical document for further details.
WRZ Integrity	Once the WRMP is finalised we will produce updated water resource system models that incorporate the expanded strategic grid. This will allow us to re-evaluate the integrity of our 28 WRZs and to join up WRZs where the Environment Agency's criteria are met. We expect to have significantly fewer WRZs at WRMP 2024, although a number of isolated WRZs will remain, particularly in the east of our supply area.
Climate Change Impact Assessment	Our previous assessments will be updated using the UK Climate Projections 2018 (UKCP18) after they are released. We will also be more closely integrating the assessment of climate change and drought impacts.
Assessing Extreme Drought Impacts	Our revised dWRMP incorporates the results of further analysis of stochastically generated droughts, including those which could be considered 'extreme' i.e. approximately 1 in 500 year return period. We are commissioning additional studies to assess extreme droughts considering a range of methods including historical analysis, weather generators and climate models.
Water Balance	In autumn 2018 we will commence a review of the water balance procedure and its relationship with the WRMP process. This will include consideration of the geographical units currently used and year-to-year variability in outputs.
Critical Period Review	Recent experience during the 2018 'Beast from the East' and the 2018 summer heatwave has demonstrated our resilience in managing peak demand. We intend to use recent evidence, including data from our smart meter trials and Survey of Domestic Consumption, to re-assess our critical periods. This will also consider imminent changes to deployable output and our supply system, using our updated water resource system models.
Hartlepool WRZ	Our Hartlepool WRZ has a stable supply-demand balance with significant headroom and therefore we have historically adopted a proportionate technical approach. However, in advance of WRMP 2024 we will undertake an analysis of drought risk and evaluate the approach to demand management.

7.3 Delivery of our Preferred Plan

Our Preferred Plan, as outlined in chapters 4, 5 and 6 includes a significant number of schemes which have short delivery timescales, and are required by 2025 or earlier in some cases. We are already working to establish the delivery teams to meet these ambitious timescales.

We will utilise our existing framework agreements to deliver our leakage, smart metering and water efficiency programmes. Our internal delivery teams played a pivotal role in the development of the strategy so we are confident that the proposed roll out and pace of the programme is achievable.

As we finalised our revised dWRMP, it was clear that we needed to increase the capacity of our existing framework agreements for the delivery of large scale infrastructure schemes. We have, therefore, already begun the process of market engagement to put in place a new Strategic Pipeline Alliance. This new delivery vehicle will be in place by mid-2019, ready to progress the potable water transfer schemes which all require detailed environmental and planning considerations.

As well as appointing new framework partners, to support the delivery of the Preferred Plan, we are utilising our existing supply chain to progress the planning and design activity for all the large strategic transfer schemes. In addition, some of the smaller schemes which have early delivery dates (such as the Norwich and the Broads to Happisburgh transfer, required by 2021) are already in progress with our existing partners.

We have also completed a detailed analysis to assess whether any of our WRMP schemes would be suited to delivery via Direct Procurement for Customers. Further details of this analysis are included in our PR19 Business Plan.

We have committed £50m of AMP6 investment to support the early delivery of our Preferred Plan, and will also utilise AMP7 'transition' funding. We are confident that the measures outlined above will result in the successful and timely delivery of our Preferred Plan between now and 2025.

7.4 Adaptive planning

7.4.1 The need for adaptive planning

Our revised dWRMP is a low regret plan focussed on demand management, the transfer and use of existing resources and supply resilience. It will enable us to support growth, adapt to climate change, enhance the environment and ensure a high level of supply resilience for our customers. Whilst we have incorporated a number of uncertainties into our revised plan, and have undertaken stress testing, we know that realisation of some future scenarios will mean that further investment is required. In some cases we may not have a long lead time to implement schemes and therefore we need to develop a plan which identifies thresholds beyond which we need to take further action.

Once we have finalised our WRMP we will embark on a phase of adaptive planning consisting of the following components:

- Further assessment of supply and demand scenarios (for example those used in the stress testing) that could affect the supply-demand balance
- Identification of critical thresholds that should trigger alternative courses of action, and associated monitoring in relation to thresholds
- Development of an adaptive plan which documents potential pathways we may need to pursue, and
- Pre-planning activities to keep open a number of strategic supply-side options.

Adaptive planning is a proven process for developing plans under uncertain conditions. For example it has been used by the Environment Agency in the Thames Estuary 2100 project, in the Dutch Delta programme and forms part of the robust decision making process piloted by the WRE programme. The construction and use of adaptation pathways is the subject of a current proposal for a new British Standard.

7.4.2 Development of our adaptive plan

We will work with regional partners including WRE as well as other stakeholders to develop our adaptive plan. We believe that there are a number of scenarios that could affect our supply-demand balance in the medium to long term. As such we will be both enhancing the scenarios we have already used in the stress testing as well as developing a monitoring plan.

Additional work on scenarios will focus on:

- Assessment of the forthcoming UKCP18 climate change projections, and
- Further work on drought including understanding of extreme drought and the relationship between drought and climate change.

Monitoring will include:

- Distribution input and especially leakage and per household consumption (PHC)/per capita consumption (PCC), against assumptions included in our revised plan
- Evidence of climate change compared to scenarios, for example whether it remains appropriate to continue using the medium scenario in the deployable output line of the supply-demand balance
- Experience from drought events and heatwaves
- Revised legislation or regulations regarding sustainability reductions, and
- The benefits of WINEP mitigation options.

We will use the scenarios in our supply system, demand and headroom models to assess the robustness of additional options. We will develop pathways that could be used to navigate through different uncertainties and identify lead times and thresholds. This will be undertaken using new methods that link robust decision making, multi-criteria search and scheduling, or/and using techniques such as real options analysis. We will relate our monitoring to thresholds and identify if and when we need to adopt an alternative path. We anticipate regularly reviewing this in advance of WRMP 2024.

In addition, we will continue trading discussions with our neighbouring water companies and third parties.

7.4.3 Pre-planning for strategic options

As part of our adaptive planning approach, we are committed to undertaking pre-planning activities for a number of supply-side options. We recognise that the future challenges we face may lead to the need for additional supply-side capacity, potentially as early as 2030. This is consistent with the wider national and regional future strategies, as discussed in chapter 5. We will continue to assess the need for new supply-side schemes as we prepare for WRMP 2024, but we recognise that new supply-side schemes are complex to deliver and have long planning timescales. These timescales make it unfeasible to deliver the schemes within one planning cycle, so we have to start planning now for schemes that may be required for delivery between 2025-2035. Delivering this pre-planning activity now will ensure that these schemes are ready to implement if they emerge in our Preferred Plan at WRMP 2024.

The strategic options we are focussing on are illustrated in figure 7.1. These are the options we believe are most likely to be selected, as supported by our recent option appraisal. They include:

- Reservoir storage options in South Lincolnshire and North Fenland WRZs
- Trading with Severn Trent Water
- Desalination at Felixstowe, and
- Water reuse and river augmentation schemes in Ipswich and Kings Lynn.

We will also continue to develop our thinking around the future role of innovative water resources options such as Aquifer Storage and Recovery (ASR).

The pre-planning activities we plan to deliver by 2025 include:

- Site selection and preliminary geotechnical investigations for reservoir storage options
- Engineering designs
- Flood risk assessment
- Planning and undertaking studies to support Environmental Impact Assessments
- Preparation for the planning application process and potentially including some schemes under a Development Consent Order, and
- Preparation for the delivery of options through Direct Procurement for Customers, as per the Ofwat PR19 methodology.

We have developed an estimated timeline for the delivery of the winter storage reservoir in our region including an allowance for setting up the Direct Procurement process, which we have included in our PR19 submission to Ofwat. The timeline shows it would take approximately 12 to 15 years to deliver a scheme of this scale, so it is essential that we start planning now if these options are to be available in the early 2030s. We have already completed a significant amount of work on these future options and will continue to work with key stakeholders to assess the future need and potential benefits of these schemes.

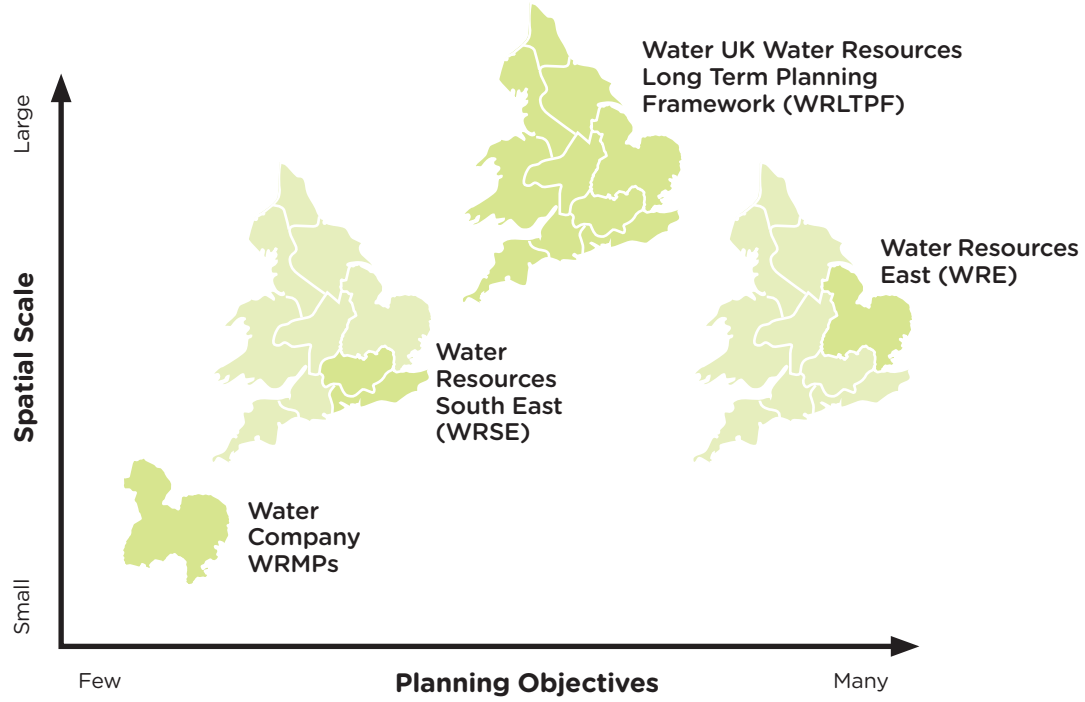
Figure 7.1: Strategic supply-side options

7.5 National and Regional Planning

Our water industry colleagues and government recognise that there needs to be joined up thinking and shared resources to meet the challenges we face. This is reflected in the recent joint letter sent to water companies 'building resilient water supplies'.

Figure 7.2 illustrates the various national and regional planning initiatives which we have considered in the development of our revised dWRMP.

Figure 7.2: National and regional planning frameworks



We are committed to supporting future Water UK national work, the development of the National Planning Framework and supporting, as appropriate, the strategy developed by the NIC. We are also committed to the future development of the WRE regional initiative, taking a leading role in developing the future scope of the project as we work towards WRMP 2024. The importance of this regional planning initiative for WRMP was reiterated in the recent joint letter sent to water companies. In addition we will continue our input to other regional planning initiatives including WRSE and WRN.

We recognise the importance of catchment partnerships and pilots and will continue to support these during AMP7.

7.6 Future sustainable abstraction

Abstraction must be sustainable, and meet legislation such as the WFD, the Habitats Directive 1992, and the Wildlife and Countryside Act 1981. As described in chapter 5, we are delivering a significant number of sustainability reductions in AMP7 in order to ensure that our abstractions are sustainable, as per the WINEP. In addition to the sustainability reductions, we will also deliver a significant number of WINEP mitigation options in order to reduce our environmental impact, including river restoration, river support, recirculation, and pond support.

However, we recognise that there is still more work to do in the move towards sustainable abstraction. Further action may be required depending on the level of environmental improvement achieved by the AMP7 WINEP mitigation options. In addition, WINEP requires us to complete a number of investigations and options appraisals in AMP7 to review the environmental impact of a small number of additional abstractions. As a result of these investigations and options appraisals, it is likely that further sustainability reductions and mitigation options will be required in AMP8. These are currently uncertain and will feed directly into the WRMP 2024.

Sustainable abstraction obligations are described in more detail in the Sustainable Abstraction supporting technical document.

GLOSSARY

Abbreviations	Definition
AA	Appropriate Assessment
AMP	Asset Management Plan
AIC	Average Incremental cost
ALC	Active Leakage Control
AMI	Advanced Meter Infrastructure
AMR	Automatic Meter Reading
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
ASR	Aquifer Storage and Recovery
BAG	Benefits Assessment Guidance
BL	Baseline
BUSWE	Business as usual water efficiency
BVP	Best Value Plan
CAMS	Catchment Abstraction Management Strategy
CAPEX	Capital Expenditure
CBA	Cost Benefit Analysis
CCG	Customer Challenge Group
CEF	Customer Engagement Forum
CEMP	Construction Environmental Management Plan
CFMP	Catchment Flood Management Plan
CO2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalent
CP	Critical Peak
CRAGS	Catchment Risk Assessment for Groundwater Sources
CSPL	Customer Supply Pipe Leakage
CTMP	Construction Traffic Management Plan
DCLG	Department for Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs

Abbreviations	Definition
DO	Deployable output
DMA	District metering area
DYAA	Dry year annual average
DYCP	Dry year critical period
EA	Environmental Agency
EBSD	Economics of Balancing Supply and Demand
EC	European Commission
EIA	Environmental Impact Assessment
ESA	Ecosystem Services Assessment
EU	European Union
GEP	Good Ecological Potential
GES	Good Ecological Status
GHG	Greenhouse Gas
GIS	Geographic Information System
HER	Historic Environment Record
HRA	Habitats Regulations Assessment
IMD	Index of Multiple Deprivation
INNS	Invasive Non-Native Species
KM	Kilometres
LA	Local Authority
LCA	Landscape Character Appraisal
LCP	Least Cost Plan
LNM	Legitimate night use
LNR	Local Nature Reserve
LSE	Likely Significant Effects
LSOA	Lower Super Output Area
LT	Long-term
M	Metres
MCA	Multi-Criterion Analysis
MCZ	Marine Conservation Zone

Abbreviations	Definition
Ml/d	Mega litre per day
MPA	Marine Protection Area
MT	Medium-term
NEP	National Environment Programme
NERC	Natural Environment and Rural Communities
NFU	National Farmers Union
NIC	National Infrastructure Commission
NNR	National Nature Reserve
NO2	Nitrogen Dioxide
ODI	Outcome Delivery Incentives
ODPM	Office of the Deputy Prime Minister
PC	Performance Commitment
PCC	Per Capita Consumption
PHC	Per Household Consumption
PPP	Policies, Plans, Programmes
PPS	Principal Planning Scenario
PRoW	Public Right of Way
RBD	River Basin District
RBMP	River Basin Management Plan
RIGS	Regionally Important Geological Site
RSS	Regional Spatial Strategy
RZ	Resource Zone
SAC	Special Area of Conservation
SAN	Small Area Network
SEA	Strategic Environmental Assessment
SELL	Sustainable Economic Level of Leakage
SIC	Standard Industrial Classification
SO2	Sulphur Dioxide
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest

Abbreviations	Definition
ST	Short-term
SV	Societal Value
TCO2e	Tonnes of equivalent carbon dioxide equivalents
ToLS	Test of Likely Significance
Totex	Total expenditure
UK	United Kingdom
UKWIR	United Kingdom Water Industry Research
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USPL	Underground supply pipe losses
WAFU	Water Available for Use
WFD	Water Framework Directive
WINEP	Water Industry National Environment Programme
WR	Water Reservoir
WRE	Water Resource East
WRLTPF	Water Resources Long Term Planning Framework
WRMP	Water Resource Management Plan
WRP	Water Resource Planning
WRZ	Water Resource Zone
WTW	Water Treatment Works

Term	Definition
Abstraction Licences	The authorisation granted by the Environment Agency to allow the removal of water from a source.
Advanced Metering Infrastructure (AMI)	Integrated system of smart meters, communications networks, and data management systems that enables two-way communication between utilities and customers.
Annual Average	The total demand in a year, divided by the number of days in the year.
Available headroom	The difference between water available for use and demand at any given time.
Automatic Meter Reading (AMR)	Technology that automatically collects consumption, diagnostic, and status data from water meter.
Baseline	A description of the present and future state of an area, in the absence of any development, considering changes resulting from natural events and from other human activities.
Best Value	"The most advantageous combination of cost, quality and sustainability to meet customer requirements" An approach that considers not only cost, but also the environment, resilience and customer preferences among others things when looking at different options.
Capital Expenditure (Capex)	Spending on capital equipment. This includes spending on machinery, equipment and building.
Climate Change Adaptation	Involves adjustments to natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.
Climate Change Mitigation	Involves taking action to reduce the impact of human activity on the climate system, primarily through reducing greenhouse gas emissions.
Consultation	Body An authority which because of its environmental responsibilities is likely to be concerned by the effects of implementing plans and programmes and must be consulted under the SEA Directive. The Consultation Bodies designated in the SEA Regulations are Natural England, Historic England (formerly English Heritage) and the Environment Agency.
Copperleaf (C55)	Asset Investment Planning and Management tool. It helps identify the optimal combination of investments and timing that respect all constraints, and deliver the greatest value.
Deficit	Where demand exceeds the supply of water.
Demand Management	The implementation of policies or measures which serve control or influence the consumption or waste of water.
Deployable Output	The volume of water that each water treatment works can put into supply.
Department of Environment, Food and Rural Affairs (DEFRA)	It is the UK government department responsible for water resources in the UK.
Dry Year Annual Average (DYAA)	Represents a period of low rainfall and unrestricted demand and is used as the basis of a water company's WRMP.

Term	Definition
Ecosystem Services	Our health and wellbeing depends upon the services provided by ecosystems and their components: water, soil, nutrients, and organisms. Therefore, ecosystem services are the processes by which the environment produces resources utilised by humans such as clean air, water, food, and materials.
Economics of Balancing Supply and Demand (EBSD)	A method to assess the balance between a company's available water resource and the demand for water by customers.
Extreme drought	Drought events with approximately a one in 500-year return period. These events are described as having a 5 per cent chance of occurring over a 25-year planning period.
Green Infrastructure	Green Infrastructure is a strategically planned and delivered network of high quality green spaces and other environmental features. It should be designed and managed as a multifunctional resource capable of delivering a wide range of environmental and quality of life benefits for local communities. Green Infrastructure includes parks, open spaces, playing fields, woodlands, allotments, and private gardens.
Historic drought	Refers to the worst historic drought on record, which we planned for in our 2015 WRMP. This was previously assumed to be drought events with approximately a one in 100-year return period.
Indicator	A measure of variables over time often used to measure achievement of objectives.
Operational Expenditure (Opex)	Money spent on the on going costs of running a business or organisation.
Outcome Delivery Incentives (ODI)	Financial incentive rates that will be applied to the PC if the company performs above or below that target.
Outage Allowance	Describes an allowance of water which represents the risk of short-term (less than 3 months) supply-side failure. This may be caused for example by pollution incidents or an unexpected need to repair a water treatment works.
Per Capita consumption (PCC)	The amount of water typically used by one person per day.
Preferred plan	WRMP that has been selected by a water company based on it best meeting the needs and statutory requirements of all stakeholders.
Problem characterisation Assessment	Provides documented and auditable trial that planners can use to explain decisions to regulators and stakeholders. The rationale and reasoning is documented for the assessment.
Level of Service	Frequency with which the water companies can impose different types of water restrictions during water shortages.
Mega litre	1 million litres of water, enough to supply near 7,000 customers.
Mitigation	Measures Refers to measures to avoid, reduce or offset significant adverse effect.
Multi-criteria Analysis	It is a technique for assessing options against a number of distinct objectives whose performance can be measured against a number of distinct objectives.

Term	Definition
Natural Capital	Environmental resources of Earth that provide goods, flows and ecological services to support life. These include water, minerals, biodiversity, etc.
National Environment Programme (NEP)	How the Environment Agency set out the environmental improvements that water companies are required to make over the following Asset Management Period.
Net Present value	The value in the present of a sum of money, in contrast to its value at some point in the future.
Non- Households	Properties receiving portable water supplies that are not occupied as domestic premises.
Objective	A statement of what is intended, specifying the desired direction of change in trends.
Scoping	The process of deciding the scope and level of detail of an SEA, including the sustainability effects and options which need to be considered, the assessment methods to be used, and the structure and contents of the SA Report.
Reliability	Refers to the certainty over option yield or saving. For example, how confident we are that a reservoir option will achieve the expected 100Ml/d yield, or a water efficiency option will deliver 10 Ml/d of water savings.
Resilience	Ability of asset networks and systems to anticipate, absorb, adapt to and/or rapidly recover from a disruptive event.
Residual Risk	It is the amount of risk that remains after controls are accounted for.
SEA Directive European Directive 2001/42/EC	'On the assessment of the effects of certain plans and programmes on the environment'. Transposed into UK law via The Environmental Assessment of Plans and Programmes Regulations 2004.
SEA objectives	There are specific objective that have been developed for this project. They are also part of the SEA Framework, against which the project objectives and design have been tested for the purposed of this SEA.
Severe Drought	Refers to drought events with approximately a one in 200-year return period. We describe these events as having a 12 per cent chance of occurring over a 25-year planning period.
Societal Valuation (SV)	The quantification of the relative importance that people place on the changes they experience.
Strategic Environmental Assessment (SEA)	Generic term used internationally to describe environmental assessment as applied to policies, plans and programmes. In this report, 'SEA' is used to refer to the type of environmental assessment required under the SEA Directive.
Supply-demand balance	The difference between water available for use and demand at any given point in time
Supply-side option	Refers to a series of investments which together increase deployable output.

Term	Definition
Sustainability Reductions	It is the reduction in water company deployable output due to a sustainability change (licence change). A sustainability reduction is calculated by the water company and included in its WRMP. Note that a sustainability change may not lead to a sustainability reduction if the source deployable output is limited by another constraint, such as hydrological yield or pump capacity."
Stress Testing	A series of stress tests to ensure that the strategy was robust to future uncertainties whilst understanding how the plan would operate in a business as usual scenarios.
Target headroom	It Is a minimum allowance – taking into account critical risk and uncertainties – required to maintain levels of service for the supply-demand situation with a given level of confidence.
Water available for use (WAFU)	Deployable output plus any bulk supply imports, take away any bulk supply exports and subtract any reductions made by outage allowance.
WFD Directive 2000/60/EC	A piece of EU legislation that requires all member states (including the UK) to make certain steps to protect and improve the quality and quantity of water within water bodies such as lakes and rivers.
Water Resource East (WRE)	A partnership from a wide range of industries, including water, energy, retail, the environment, land management and agriculture working together to safeguard a sustainable supply of water for the East of England.
Water Resource Zone	The WRZ is the principal building block used by companies to develop forecasts of supply and demand and produce a supply-demand balance (SDB). UKWIR/Environment Agency defines the WRZ as: "The largest possible zone in which all resources, including external transfers, can be shared and hence the zone in which all customers will experience the same risk of supply failure from a resource shortfall."
Water Resources Management Plan (WRMP)	A company's plan for supplying water to meet demand over a 25-year period.
WINEP mitigation options	Implemented mitigation schemes alongside smaller sustainability changes.