Draft Water Resources Management Plan 2018

1 December 2017

SEVERN TRENT

Draft Water Resources Management Plan 2018

Contents

Technical appendices

For this public domain version of this document the following appendices have been redacted as they contain sensitive security and commercial information:

A1	Our water resource zones
A2	Calculating deployable output
A6	Outage
A7	Imports and exports
A11	Managing drinking water quality risks
C2	Target Headroom modelling assumptions
D4	Water trading options
D10	Description of our recommended supply options

We have also replaced the names of certain sites with Site A, Site B etc where required.

1. About Severn Trent Water

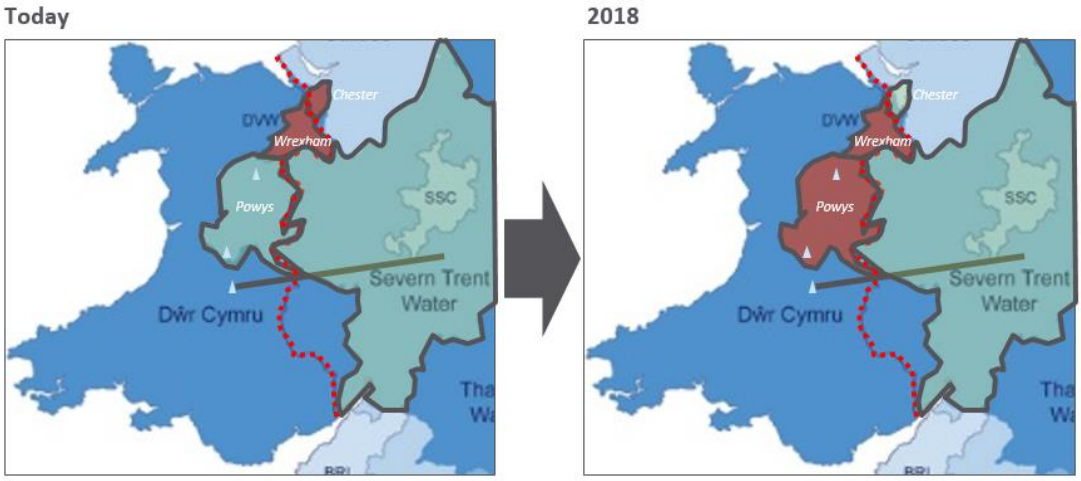
Severn Trent Water is one of the largest of the ten water and waste water companies in England and Wales. We strive to provide high-quality services to more than 4.3 million households and businesses in the Midlands and mid-Wales. Our customers pay the lowest average bills in England and Wales.

By 2020, we want to be the most trusted water company: delivering an outstanding customer experience, the best value service and environmental leadership.

Severn Trent Water is part of Severn Trent Plc, and is listed on the London Stock Exchange in the FTSE100. In 2017 we welcomed Dee Valley Water as part of Severn Trent Plc with the shared purpose of serving our communities and building a lasting water legacy.

This draft Water Resources Management plan relates to the area currently served by Severn Trent Water. A separate plan is being developed for the existing Dee Valley Water area. Our application to Ofwat for a new licence appointment / variation (NAV) for these two licensed undertakings is due to complete in April 2018 (Figure 1). Following these licence variations, we intend to publish the final WRMPs based on the geographies of the new areas of appointment, so far as reasonably practicable given the integrated nature of the supply systems and underlying models. This would be in the form of a separate English WRMP and Welsh WRMP, and will be in keeping with our customer and stakeholder engagement to date in England and Wales. We will use the customer and consultee feedback collected through our draft WRMP consultation process to inform those final WRMP publications.

Figure 1: Changes to the Severn Trent Water Area



What we do

Through our Severn Trent Water business we provide 1.8 billion litres of clean drinking water every day – the water our customers drink – to 7.9 million people, and sewerage services – the wastewater we take away – to 8.95 million people in an area covering 21,000 square kilometres in the Midlands and mid-Wales.

For further information about our business, please visit www.stwater.co.uk

2. About this draft Water Resources Management Plan

This is Severn Trent's fourth published draft Water Resources Management Plan (WRMP) for consultation. It is a statutory requirement that every five years water companies produce and publish a WRMP. The WRMP should demonstrate that we have long term plans in place to accommodate the impacts of population growth, drought, our environmental obligations and climate change uncertainty in order to balance supply and demand.

Our draft WRMP contributes to government's and regulators' wider strategic objectives. We have taken into account the expectations set by Defra in its April 2017 consultation on the *Strategic policy statement (SPS)* to Ofwat. The SPS sets out strategic objectives for Ofwat to take into account when setting price limits, including the need to reduce the long-term risk to water supply resilience from drought and other factors. Defra also set clear expectations that there should be ambitious plans to reduce leakage and help customers use water more efficiently. The SPS reinforced the expectations for drought resilience and ambitious demand management action that had already been set out by Defra in its *Guiding principles for water resources planning*.

We have also taken account of the recommendations made in Water UK's *Long Term Water Resources Planning Framework*, which explored ways of increasing national drought resilience, including the use of new strategic water transfers. The options we have considered within our draft WRMP would facilitate new strategic transfers if needed in future.

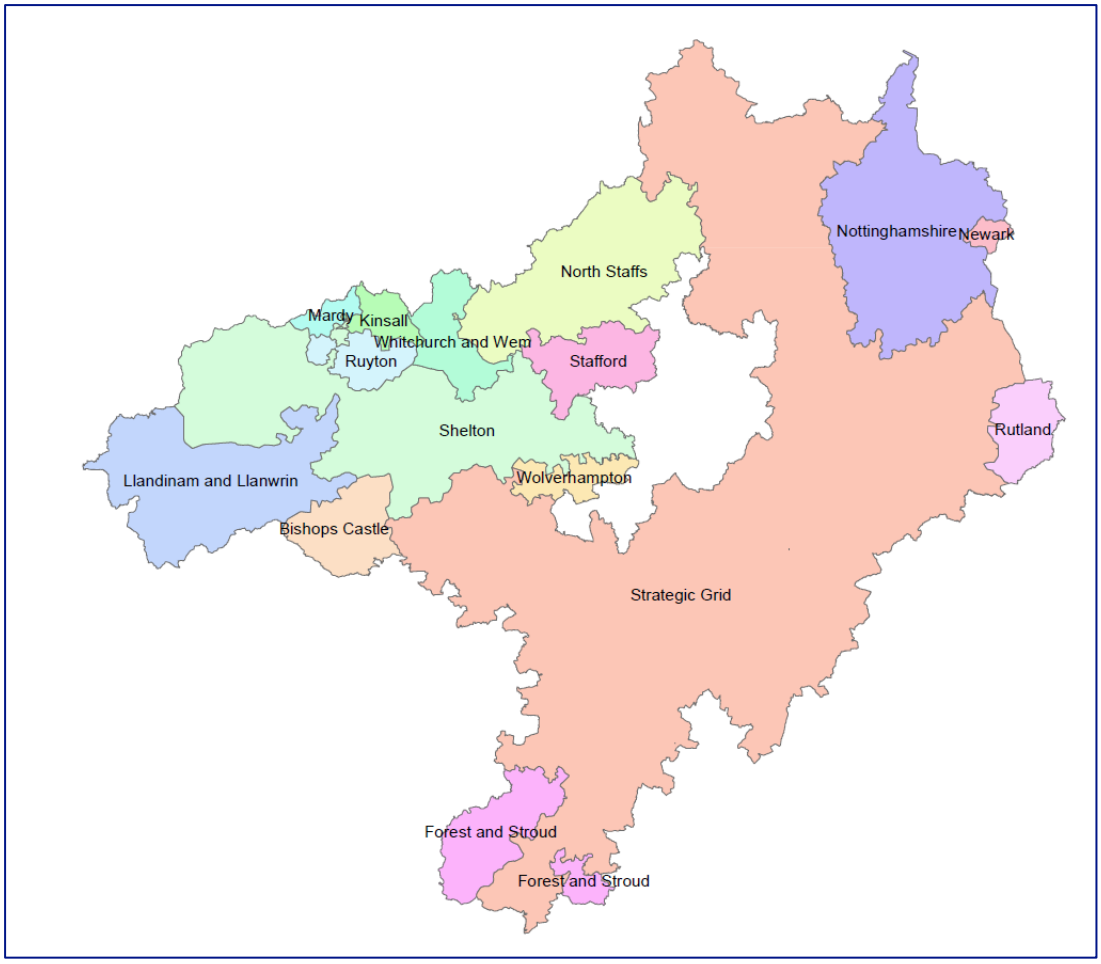
We began working on this draft WRMP in early 2016 to understand new and emerging future water supply / demand challenges, and to explore the options available to us. We have used our in-house expertise in hydrology, hydrogeology, ecology, engineering and economics to define and quantify risks and future supply / demand scenarios. We have also called on a number of specialist consultants and partners to help us develop the recommendations set out in our draft WRMP. Throughout the development of this plan, we have shared our emerging thinking with technical specialists at the Environment Agency, and we have engaged with expert stakeholders to understand their views.

Our water resource zones

For the purposes of water resources planning, we divide the company supply area up into 15 water resources zones (Figure 2). These zones vary widely in scale, from the Strategic Grid zone which supplies the majority of our customers, to the small zones of Mardy and Bishops Castle which supply much smaller populated areas.

Our zones have very different water resources concerns, with some requiring significant investment in the long term to ensure secure supplies, while others will need minimal investment other than to maintain the current assets and infrastructure. These future pressures are explained in this draft Water Resources Management Plan and the supporting technical appendices. Our plan also explains our long term plans to ensure sufficient supplies are available in each of these zones.

Figure 2: Severn Trent Water's water resource zones



New challenges

For this WRMP we face a new, strategic challenge in the form of demonstrating that our plan plan protects the environment in the long-term by not putting at risk the future ecological status of the water bodies in our region (as defined by the Water Framework Directive). This challenge requires a material shift in our thinking, and means that we need to make changes to how and where we currently source our water supplies.

In this draft WRMP we set out the actions that we recommend to meet the long term supply / demand challenge. Due to the scale of the challenge, and based on stakeholder engagement, we are prioritising demand management and propose a step-change in leakage, water efficiency and metering activity. To complement these ambitious proposals, our plan also includes investment in new sources to maintain the security of supply and replace those sources where continued abstraction could deteriorate the water environment.

Delivering multiple benefits

This draft WRMP has been developed in parallel with our business plan for 2020-25 - as part of Ofwat's (our economic regulator's) 2019 price review (PR19) process. By developing our WRMP in conjuction with our business plan, we have worked to ensure that the schemes and activities included in this WRMP not only contribute to addressing future supply/demand challenges, but also deliver broader benefits to our customers by creating more resilient supplies.

The five year investment programmes included in our business plan are also referred to as Asset Management Plans or AMPs. The 2020-25 planning period is referred to as AMP7 and is referred to throughout this draft WRMP. It also looks further ahead to AMP8 and beyond.

Your views on this draft WRMP

We are now seeking your views on the proposals set out in this draft WRMP. In particular, we would welcome your views on:

- our assessment of future risks to water resource availability; and
- our proposals for making sure we have sufficient supplies to meet future demand for water.

The consultation period will end on **14 May 2018**, after which we will consider any responses and update our plan accordingly. We expect to publish our final WRMP in the autumn of 2018.

The statutory water resources management planning process requires that you send your comments on our draft WRMP to DEFRA who will then pass them on to us for review.

You can respond to our draft WRMP by email to **water.resources@defra.gsi.gov.uk** (please copy us in - futureconsultation@severntrent.co.uk) including the words "Severn Trent draft water resources management plan" in the subject header.

You can also respond by post to:

Secretary of State, Department for Environment Food and Rural Affairs (Defra)
Severn Trent Water Resources Management Plan Consultation
Water Resources
Department for Environment Food and Rural Affairs
Area 3D
Nobel House
17 Smith Square
London
SW1P 3JR

3. Our draft WRMP in summary

This draft WRMP explains the technical assessments and modelling we have used to explore the future potential risks to the water supply / demand balance. The plan sets out our proposals for meeting these future challenges, and recommends what steps we believe are needed over the coming years to maintain security of water supplies for our current and future customers.

Responding to future challenges

In this draft WRMP we forecast an significant deficit between supply and demand for water. The key difference from our previous plans is the need to prevent the risk of future environmental deterioration, which is a fundamental requirement of the Water Framework Directive. This means that, in order to protect our environment for future customers, some of our current sources of water can not be relied upon in the future and we need to find alternative ways of meeting demand.

Our plan aims to respond to this, and other strategic challenges, and ensure that we:

- preserve our current level of resilience against droughts;
- tackle unsustainable abstraction and prevent future environmental deterioriation;
- appriopriately plan for climate change;
- meet future population growth;
- improve the resilience of customers' supplies;
- meet our customers' and stakeholders' needs and expectations;
- meet our wider regulatory obligations; and
- understand and allow for future uncertainty.

Our longer term strategy

To achieve these outcomes, our long term water resources strategy is twofold.

We will use **demand management measures** to reduce the amount of water we need to put into supply by:

- reducing leakage on our network;
- helping customers to use less water through water efficiency activities and education; and
- increasing the coverage of water meters across our network to further reduce consumption and to improve our understanding of water demand patterns.

While making the best use of our **sustainable sources of supply** by:

- reducing abstraction from those water sources that have a detrimental impact on the environment;
- making sure our future water abstractions do not pose a risk of environmental deterioration, as required by the Water Framework Directive;
- increasing the flexibility and resilience of our supply system;
- increasing or optimising deployable output from existing, sustainable sources where possible;
- using catchment restoration techniques to improve habitats and ecological resilience to low flows;
- using catchment management measures to protect our sources of drinking water supply from pollution risks; and
- exploring trades in and out of our region to optimise national use of resources.

Understanding the views of our customers and wider stakeholders

We have worked with a wide range of stakeholders throughout the production of this draft WRMP. We have sought to understand whether we are addressing stakeholders' concerns about long term water supplies, and we have explored where we may have common risks or opportunities. Throughout our stakeholder engagement, we have heard clear feedback that we should be ambitious in our leakage and demand management thinking, and that we should continue to deliver on our environmental commitments. These views have shaped our thinking as we have explored the options set out in the draft plan.

4. Our current approach

Each WRMP describes our plans to meet expected changes in supply and demand for water over the coming years. We review our WRMP every five years and we revise our long term plans to reflect our latest understanding of the future supply and demand needs.

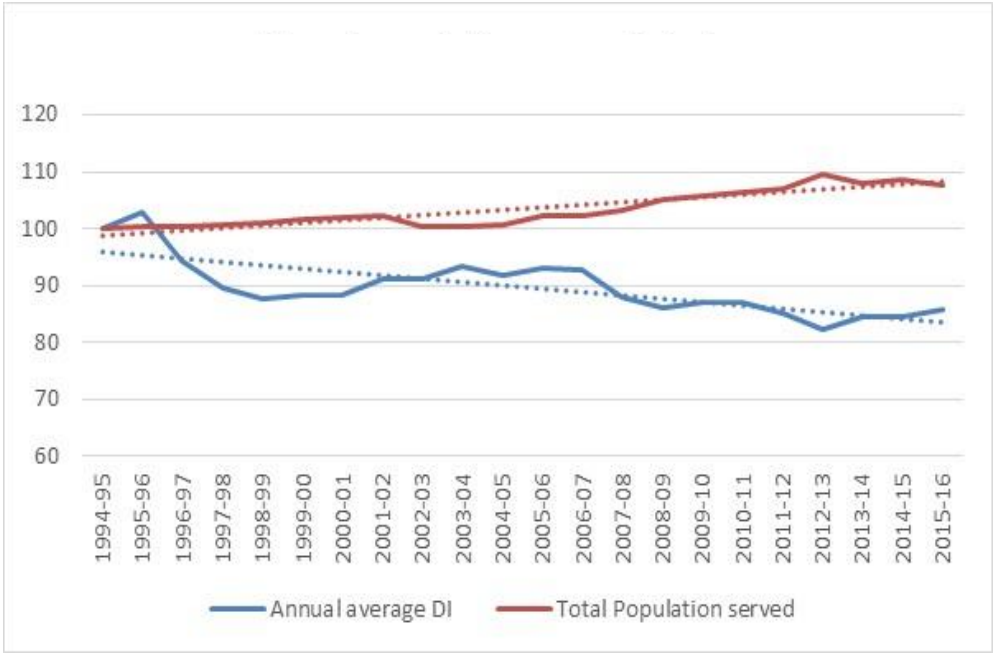
We have successfully delivered the supply and demand improvements described in our previous WRMPs, ensuring that we meet changing demand for water and preserve the security of our supplies. And in turn, this has helped us to maintain our record of having no drought related water use restrictions since 1995-96.

Meeting the changing demand for water

The success of our leakage and demand management initiatives means that over the past ten years we have been able to supply the growing number of customers in our region without having to increase the total amount of water we put into supply. Figure 3 illustrates that the long term downward trend in water into supply has been achieved against a backdrop of steadily growing regional population.

The activities set out in our previous water resources management plans mean that we will have reduced leakage by 72Ml/d (15%) between 2010 and 2020, and reduced water consumption by around 45Ml/d through our water efficiency programme.

Figure 3: Index of distribution input and population growth



Our successful leakage and demand management record gives us a strong platform on which to build the ambitious proposals set out in this latest draft WRMP.

Improving security of supply

Our previous plans have explained how we will invest in new and improved sources of supply so that we can maintain the security of water supplies. Some of the most significant water supply improvements made over recent years include:

- increasing the capacity of the Derwent Valley Aqueduct by duplicating sections of pipeline;
- providing a new, alternative source of supply on the River Severn to support our 1.3 million customers in Birmingham and to facilitate the proactive maintenance of the Site S;
- drilling three new production boreholes to supply Birmingham;
- reburbishing boreholes for use as support to the Site S flow; and
- converting our Hockley boreholes to public water supply sources for emergency use.

As well as these new water supply assets, we have used other innovative ways to improve the security of our water supply.

Through water trading discussions in 2015 we agreed to purchase 31Ml/d abstraction rights from a third party on the River Severn and transfer these rights to our existing Site G water treatment works. Securing these rights increases our Strategic Grid deployable output, drought resilience and provides greater operational flexibility, and defers the need for some of the planned water resources schemes outlined in our last plan. An abstraction rights trade on this scale had not been completed before in England and Wales.

In recent years we have implemented an ambitious catchment management programme to protect our sources from pollution. Catchment management plays a critical role in supporting our supply/demand plan by helping ensure reliable and sustainable output from our existing sources.

This WRMP builds on our track record, but includes a further step change in our ambition in response to the future water supply challenges that we face.

5. Our response to future water supply challenges

As we have developed this draft WRMP, we have had regard to Government policies and priorities as set out in Defra's Guiding Principles document and the detailed technical requirements specified in the Environment Agency's Water Resources Planning Guidelines. We have used this policy and technical guidance to inform the methods used to develop the plan, and to help us in our decision making process. This includes the future water supply challenges that we have identified, and the outcomes for customers and the environment that we will deliver in response to them.

Preserving our resilience against droughts

The primary purpose of the WRMP is to demonstrate that we will be able to sustainably meet the demand for water over the next 25 years, even when under drought conditions. The 2017 Water Resources Planning Guideline recommends that as a reference level of service, companies' WRMPs should be tested agains a reference 1 in 200 year drought event. We are also aware that Ofwat is currently consulting on a 1 in 200 drought resilience metric for all water companies to report against in AMP7.

For previous WRMPs, our historic level of service has been to make sure we experience no more than three hosepipe bans every 100 years, and that we should never resort to emergency drought measures such as standpipes or rota cuts. Since the 2014 WRMP, we have worked with regulators and the wider industry to explore new ways to quantify drought risk so that we can better evaluate whether future investment is needed. We have done this by examining historic extreme droughts that occurred in the 19th century and comparing their severity with events that occurred in our 20th century data record. We have also used advanced statistical techniques to simulate theoretical drought events that go beyond our historic experiences.

Our drought assessment concludes that through the actions we have taken in the past, our raw water supplies are already resilient to a 1 in 200 year drought event.

Therefore we do not anticipate needing to invest in new sources of water for the purpose of improving drought resilience. Instead we will be looking to preserve our drought resilience as we consider how we respond to our other long term water supply and demand pressures. Also, through our wider water distribution investment planning we will identify where we need to increase our network distribution capacity to meet changing patterns of demand, particularly at peak times.

Securing sustainable abstraction and preventing future environmental deterioriation

Previous WRMPs have dealt with the legacy of public water supply sources that impact on the environment and contribute to low flow and aquatic ecology problems. This latest draft WRMP continues that ongoing programme of restoring sustainable abstraction (RSA) and builds on the extensive environmental impact investigations we are carrying out in AMP6, our largest ever impact investigation programme. For this draft WRMP, the RSA implications are that we need to reduce abstraction at a number of sources by up to 69Ml/d over the next ten years.

We have also considered the future, long term impacts of our wider abstractions. We need to put measures in place that will prevent a future deterioration of the environment, which is a fundamental objective of the Water Framework Directive. For us, that means we need to be satisfied that our abstractions and operations do not cause environmental deterioration at some point in the future.

This WFD 'no-deterioration' issue is a new challenge for the WRMP process and presents us with a material change to our previous WRMP assessments. The overall impact of this Water Framework Directive challenge is that up to 159MI/d of our current deployable output may have to be replaced. We have worked with the EA since 2016 to assess the likelihood of our sources causing future deterioration, and we have developed an approach that allows us to prioritise where we need to provide alternative ways of supplying customers. We have also identified those sources where there is less likelihood of future deterioration, meaning we can maintain our existing sources of supply.

As a result of this risk and prioritisation approach, we have developed a package of measures that we propose to implement over the next ten years to reduce unsustainable abstraction and prevent future deterioration. These measures range from strategic investment in new, alternative sources of supply to replace those abstracitons that could cause future harm, through to local environmental protection measures that will mitigate for the effects of our ongoing operations. Our draft plan also includes a step increase in leakage and demand management measures which will play a key role in preventing an increase in water abstraction which could otherwise contribute to a future deterioration of Water Framework Directive environmental status.

Planning for climate change and uncertainty

Our draft WRMP takes into account the potential long term impacts of climate change on our water resources. The WRMP also addresses the significant uncertainty around those long term impacts.

Our draft plan uses the best practice UKCP09 datasets and combines them with our own water resource modelling capability to produce a range of plausible, climate impacted future scenarios. We have tested the impact of the full range of those scenarios on our investment decision making, and have produced a plan that takes a proportionate approach to mitigating for this future uncertainty. The approach we have taken is an evolution of that used for our 2014 WRMP and which was used to underpin our 2015-20 (AMP6) water supply / demand investment measures.

While the UKCP09 climate change scenarios present us with a wide range of potential impacts, almost all of the scenarios point to a long term loss of deployable output due to changing weather conditions. As a result, we are proposing ambitious 'no-regret' leakage and demand management measures for 2020-25 (AMP7) that will complement our longer term plans to improve water supply reliability.

Our climate change modelling approach is described in detail in Appendix A.

Meeting future growth

We need a plan that can provide a reliable supply of water to our current and future customers. We expect population and housing numbers to continue to grow across our region and we need to be able to meet that growth in demand for water services. Our plan is to offset this growth through demand management measures, by improving the flexibility of our water supply network and by providing new sources of water where necessary.

Since the year 2000 the population of our region has grown by 0.5million people, but over this same period the total amount of water we put into supply has fallen by 3%. We have achieved this in part by reducing leakage on our own network, and helping customers to reduce their own water consumption.

Our draft WRMP highlights that the population of our region is likely grow by a further 1.13 million people over the next 25 years and at the same time our water resources will become more scarce. Therefore we need to increase our leakage and demand management efforts to offset this growth in water demand.

Providing resilient supplies

The WRMP specifically considers our resilience to drought events, and sets out our long term proposals to manage this risk. This draft WRMP has been developed in parallel to our wider PR19 investment plans to prevent loss of supplies to customers. Our PR19 plans – the development of which will be completed in the latter half of 2018 – set out investment we need to make across the whole of our water supply and distribution system to so that our customers benefit from:

- water that is always there when they need it; and
- water that is good to drink.

Our plans to achieve these outcomes include a programme of proposed investments that will improve our ability to maintain supplies to customers during times of loss of water resource (eg due to borehole contamination), loss of treatment capacity (eg due to asset or power failure) or distribution issues (eg burst mains). Our overall strategy for managing system resilience is to:

- operate at the right level of risk;
- minimise failure points and implement a more pro-active maintenance approach which allows investment to be prioritised effectively; and
- maximise efficiency and resilience - build a future network which is resilient and effective for customers and the environment and efficient to operate.

Our approach has been to follow the four principal strategic principles of resilience planning (Figure 4), as defined in the Cabinet Office's *Keeping the Country Running: Natural Hazards and Infrastructure* guidance, or a combination of them where appropriate to deliver most cost effective and proportionate risk management response to the hazards and threats.

Figure 4: The four strategic principles of resilience planning

Source: ***Keeping the Country Running: Natural Hazards and Infrastructure Report***

For our wider PR19 investment planning, we have applied these strategic principles to the following areas.

- Resilience of our critical assets
- Borehole and ground water resilience
- Power resilience
- Local resilience
- Risk to our assets from flooding

The supply / demand schemes outlined in this draft WRMP contribute to achieving our PR19 outcomes. Currently, we have not identified any wider resilience investment needs that directly impact on the WRMP. Instead, when we are designing new water supply / demand schemes to meet the needs set out in our draft

WRMP, we are including wider resilience benefits within their design and scope. In that way, we are designing supply / demand solutions that not only achieve our long term water resources needs, but also provide multiple benefits and contribute to our ability to manage asset failures.

The supply schemes outlined in this draft WRMP have therefore been designed to provide 'optimum' solutions that deliver holistic benefits and which are co-ordinated with the wider needs of the investment plan. We are seeking supply / demand solutions that could give us additional resilience benefits for no additional cost, or where the marginal cost of improving resilience makes it cost beneficial to include it in the scope of the scheme design. We will continue to refine the detailed scope of these solutions between draft and final WRMP.

The full range of drivers that have been considered as we have sought to optimise water resources and supply / demand solutions over the long term are summarised in the Table 1 below:

Table 1: Drivers considered optimise water resources and supply / demand solutions

Driver	Summary of need and opportunity
Reduce operating costs	Reduce water treatment and pumping costs by achieving economies of scale and using lower cost works.
Enable Strategic Grid assets to be efficiently maintained	Improve maintenance efficiency through strategic rebuild rather than patching individual processes. Allow more efficient maintenance by extending the period for which a whole process stream can be taken offline. Reduce water quality and customer interruption risks when works are taken out of service. Enable major water treatment works to be taken fully offline. Enable critical Grid aqueducts and pipelines to be taken offline for inspection and extended maintenance.
Drought resilience	Increasing resilience to drought and reducing cost of failure.
Supply demand pressures	Provide increased capacity to address future deficits driven by climate change, water framework directive and population growth. Release 'locked up' deployable output by removing constraints.
Water quality risk	Effectively meet new raw water challenges and drinking water standards.
Water trading	Identify opportunities for trading water with neighbouring water companies, both into and out of our region.
Other resilience	Remove Strategic Grid risks by developing a flexible network that can continue to maintain supplies during an unplanned outage of a water treatment works or strategic link. Provide more headroom to meet future peak demand.

Meeting our customers' and stakeholders' expectations

We have been engaging with our stakeholders throughout the production of this draft WRMP. We began formal engagement at the launch of our stakeholder workshops in 2016, and we have continued this proactive engagement through a series of further events, forums and consultation exercises. Through this process we have heard from a wide range of interested parties including regulators, environmental interest groups, planning authorities and customer representatives.

Chapter 7 lists the stakeholders we have worked with, and how their views have helped shape this draft WRMP.

We have heard a consistent message throughout this engagement that our plan should focus on ambitious leakage and demand management measures and on ways we can better engage with customers on the

environmental impacts of water resource management. The recommendations set out in this draft WRMP have been shaped by this customer and stakeholder feedback.

Meeting our wider regulatory obligations

While the primary purpose of the WRMP is to ensure we have sustainable, long term plans to meet future demand for water, we also need to take our wider regulatory obligations into account. As part of the WRMP planning process, we have been given policy and technical guidance from Defra and our regulators including the Drinking Water Inspectorate, Environment Agency and Ofwat. This guidance covers a variety of statutory requirements covering topics such as supply resilience, drinking water protection and environmental protection. The guidance also sets out policy expectations and performance challenges covering leakage, demand management and innovation.

Throughout the development of our draft WRMP we have sought to address these different requirements and expectations. We believe that our plan provides a holistic approach to achieving these multiple drivers in an affordable and proportionate way.

Managing uncertainty and making complex decisions

Our plan looks ahead at the possible water supply and demand issues that we face over the next 25 years and longer. Many of these issues are very uncertain in terms of the magnitude of their impact, the likelihood of them occurring and the timing of when they could occur. Therefore, it is important that we test how sensitive our plan is to these uncertainties and that we understand which planning assumptions are most significant.

We have used a variety of methods to manage this uncertainty and to test the impacts on our long term plans. Through our approach, we have produced a plan that considers short, medium and long term risks and that recommends investment decisions that are 'low-regret' and are flexible enough to adapt to a changing future.

Chapter 8 describes the different stages of our decision making framework, and how we have arrived at the recommendations made in this draft WRMP.

The size of our supply / demand challenge

Based on our understanding of the future challenges described above, we have assessed the likely impacts on our ability to maintain a balance between the supply and demand for water over the next 25 years and longer term. Our assessment shows that without future investment, we face supply / demand shortfalls in our Strategic Grid, Nottinghamshire and North Staffordshire water resource zones. Figures 5 to 7 illustrate the potential scale of those shortfalls if we do not invest new supply / demand measures. Our proposals to manage these future challenges and prevent future supply / demand deficits from occurring and set out below in Chapter 6.

Figure 5: Strategic Grid WRZ baseline supply / demand balance

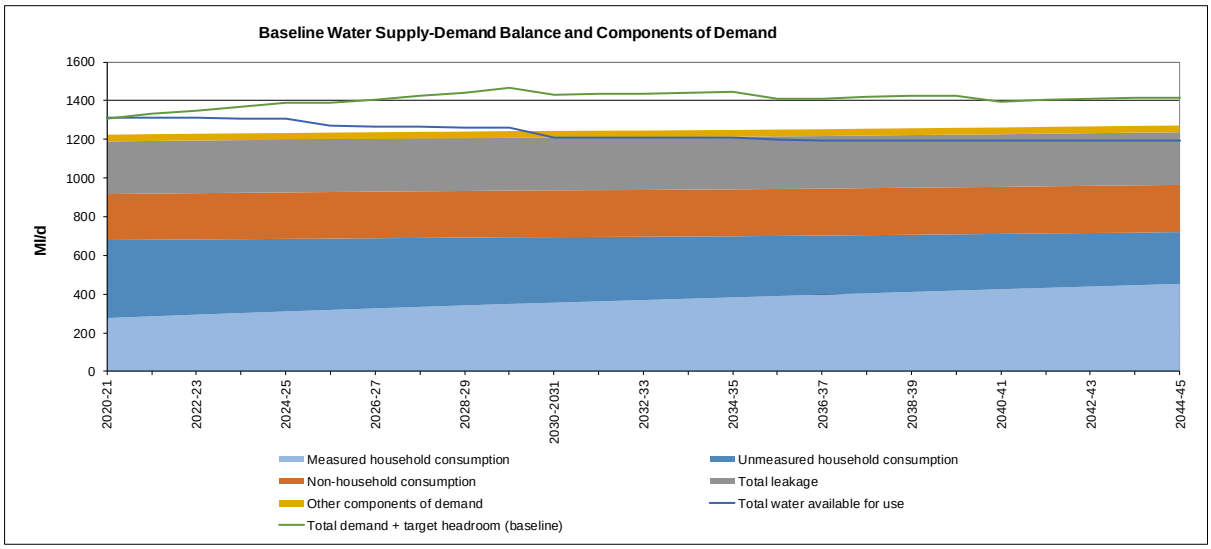


Figure 6: Nottinghamshire WRZ baseline supply / demand balance

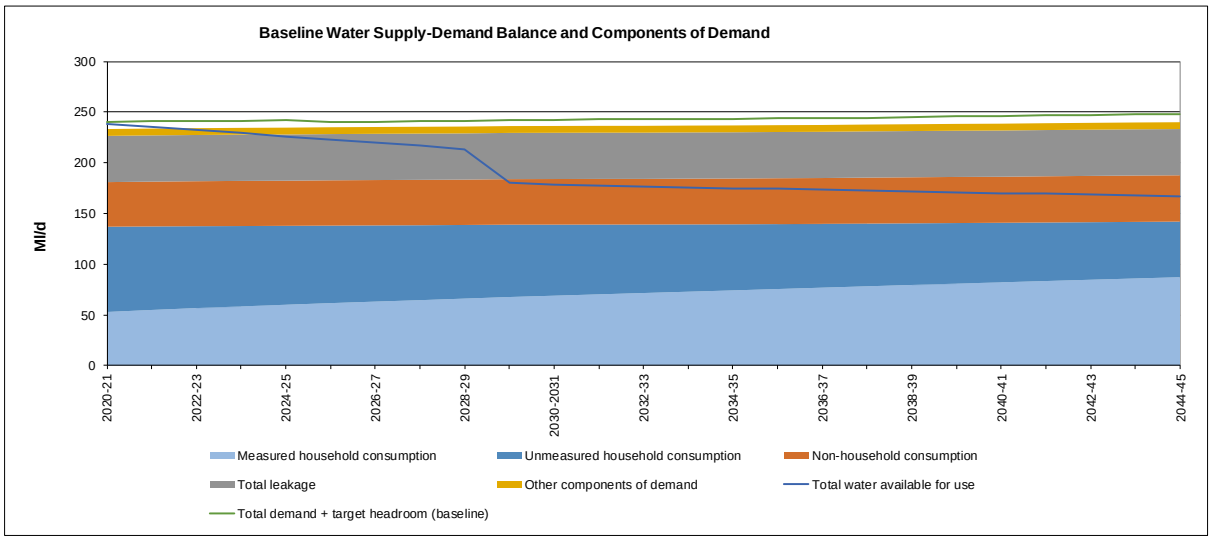
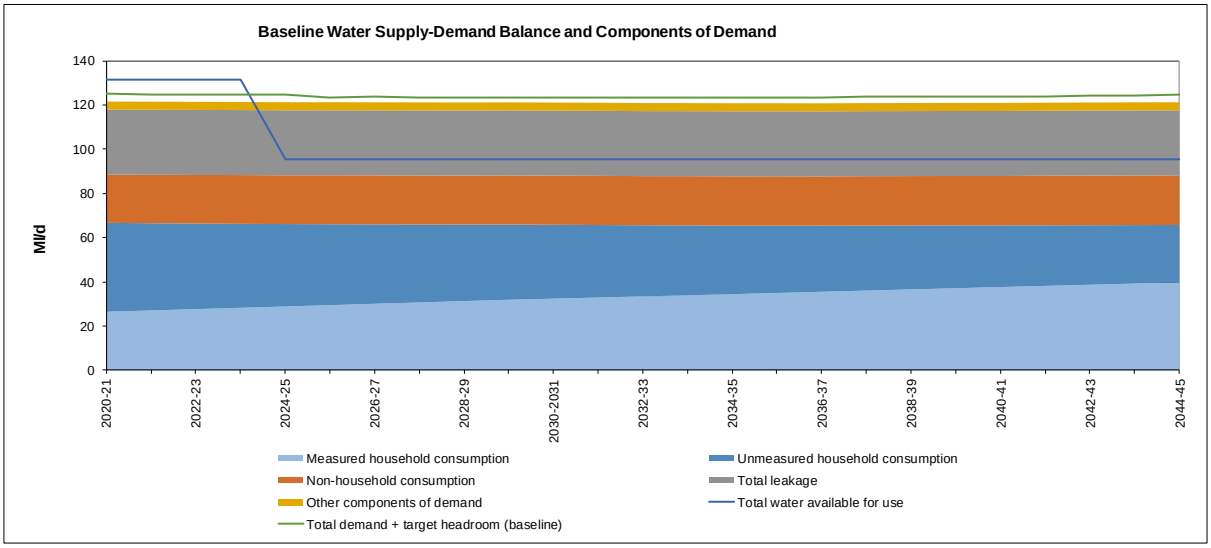


Figure 7: North Staffordshire WRZ baseline supply / demand balance



6. Our long term water resources strategy

While this is our fourth published WRMP, it responds to a supply / demand challenge that is far greater than in any of our previous plans. In particular, the issues around long term sustainable abstraction and how we achieve our Water Framework Directive obligations mean we need to make a step change in our leakage and demand management performance, while developing new strategic sources of supply for the long term. Our long term strategy is therefore to maximise the use of demand management measures to reduce the amount of water we abstract from the environment, while making the best use of our sustainable sources of supply.

We explain the impacts of the different supply and demand challenges that we face over the coming years, and set out our proposals for meeting these challenges and making sure customers' supplies are not put at risk below. Supporting details on these issues and our proposals can be found in the accompanying technical appendices to this WRMP document.

Reducing leakage on our network

Leakage currently makes up around 23% of the total water we put into supply. As explained in Chapter 4, we have a strong track record of reducing leakage, and over the past 10 years this has helped us to meet the water needs of a growing population without having to increase the amount of water we abstract and put into supply. Our leakage reduction activities will have reduced leakage by around 72Ml/d (15%) over the ten years between 2010 and 2020.

As part of this draft WRMP, we propose to reduce leakage by a further 66Ml/d (15%) over five years between 2020-25. This is driven in part by our need to generate more headroom to accommodate the impacts of climate change uncertainty, and to provide a significant contribution to offsetting the AMP8 supply / demand impacts of preventing environmental deterioration to achieve Water Framework Directive objectives. This level of leakage reduction is extremely ambitious, and is part of what we believe to be a 'no-regret' package of AMP7 leakage, metering and demand management measures. The 15% target is the economic level of leakage reduction needed for AMP7, and contributes to our wider package of demand management and supply improvement investment proposals that has been derived using our least cost supply / demand investment modelling.

Every five years we update our long term economic level of leakage assessment as part of the WRMP process. Our traditional approach to setting leakage reduction targets in previous WRMPs has been led by an economic appraisal of the costs and benefits of reducing leakage in the context of the overall supply / demand needs. In zones where there is a forecast supply / demand deficit, then leakage reduction has been considered as part of the least-cost package of measures to resolve that deficit, along with water resources and other demand management measures.

Our 2013 draft WRMP based the leakage reduction target on this traditional, economic level of leakage approach. At that time we had just delivered the industry's largest leakage reduction programme of 9% between 2010-15, and we proposed to continue to reduce leakage by a further 3% between 2015-20 as part of our least cost plan. We published and consulted on our draft WRMP and we received feedback that our leakage target was not ambitious enough when compared with other companies. As a result of that feedback, for the final WRMP we went beyond that economic leakage appraisal and we doubled our ambition to a 6% reduction for the five years 2015-20.

Our experience from the 2013 draft WRMP led us to realise that we need to be more ambitious when assessing our leakage reduction options. As we have developed this latest draft WRMP, we have been working with a wide range of stakeholders to understand their views and priorities. Throughout this stakeholder engagement, we have heard a clear expectation that we need to do more to reduce leakage on our network. At the same time,

our regulators have set an ambition that the industry needs to continue to drive leakage down, and most recently Ofwat has set an expectation that companies will reduce leakage by at least 15% by 2025.

For this latest draft WRMP, we have used our stakeholders' and regulators' expectations to set a range of leakage ambitions, and we have used our investment modelling techniques to test what these mean for our economic level of leakage. We have used this leakage scenario planning to explore whether a traditional economic level of leakage approach can deliver our stakeholders' expectations and to quantify how we would meet Ofwat's leakage challenge. Through this scenario approach we have been able to understand where we need to improve and innovate our leakage find and fix activities and become more cost effective.

The leakage targets we are proposing through this draft WRMP are shown in Table 2 below. The biggest leakage reductions are targeted in the water resources zones with the greatest supply / demand needs.

Table 2: Proposed Leakage Targets

Table 2: Optimised 25 year leakage targets per water resource zone (Ml/d)Water Resource Zone	**2019-20**	**2024-25**	**2029-30**	**2034-35**	**2039-40**	**2044-45**
Bishops Castle	0.6	0.6	0.6	0.58	0.6	0.6
Kinsall	1.1	1.1	1.1	0.96	0.9	0.9
Mardy	0.9	0.9	0.9	0.94	0.9	0.9
Ruyton	1.6	1.6	1.6	1.63	1.6	1.6
Newark	1.8	1.8	1.8	1.82	1.8	1.8
Rutland	1.9	1.9	1.9	1.9	1.9	1.9
Whitchurch and Wem	3.0	3.0	3.0	2.96	3.0	3.0
Llandinam and Llanwrin	4.8	4.8	4.8	4.76	4.8	4.8
Stafford	5.4	5.4	5.4	5.38	5.4	5.4
Forest and Stroud	15.0	14.6	14.6	14.56	14.4	14.2
Wolverhampton	14.4	14.4	14.4	14.38	14.4	14.4
Shelton	26.6	26.6	26.6	26.59	26.6	26.6
North Staffs	29.4	29.4	29.4	29.41	29.4	29.4
Nottinghamshire	45.6	37.2	37.2	37.18	37.2	37.2
Strategic Grid	272.1	213.9	213.9	212.95	199.0	199.0
Company total	**424.2**	**357.1**	**357.1**	**356**	**341.9**	**341.5**

Influencing customers' use of water through water efficiency activities

Similar to our approach to leakage, our thinking on water efficiency has been shaped by stakeholders' views. We have heard a clear expectation that our long term plans should include ambitious demand management activities.

We already have an ambitious water efficiency programme, and over AMP6 we will deliver around 25Ml/d of water savings. We will do this by providing our customers with water efficiency advice, free products on request and subsidised higher value products on request, plus our more proactive targeted home water efficiency checks.

In AMP6 we launched our water efficiency home check programme, which started in the Rugby area and then expanded to Coventry. Customers in and around the area can sign up for a free home check, where we will visit the customer's home and fit free water saving devices, offer advice on how they can save water and check for

simple leaks. This free service will help customers save water, energy and money. So far we have completed over 23,000 home checks and we have used the learning from this activity to inform this draft WRMP.

Our draft WRMP proposes to continue with these water efficiency activities, and to scale up our water efficiency home check programme. This approach is more expensive than simply providing products on request to customers, but provides greater certainty that products are installed and that savings are achieved. Our experience of this approach in 2015-17 has also shown that it is also popular with our customers. To maximise cost effectiveness, we intend to roll this programme out area by area and we will focus on areas facing supply demand deficits. We will also extend the home check programme to engage directly with social housing providers to help their tenants save water. This approach will help more financially vulnerable customers by making their water, and potentially their energy bills, more affordable.

We will also continue with our customer and community programmes to inspire our customers to change their water use habits. Our AMP6 community engagement team are focused on delivering two key messages: the importance of water efficiency, and ensuring our drains remain clean and blockage free. This work is really important in protecting our environment and our customers from pollutants and external and internal flooding. By focussing on water efficiency in this way, we also give customers the potential to reduce their water usage and therefore water bills.

Our proposals focus on working with household customers and we expect them to reduce customer demand by around 19Ml/d through our programme over AMP7. The expected savings are derived from our improved understanding of the impact of activities which we have learned from our AMP6 water efficiency home check programme. The water savings data we have gathered from our AMP6 home check programme means we have updated our assessment of the effects of fitting different water efficiency devices. In the longer term, our education and behavioural change activities will become an increasingly important demand management measure as there will be fewer options to retrofit water efficient devices.

Our draft WRMP does not include specific activity with non-household customers. Reducing demand for water by working with non-household customers is a key opportunity, but there is more work to do with retailers to better understand their planned water efficiency activity in our region as the market develops. We will continue to engage with retailers to explore these opportunities and we will continue to monitor what is happening in this market.

Increasing the coverage of water meters to support water efficiency and improve our understanding of water demand patterns

Our previous Water Resource Management Plans have set out an ongoing approach to household metering that has been led by customer demand for the free meter option. As a result, only around 41% of households in our region currently pay by meter. Our last WRMP projected that this would grow to around 70% by 2040 based on our current metering policy.

We have already described our ambition to achieve a step change in leakage reduction and demand management, and we believe that metering could play a crucial role in enabling that ambition. Experience reported by Southern Water, Thames Water and Affinity Water during AMP5 and AMP6 suggests significant demand reductions of between 8% and 16.5% can be achieved as a result of large scale metering roll out as well as a 10% reduction in peak demand. We are proposing a change to our metering policy, moving from a reactive approach to a more proactive and targeted approach to increase household meter coverage.

We have explored a range of metering growth strategies that could accelerate the rate of meter coverage through AMP7 with options to get to full metering by the end of AMP8 or AMP9. Based on the benefits reported

by other companies, we believe that achieving full meter coverage could deliver up to an 80Ml/d demand benefit. Our current thinking is that to secure the full 80Ml/d reduction would require us to adopt an external metering policy and combine this with a policy of helping customers tackle supply pipe leakage on their properties. We have previously expressed support for supply pipe adoption, and we would be pleased to see this happen at some point in the future for the benefit of our customers, as it would simplify addressing the problem of supply pipe leakage. We also want to explore what smarter metering technologies could be deployed in future.

We do not currently have the power to implement a compulsory metering programme as we are not classified by the Environment Agency as a seriously water stressed area. However, the scale of the emerging supply / demand challenge means there are grounds for exploring with Environment Agency and Defra whether such an application would be appropriate, whether for the whole region or specific water resource zones, and on what timescale. In the absence of these legal powers, we are recommending a 'persuaded optant' strategy in AMP7. This means installing meters proactively and offering customers the opportunity to switch based on information on what their measured bill would be.

We believe this metering approach complements our 'no-regret' package of AMP6 leakage, metering and demand management measures. We would follow an area by area approach, targeting the water resource zones with the greatest supply/demand deficit (Notts, North Staffs and Strategic Grid). This will complement our longer term plans for new water source development, as we want to (and will need to demonstrate to planners and regulators that we have) fully explored options to manage water demand before we seek to develop new sources of water.

As a result of this metering policy change, we expect the rate of meter coverage to accelerate in AMP7 and we aim to have achieved full coverage by the end of AMP9. We have considered the cost / benefit implications of a range of metering delivery profiles, and we have tested different options for increasing the pace of delivery and for prioritising which zones to focus on. The expected meter coverage that our recommendation will deliver is set out in the Table 3 below.

Table 3: Household meter installations and coverage per AMP

		AMP7	AMP8	AMP9	AMP10
Current metering policy	Number of meter installations	147,878	134,619	122,549	111,560
	%age of households metered by end of AMP	55%	60%	65%	69%
Recommended new metering policy	Number of meter installations	497,878	779,332	420,220	0
	%age of households metered by end of AMP	65%	88%	100%	100%

We expect the increase in meter coverage to deliver an average demand saving of around 10Ml/d by the end of AMP7. This is based on an assumed consumption saving of around 10% and includes benefits from finding and fixing leaking supply pipes.

However, we believe that there are wider demand management benefits that will result from increasing metering coverage, especially if we target the delivery on a geographical basis. In particular, we view the need for increased meter coverage to be a crucial enabler to delivering our very ambitious leakage reduction strategy. Currently around 60% of our household customers are not metered, and that means we have to estimate their consumption when we monitor leakage performance on our network. That makes it very difficult to distinguish changing consumption patterns from any leakage breakout on our network.

By increasing the number of metered properties on our network, we will have greater visibility of changing water demand patterns and better control of our network performance. This will make leaks easier to detect, and will mean we are able to deploy leakage repair more effectively and efficiently. This improvement in leakage detection and repair performance will be crucial to us achieving our challenging 15% leakage reduction target.

Reducing abstraction from those water sources that may be having a detrimental impact on the environment

Our plan addresses the legacy of unsustainable sources of water abstraction that, in some cases, date back over 50 years. Previous plans have included measures to reduce the impact of our historic abstractions on the environment and to provide alternative sources of supply where necessary. Our 2014 WRMP included schemes that would deliver a package of short term catchment restoration solutions to complement longer term abstraction and supply infrastructure reconfiguration. The proposals set out in our new draft WRMP would mean scaling this approach up over the next ten years.

In AMP6 we are delivering an ambitious environmental programme that will improve rivers across our region. We have committed to improve river water quality and ecology in over 115 water bodies across our region, along with improving the condition of 75 hectares of designated SSSIs. Our improvement activities include removing or reducing the impacts of our water abstractions on river ecology, improving approximately 258km of river reach.

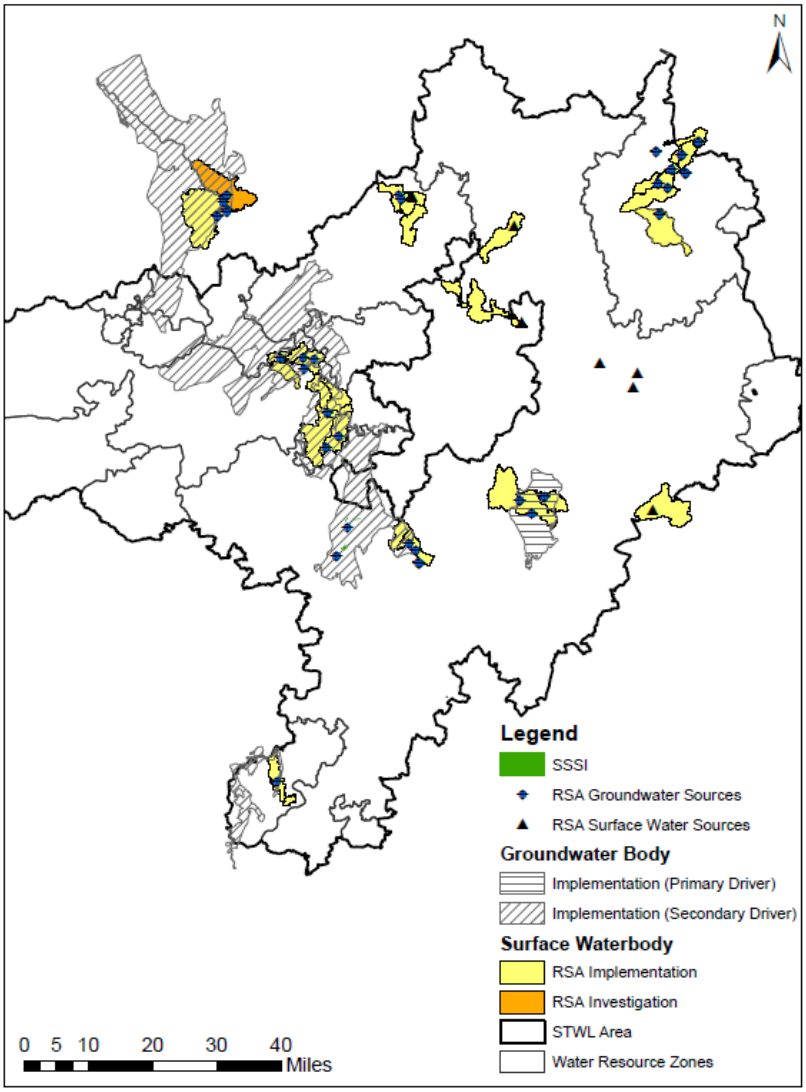
During AMP6 we have also undertaken our largest ever programme of Restoring Sustainable Abstraction investigations. In AMP6 we investigated 37 of our public water supply abstractions (29 groundwater and 8 surface water), which provide up to 191 Ml/d of current daily abstraction. Our AMP6 work has focussed on quantifying the magnitude of any impacts and identifying the cost / beneficial options for removing those impacts. The learning from these investigations has informed the scope of this draft WRMP. Our investigations indicate that we need to reduce abstraction at a number of sources by up to 69Ml/d over the next ten years. Figure 8 below shows the sources being investigated, and illustrates the water resource zones most affected.

This draft WRMP includes short and long term measures to remove or offset the environmental impacts of these abstractions, and to help the associated water bodies achieve Water Framework Directive (WFD) objectives. In the short term we propose localised environmental protection measures that will allow us to continue to abstract from some sources until we can put longer term solutions in place to reduce or stop abstraction. We will also deliver an ambitious leakage reduction programme and a step change in demand management so that we prevent water abstraction increasing.

However, the volume of abstraction at risk means that there is a need for new and alternative resources to be developed in order to maintain long term security of public water supplies. This challenge is further heightened by the need to protect the water and wetland environment from future deterioration, a key obligation under

the Water Framework Directive. Historically, we could have accommodated abstraction reductions at unsustainable sources by increasing output from other, neighbouring sources of supply. The sites most affected by RSA impacts tend to be situated in the same water bodies as those sites with the greatest risk of causing further environmental deterioration in future. This means that we have had to rethink our approach to dealing with unsustainable abstraction, and we are having to think about the needs of the entire water body rather than just the localised impacts of our existing sources.

Figure 8: Unsustainable water bodies and water sources



Making sure our future water abstractions do not pose a risk of environmental deterioration, as required by the Water Framework Directive

For this WRMP we face a new, strategic challenge in the form of demonstrating that our plan does not put at risk the future ecological status of the water bodies in our region.

Under the Water Framework Directive we have an obligation to prevent the deterioration of the quantitative and qualitative status of a waterbody. We have already described that our WRMP needs to explain how we will address unsustainable abstraction at sites that may have a history of causing environmental damage. For this latest WRMP, Government and regulatory guidelines also require that the WRMP show how we will prevent any future deterioration in Water Framework Directive status. For example, deterioration of the quantitative status of a waterbody could arise if our abstractions increased in the future due needing to meet growth in demand.

This has a significant impact on our future supply capability and is a material change to our previous WRMP thinking. Many of our existing sources of water abstract at rates below the amount that they are fully licensed to take. This headroom in our abstraction licences is vital as it allows us to meet increases in demand during hot dry weather and plan for any growth in demand resulting from population change and housing development. Abstraction licenses issued today require such headroom to be justified as both legitimate and environmentally sustainable. However, many of our historic licences were not subject to the kind of rigorous environmental assessment required today.

The supply / demand forecasts we make in our WRMP are based upon an assessment of the maximum amount of demand we could meet using our fully licensed sources of supply. We know that we need to reduce unsustainable abstraction from sources that are causing environmental harm, and we know that we need to meet demand from a growing population. Our previous plans have been based on an assumption that we can accommodate these changes by increasing abstraction from sources where there is abstraction licence headroom. For this new draft WRMP, the WFD no deterioration requirement means we can no longer automatically assume we can take the full volumes that have been licensed.

We have been working with the Environment Agency on this issue since early 2016 to understand how our sources could put future Water Framework Directive water bodies at risk, and how we should deal with this challenge. As a result, our plan includes measures to manage this environmental risk in the short term, and longer term investment to reconfigure our water supply and abstraction system. For this draft WRMP we have worked on the basis that any formal changes to abstraction licences would not come into effect until the end of AMP8 in order to give us time to deliver the necessary new infrastructure.

The types of solutions we plan to deliver fall into the following categories:

- **Adapting our supply system and providing alternative ways of meeting future demand without increasing abstraction from sources that would deteriorate the Water Framework Directive status**. We propose to do this at those sources where we can be confident that deterioration is likely to occur if we increase our future abstractions. In many instances, there may be multiple other drivers impacting on the water body, such as already unsustainable abstractions or poor river water quality. In these cases the multiple lines of evidence tell us that we need to change our existing supply arrangements and use new, more sustainable sources of supply for the long term. For example, the combination of environmental pressures on groundwater bodies in our Nottinghamshire water resource zone tell us that we need to make strategic changes to the way we supply water to this zone.

  The planning and engineering aspects of developing new sources of water supply and reconfiguring our networks mean that such solutions are likely to require more than one AMP cycle to deliver. Therefore we are proposing a ten year package of environmental and catchment protection measures from 2020 to 2030 that will reduce the risk of deterioration in the short term, while we deliver new sources of supply for the long term.

- **Mitigating for the effects of abstraction and preveting future deterioration from occurring**. We will take this approach at sources where we believe we understand the potential for future deterioration and we believe we can manage the risk through a series of preventative actions. Measures such as local

flow support, river restoration measures to improve environmental resilience, catchment and partnership solutions or localised demand management will help us mitigate against the risk of deterioration.

Other measures such as enhanced source abstraction management controls through better Instrumentation Control and Automation (ICA) and telemetry and new distribution links to more sustainable sources of water will help us to prevent increasing overall abstraction from the water body and further reduce the risk of deterioration.

- **Investigating the environmental impacts of current abstraction and better understanding the likelihood of future deterioration occurring**. We will do this at sources where we have no environmental data and therefore do not fully understand the risk of deterioration. We believe that we will need to collect data and undertake further assessments to improve our understanding of the risks. We would be promoting sources within this category for no deterioration investigations in AMP7.

The overall impacts of the Water Framework Directive no deterioration and RSA challenges on our water sources are shown below (Figure 9). Figure 9 illustrates the complexity of the challenge, and how it particularly affects our Notts, North Staffs and Strategic Grid water resource zones.

Figure 9: Water Framework Directive and RSA abstraction pressures

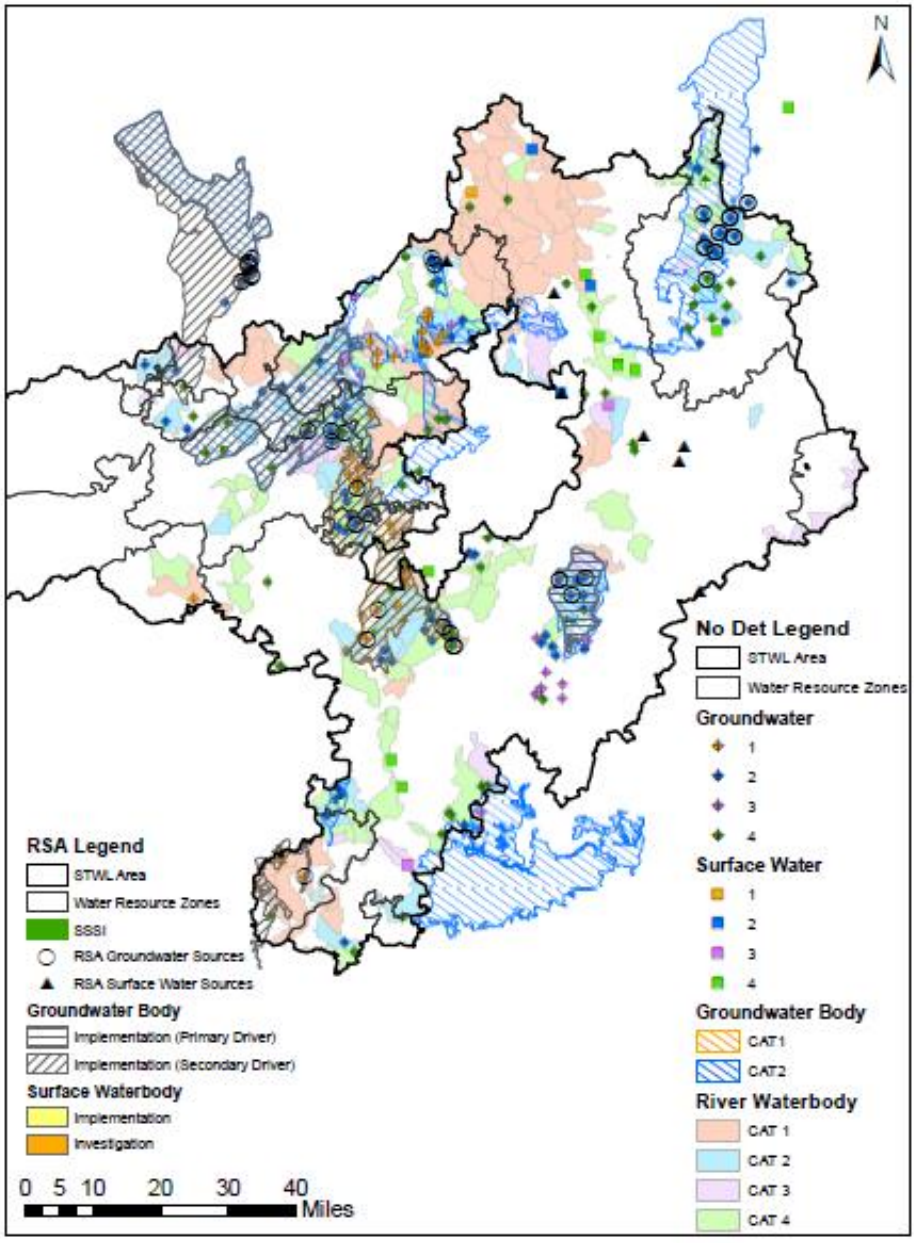


Figure 9 illustrates the different categories of environmental risk that we need to address through our draft WRMP:

- Category 1: Serious damage is being caused to the waterbody by current abstractions levels that are impacting either river flows flows or protected areas.
- Category 2: Waterbodies where future increases in abstraction up to 2027 (future scenario) are likely to cause deterioration to the waterbody or where the effects of current abstractions on river flows are not the main reason for the waterbody failing to achive good status.
- Category 3: Future increases in abstraction after 2027 and before 2040 (future scenario) are likely to cause deterioration within the waterbody.
- Category 4: Waterbodies that are not at risk of deterioration up to 2040.

The combined effects of the Water Framework Directive challenge and the need to reduce unsustainable abstraction are factored into the supply forecasts used in this draft WRMP.

Improving our long term supply capability

While we are committed to achieving a step change in leakage and demand management, these measures alone will not be sufficient to secure future supplies. Improvements are needed to replace the output from unsustainable sources of abstraction, and to give us the capability to meet future demand without putting the water framework directive objectives at risk.

Broadly, the challenges around unsustainable abstraction mean that there is a need to reduce pressure on the groundwater bodies from which our borehole sources abstract. In the future, to prevent deterioration there can be no sustained increase in the amount we abstract from a number of our region's groundwater bodies. As a result, our proposed improvements in supply capability focus on making more use of surface water sources of supply. The new schemes that we propose in this draft WRMP largely involve making more use of our existing river abstractions, our existing storage reservoirs and the treatment works that we use to deploy that water. We also propose to enhance our strategic water distribution links so that we have more flexibility to move water around our system to the locations that need it most.

Our draft WRMP looks ahead over the next 25 years, and we recognise that there is increasing uncertainty over the scale and timing of some of our future needs. The actions we are proposing in this draft WRMP reflect the different degrees of confidence we have about our short, medium and long term supply / demand needs. In the table below, we have presented the recommended supply schemes in the order of the future AMP period when we would be delivering them. The schemes proposed for the AMP7 and AMP8 periods cover our expected supply / demand needs for 2020 to 2030. The costs of delivering the AMP7 schemes, and the first stages of the AMP8 schemes, will directly inform our PR19 investment plan for the AMP7 period.

We are confident that the schemes we are proposing for the AMP7 period will be needed to meet the environmental challenges of reducing unsustainable abstraction and ensuring our existing sources do not cause future environmental deterioration. Table 4 below summarises the new water supply schemes that we propose to deliver over the five years 2020-25 as the first phase of our long term water resources strategy. These schemes all involve making better use of existing, sustainable sources of supply and enhancing our ability to deploy this water. We consider these to be 'low regret' investment decisions that complement our demand management and environmental improvement plans, and these are all solutions that will also contribute to our wider supply resilience ambitions. The table also summarises the AMP8 schemes that we will investigate in more detail during AMP7, ready to deploy in AMP8.

The schemes proposed for the much longer term are far more uncertain, and we are not committed to investing in their delivery at this stage. The nature of the schemes we are promoting means that we do not need to commit investment to large scale water resource developments that will take many years to deliver, and we are able to revisit these very long term decisions through the WRMP process every five years.

Table 4: Recommended new supply schemes for the period 2020-25

Scheme Name	Description	Water Resource Zone	Supply benefit (Ml/d)	AMP
Heathy Lea to North Nottinghamshire transfer solution	This solution aims to provide new strategic transfer capacity from the Strategic Grid water resource zone (WRZ) into the Nottinghamshire WRZ, via a new pipeline with a total distance of 34.6km. A new pumping station is also proposed as part of this solution.	Notts	25	AMP7
Birmingham Groundwater Scheme boreholes conversion to potable supply	Severn Trent operate five river augmentation boreholes in Birmingham, which were designed to supply additional water into tributaries of the Trent, to support one of our downstream abstraction points. These Birmingham Groundwater Scheme assets are rarely used at present and could deliver much greater benefits if used for direct supply in Birmingham. The boreholes will pump to a new centralised water treatment works, and will introduce a groundwater element into the Birmingham supply system, improving supply capacity and resilience.	Strategic Grid	15	AMP7
Site C water treatment works enhancements	The current maximum output of Site C treatment works is limited to 27 Ml/d, this scheme will enable the site to produce 36 Ml/d deployable output. This scheme will install additional treatment capacity which will increase output and improve resilience by providing some redundancy in our treatment process to allow maintenance and protect against failure.	Strategic Grid	9	AMP7
Site I water treatment works enhancements	A minor improvement to the treatment process at Site I WTW will allow us to increase treatment capacity. The additional output will be used in the Strategic Grid.	Strategic Grid	2	AMP7
Site E water treatment works expansion and transfer main supported by raw water augmentation of the River Trent	Using spare raw water from Carsington reservoir, and diverting final effluent from Barnhurst STW into the River Penk, we will use our existing abstraction at Witches Oak intake to support a 50 Mld expansion of Site E WTW. A new pipeline will transfer the additional potable water for use in the Strategic Grid.	Strategic Grid	35	AMP7
Site F water treament works expansion	Using spare raw water from Carsington reservoir, we will use our exsiting abstraction at Site F to support a 30 Mld expansion of Site F WTW. Existing pipelines will be used to transfer the additional potable water for use in the Strategic Grid.	Strategic Grid	10	AMP7

Site B water treatment works enhancements	By improving the treatment processes, we will increase the sustainable output of Site B WTW using the existing raw and potable water transfer capability.	Strategic Grid	3.6	AMP7
Whaddon (Strategic Grid WRZ) to Forest & Stroud WRZ transfer solution	Using the existing Strategic Grid assets, we will use newly created Deployable Output to support the Forest & Stroud WRZ.	Forest and Stroud	5	AMP7
Improve Site L water treatment works outputs during low raw water periods	The maximum design capacity of Site L treatment works is 48 Ml/d but its normal output is closer to 44 Ml/d. Site L operates in conjunction with the wider groundwater sources in the North Staffordshire water resource zone, and the zonal deployable output is maximised by optimising the balance between the reservoir and the groundwater sources. During winter and spring, we maximise use of the reservoir while storage is at or above target levels, and during summer months we reduce output from the reservoir and increase use of the groundwater sources. The minimum output from Site L treatment works is around 16Ml/d due to the configuration of the water treatment process. This minimum output is a key constraint on the zonal deployable output. When reservoir storage is very low we cannot reduce Site L treatment output below 16Ml/d, and so to preserve storage we have to shut down the treatment works and transfer all demand onto the groundwater sources. This solution will reconfigure Site L treatment works to allow output to go below the current 16Ml/d minimum. This will giving greater operational flexibility during dry weather and will improve the conjunctive use with the North Staffordshire groundwater system.	North Staffs	7	AMP7
Peckforton Group boreholes treatment enhancement and sustainable abstraction changes	Groundwater abstraction from the Peckforton borehole group has been demonstrated to have adverse impacts on the Adlford Brook and surrounding water body. Our AMP6 Restoring Sustainable Abstraction studies have demonstrated that there is a need to reduce overall licensed quantity of abstraction. Our modelling has also demonstrated that reducing output below recent actual quantities will have a material impact on the overall deployable output of the water resource zone. Our proposed solution will give us a more sustainable and flexible source of supply that will allow us to retain the ability to increase output to cope with short term increases in demand, but will	North Staffs	6.5	AMP7

	restrict the long term output from the sources to more sustainable quantities. Current output from the Peckforton borehole group is constrained by raw water quality. Our proposal is to install enhanced water treatment so that we can overcome the water quality constraints and deploy the peak licensed quantity to meet short term demand increases. The solution will include enhanced water treatment installation, new chlorination treatment, new pumping plant and the potential upgrade booster pumps to get water into the North Staffordshire zone. While this will allow us to increase output from the source by up to 6.5 Ml/d over current levels for short periods of time, we would also vary the group abstraction licences to a 5 year rolling average quantity of around 13.7Ml/d. These abstraction licence reductions will also be supplemented by wider catchment and river restoration measures to improve ecological resilience in the surrounding water body. This solution means that abstraction will be more sustainable in the long term without putting security of supply at risk.			

Looking further ahead, there is less certainty about the scale and timing of when additional new supply capability is needed. In this draft WRMP we have described our assessment of the long term pressures on future supply and demand for water, and these are described in more detail in the technical appendices. We are proposing further investment in new supply capability for the period 2025-45 to address these long term challenges, and to cope with future uncertainty. The nature of these longer term solutions is to try to make use of existing water supply assets, and to focus on innovative and sustainable use of surface water supplies.

Table 5 sets out our proposed longer term supply improvement schemes. The nature of these schemes means that they can be delivered in relatively short time periods of between five to ten years. This means that they are relatively flexible, and they do not require us to commit to very long term decisions at this moment in time. If we proceed with the proposals outlined in this draft WRMP, our activities for the period 2020-25 would include further exploration of these longer term solutions to improve our understanding of any associated environmental, delivery or commercial risks and have them ready for implementation at the next round of WRMPs.

Table 5: Proposed new supply schemes for the period 2025-2045

Scheme Name	Description	Water Resource Zone	Supply benefit (Ml/d)	AMP
River Soar to support Site B water treatment works	This scheme will make use of the River Soar to support Site B water treatment works during critical periods. Site B treatment works receives its water from Cropston and Swithland reservoirs. One of the most viable options to increase raw water availability is to provide a new feed into the system from the River Soar. This scheme would preserve reservoir storage by using the river source when flows are above the hands off flow (HOF), and then using reservoir storage to supply the treatment works when river levels are below HOF. Based on the 2013 EA Soar CAMS review, the river has 17Ml/d water available for abstraction. This solution would also include: the creation of a primary settlement lagoon to aerate water and trap river sediment prior to transfer to Site B treatment works, new raw water pipelines & pumping stations, and upgrades to treatment processes to enable treatment of river water.	Strategic Grid	17	AMP 8
East Midlands third party raw water storage asset including new water treatment works	We have been engaging with a number of third parties who own existing, operational assets that are nearing the end of their useful life and that could be used for future raw water storage. We have not included specific details of the preferred option here due to our ongoing commercial discussions, but we describe the option here as the conversion of third party assets for the strategic storage of water abstracted from rivers during periods of high river flow. Several assets have been investigated and the SEA has identified the need to carefully develop such solutions to avoid adverse effects on geological SSSIs that are present within some disused assets, as reflected in the precautionary major adverse rating for the SEA geological objective. Further investigations will be required to develop this innovative solution in a sustainable manner so as to minimise adverse environmental effects whilst maximising the potential beneficial effects associated with using such assets for substantial and sustainable water	Strategic Grid	45	AMP 8

	supply benefit, as well as allied recreational and biodiversity enhancement opportunities. The solution will include the conversion of the asset to a raw water storage reservoir which will be filled with water pumped from the River Soar at times of high flow. A new water treatment works located at the asset will treat raw water from either the River Soar or raw water storage reservoir. A new pipeline will transfer potable water to the nearby Avon Soar Link Main which forms part of the Strategic Grid.			
Carsington Reservoir support to Site Q water treatment works with Site Q water treatment enhancements	This scheme will increase the dry weather output from Site Q water treatment works by increasing abstraction from the River Dove, supported by additional releases from Carsington reservoir. Infrastructure will be installed to enable augmentation releases of up to 30Ml/d from Carsington Reservoir to the River Dove catchment. A new contact tank will be installed at Site Q water treatment works to operate in series with the existing contact tank to increase the overall treatment output to 235Ml/d.	Strategic Grid	30	AMP8
Draycote Reservoir capacity increase (Size A) with transfer main from Site C water treatment works to Coventry	A small increase in storage capacity at Draycote Reservoir will allow us to increase output at Site C WTW. A new pipeline will transfer potable water to our existing network for use in the Strategic Grid.	Strategic Grid	9	AMP8
Site R water treatment works to Baslow pipeline capacity increase	By improving the hydraulic performance of the DVA we will be able to use spare treatment capacity at Site R WTW. Additional raw water will derive from a combination of existing spare capacity in the Derwent Valley reservoirs and a reduction in the export to Yorkshire Water which is currently up to 68 M/ld..	Strategic Grid	20	AMP8
Stanford Reservoir capacity increase	At Stanford Reservoir an expansion of 10% would provide an additional 134 Ml of storage. The embankment has been designed to overtop for events between the 150 year and 1,000 year floods. In this option the spillway is to be raised by a small amount without making any alterations to the embankment.	Strategic Grid	2.5	AMP8
Thornton Reservoir to support Site B water treatment works	This scheme will make use of the Thornton reservoir by constructing a raw water main and installing a booster pump to Site B water treatment works.	Strategic Grid	12	AMP8

Ambergate to Mid Nottinghamshire transfer solution	This solution involves the construction of a new strategic link main from the Strategic Grid water resource zone into the Mansfield area of the Nottinghamshire zone. The concept is for a new 21km pipeline and pumping station to be installed, which will transfer water from our River Derwent sources via the Strategic Grid into the Nottinghamshire zone to replace unsustainable groundwater abstraction.	Nottinghamshire	30	AMP8
Whitacre Reservoir capacity increase	This scheme will increase Whitacre reservoir capacity by 5% to provide an additional 74 Ml of storage, involving raising the top water level by 0.17m	Strategic Grid	2.5	AMP9
Ladyflatte boreholes recommissioning	Ladyflatte borehole stopped abstracting in 2013. It is licenced to produce just over 3Ml/d and the treatment was designed to treat that quantity. Upgrading the process units to achieve the licence would be considered as part of the scheme.	Strategic Grid	2.7	AMP9
Lower Shustoke capacity increase	At Lower Shustoke reservoir an expansion of 10% would provide an additional 192 Ml of storage and would involve raising the top water level by 0.52m. Lower Shustoke reservoir operates in conjunction with Upper Shustoke which, together, form an off-line storage facility. At this stage it has been assumed that a non-return arrangement could be fitted to the pipework connecting the two reservoirs. This arrangement would enable the lower reservoir to be held at a higher water level than in the upper reservoir.	Strategic Grid	2.5	AMP9
DVA to Nottingham transfer pipeline capacity increase	This new pipeline will enhance the network connection between the Derwent Valley Aqueduct and the Nottinghamshire water resource zone to enable additional transfer of potable water from the Strategic Grid into this zone.	Nottinghamshire	15	AMP9
Maximise deployment from Diddlebury water treatment works and nearby borehole	The concept behind this scheme is to upgrade existing assets at Diddlebury water treatment works to provide an additional flow into the local distribution service reservoir in order to meet peak demands within our Ludlow control group.	Strategic Grid	0.9	AMP9

Using river restoration techniques to improve habitats and ecological resilience to low flows

Our plan includes short and long term measures to remove or offset the environmental impacts of abstractions, and to help the associated water bodies achieve Water Framework Directive objectives. In the short term we propose localised environmental protection measures that will allow us to continue to abstract from some sources until we can put longer term solutions in place to reduce or stop abstraction.

In those water bodies where local environmental protection measures could work as mitigation for abstraction impacts, we will engage with local stakeholders and landowners and aim to develop catchment partnerships to assist in the implementation of these schemes. We will also work with existing partners and collobarate with the Catchment Based Approach (CABA) network to deliver these improvements.

The localised environmental measures that we propose include:

- Local flow support measures

  These types of options involve providing additional water to localised river reaches in times of low flow . This can be achieved in river reaches below reservoirs by releasing water into the river to ensure flow does not get too low and by providing some variation in the amount released through the year. In rivers that are not downstream of a reservoir water can be added from another source, such as groundwater if water is available.

- Catchment and river restoration improvements

  Many streams suffer from a range of problems that exacerbate the impacts of low flow, such as modification of the channel, lack of instream habitat, pollution, sedimentation and barriers to the movement of fish. Reducing abstraction without also addressing other issues in the waterbody will only provide limited benefit, whereas improvements in stream habitat it will improve the stream in the short term and also enhance the environmental benefit of the longer term reduction in abstraction.

  The main types of environmental improvements that could be made include realignment and changes to make the shape more natural, instream measures to improve the diversity of habitat types, riparian management such as fencing and buffer strips to reduce nutrients and sediments entering rivers, fish passes and removal of instream barriers.

We are already using this kind of approach in AMP6, but on a smaller scale. For example, we are implementing a ten year plan to resolve the legacy of unsustainable abstraction in the Bromsgrove groundwater unit and the associated impacts on the Battlefield Brook. Our plan is to scale up this kind of approach in AMP7 to make physical catchment changes that will mitigate for the effects of abstraction and reduce the risk of future abstraction.

We are also exploring whether we can use Ofwat's Abstraction Incetnive Mechansim (AIM) as an innovative way of helping prevent future deterioration. In AMP6 Ofwat introduced the Abstraction Incentive Mechansim (AIM) as a way of incentivising water companies to minimise abstraction from sources with the potential to cause environmental harm. The AIM works by rewarding or penalising abstractors based on the amount they take from a source over the year, with reference to an environmentally sustainable threshold. We are proposing to adapt the AIM approach as a mechanism to help reduce the likelihood of future water body deterioration. We propose to use AIM at a number of sites with the potential to cause future deterioration, and set abstraction performance targets that are based on maintaining recent actual rates of abstraction. The AIM approach would penalise us at

the end of AMP7 if we have made a sustained increase in abstraction from these sites over the five years 2020-2025.

We are developing this AIM approach as part of our wider PR19 plan for AMP7. We are exploring how we could translate this adaptation of AIM into a business performance commitment that would help to prevent future environmental deterioration and contribute to achieving the objectives of the Water Framework Directive.

Case Study – Battlefield Brook

The Environment Agency identified Battlefield Brook through the National Environment Programme as a stream where improvement may be required to meet 'good' river quality status. Battlefield Brook rises on the Lickey Hills and flows south westwards to become the Sugar Brook in Bromsgrove. In its lower reaches it flows through Sanders Park which is a priority Biodiversity Action Plan site and an important public amenity. The section of the brook through Sanders Park was canalised and lined with concrete in the 1960s.

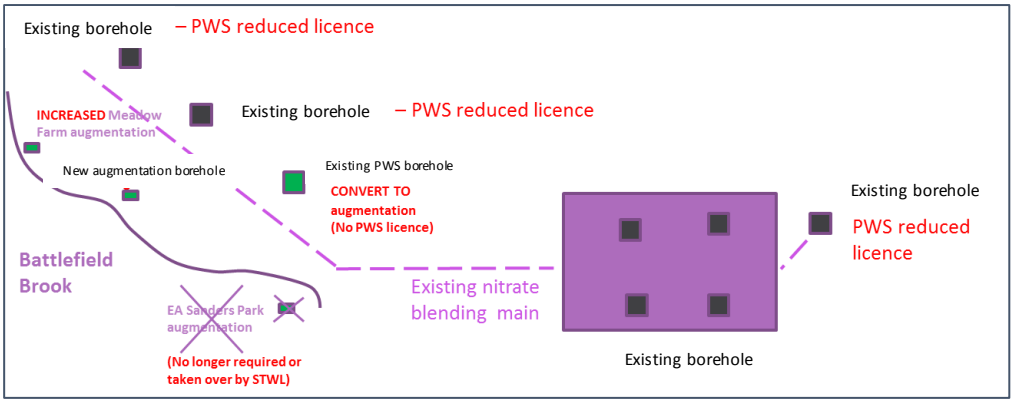
We investigated the effect of our abstractions on the local ecology between 2010 and 2013 prior to publishing 2014 WRMP. The brook flows over an 'over-abstracted' groundwater unit, so to make our abstraction in the region more sustainable we are implementing a solution to reconfigure the existing public water supply system to reduce long term abstraction and provide additional flow support to the brook. We aim to complete this work by the end of AMP7 (2025).

The Battlefield Brook also required habitat improvements to enable the watercourse to achieve "good" river quality status. We are currently working on a local solution which will be completed in a shorter timeframe. This scheme will remove approximately 300m of the existing concrete channel running through the park and replacing it with a naturalised channel which will connect the already naturalised sections of the upstream and downstream reaches of the brook. This work aims to improve local habitat and provide an environment in which wildlife, such as the water voles, can populate and traverse between the natural upstream and downstream sections of the brook. The design has taken into account best practice to specifically create habitats for water voles. We have been working collaboratively with Bromsgrove District Council on the design, taking into account their local knowledge to provide improvements and maintain specific vegetation.

Our 2014 WRMP put forward a two phase improvement plan covering AMP6 and AMP7:

i) Local solution: naturalise stretches of the water course to improve habitat and ecological resilience.

ii) Strategic solution: reconfigure the existing public water supply system to reduce long term abstraction and provide additional flow support to the brook.



The proposals set out in this latest draft WRMP build on this type of approach but on a much larger scale, focussing on those water bodies with the greatest pressures.

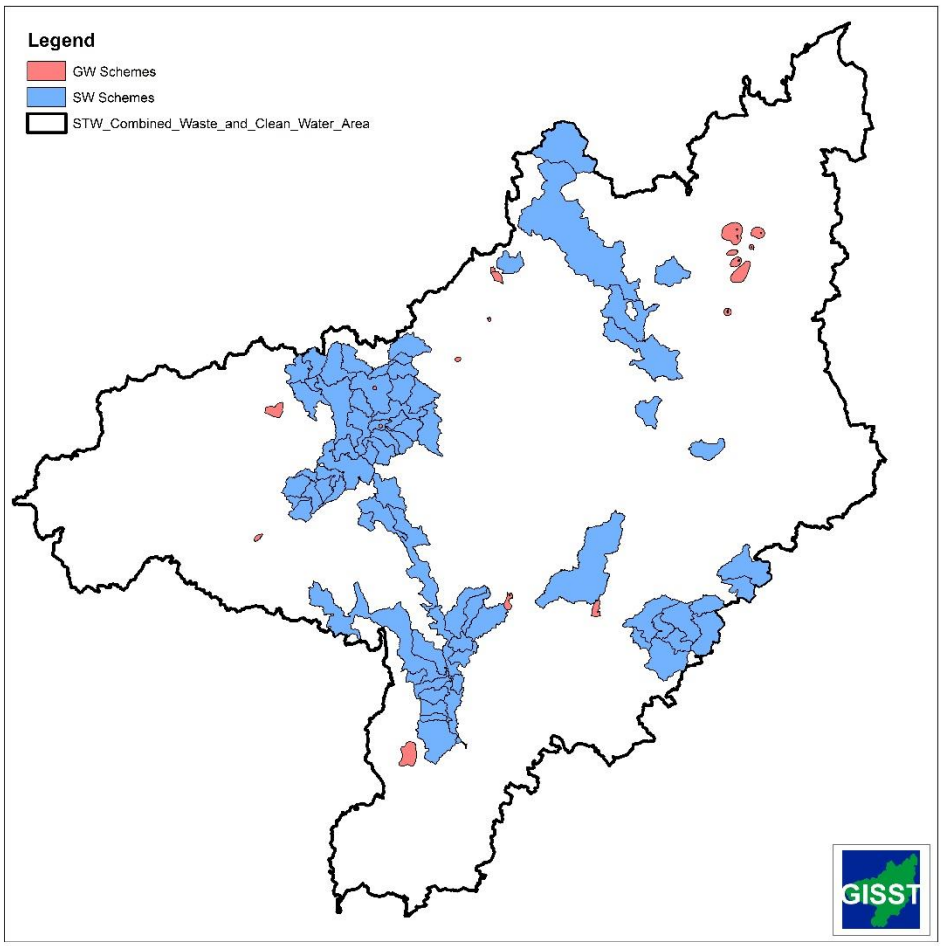
Using catchment management measures to protect drinking water supplies

Our drinking water protection strategy is to, where possible, use catchment management techniques to reduce the number of drinking water failures and minimise or delay future water treatment expenditure on raw water quality deterioration. This will be achieved through collaboration with Environment Agency, Drinking Water Inspectorate and Ofwat along with other key stakeholders and catchment partnerships. It will also deliver our obligations under the WFD, further enhance catchment risk assessments that support our drinking water safety plans (DWSPs) and reduce carbon usage.

Over the last two AMPs our catchment management programme has been both ambitious (covering the whole of the STW region) and pioneering (one of the first such programmes in the country). We undertake catchment investigations and deliver improvement schemes in both surface water and groundwater catchments. This programme of work has allowed us to sustainably and cost beneficially manage water quality risks in accordance with regulatory requirements in Article 7 of the Water Framework Directive and Water Supply (Water Quality) Regulations.

Our AMP6 catchment activities involve us working with landowners and partner organisations to reduce potentially harmful agricultural run-off into our region's rivers (Figure 10). We have recruited our own in-house agricultural advisers to deliver our catchment programme by engaging with farmers across 27 different catchments. Partnerships such as those with Wye & Usk Foundation, Trent Rivers Trust, Severn Rivers Trust, Catchment Sensitive Farming and Nottinghamshire Wildlife Trust are also key to helping us deliver our AMP6 catchment ambitions. Through this approach we are reducing agricultural run-off, such as pesticides getting into the water and polluting it, therefore improving river water quality, reducing treatment costs and improving the river environment as a whole.

Figure 10. Map of catchment schemes in AMP6

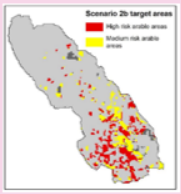


Our plan for AMP7 and beyond includes the continuation of our 27 current catchment schemes plus eight new schemes recommended through our AMP6 investigations (Figure 11). The proposed catchment schemes will help protect our current sources from water quality risks, ensure no deterioration, help improve the resilience of our assets, and generate wider environmental benefits.

Figure 11. New catchment schemes for AMP7

NEW CATCHMENT SCHEMES FOR AMP7

Surface water

Dove	Ogston	Mitcheldean
Metaldehyde scheme on arable land in the Hilton Brook, Foston Brook and Rolleston Brook sub-catchments of the River Dove catchment supporting continued work in Staunton Harold catchment. 	Metaldehyde scheme on high and medium risk areas of arable land within the Ogston Reservoir natural catchment. Also addressing nutrients and grassland herbicides. 	Metaldehdye scheme on arable land within the three Mitcheldean sub catchments – shown in orange below. 

Groundwater

Astley	Bellington	Copley	Hilton
• Strong CBA justification for advisory scheme • Light touch advisory scheme would address uncertainty in trend – sensitive analysis envelope around trend takes baseline just above target concentration for site	• Light touch advisory scheme recommended to address changes in the catchment observed during walkovers e.g. increase in veg growing • Scheme would address short term start up spikes	• Light touch advisory scheme to address uncertainty in trend and start up spikes – potential to combined under Hilton scheme – located close by	• CBA justification for light touch advisory scheme to address uncertainty in model and mitigate any significant change in the catchment

The scope of our future drinking water catchment management activities includes the following:

STEPS (Severn Trent Environmental Protection Scheme)

Under our STEPS scheme we offer capital grants to farmers to undertake works which will help reduce diffuse pollution e.g. installation of biobeds/biofilters. The capital grants window is open annually from January to March.

Since 2015 we have undertaken three rounds of grant applications and have received over 600 applications for funding. Applications have ranged from improved pesticide handling facilities to water course fencing to rainwater harvesting equipment. More innovative ideas have been welcomed through a unique 'farmer innovation' option where farmers present their own ideas for improving water quality.

Payment for Ecosystem Services - Farmers as Producers of Clean Water (FaPCW)

Farmers as Producers of Clean Water (FaPCW) commenced in September 2016 and runs annually between September and December each year (highest risk Metaldehyde period). This scheme pays farmers for producing clean run-off from their land and therefore contributing to improvements in drinking water quality within their local sub-catchments. The scheme encompasses the principles of PES (paid ecosystem services) with the overall aim of changing farmer behaviour and promoting ownership of the river within their catchments. It is envisaged that this approach will help drive long lasting behavioural change and sustainable improvements in water quality.

The scheme provides landowners with information on what activities can help reduce Metaldehdye losses. However, it does not stipulate that they must undertake these activities, but instead it allows the farmer to choose management options that suit their farm business. Farmers can receive payments per hectare for improvements or no deterioration downstream in water quality.

Advice and Training

In addition to our schemes we also offer the following support to farmers:

- Pesticide sprayer testing
- Pesticide Application training
- Metaldehyde spreader calibration

We are the first water company to partner with Natural England's Farm Advice Framework (FAF) contract and are funding farm advice visits through this established framework of approved technical expert contractors. This framework is being used to deliver Defra's current countryside stewardship programme.

We also fund a pesticide amnesty to reduce the amount of unwanted pesticides within catchments. To date in AMP6 a total of 13 tonnes of pesticides that were being stored by farmers in our catchments have been removed.

Water trading

Through the pre-consultation process we have investigated opportunities to trade or share water resources with third parties. We have met with all neighbouring water companies and potential suppliers from other sectors on a bi-lateral basis and worked within regional water resource initiatives to scope out and agree viable options. This effort has identified 30 potential imports and exports that we consider viable (see Table 6 and Figure 12).

Table 6: Summary of water transfers in active discussion (all figures in Ml/day)

	Imports			Exports*		
	Raw	Potable	Total	Raw	Potable	Total
Water companies	105	122	227	419	56	475
Other sectors	127	-	127	-	-	-
Total	232	122	354	419	56	475

* All sources of 'export' water are new with the exception of 15Ml/day of existing licence at Site O

Our increased effort and wider engagement means that potential water trading volumes have increased significantly from WRMP14; imports rising from 135Ml/day to 354Ml/day and exports rising from 300Ml/day to 475Ml/day. Broadly the imports are from the north and west of our region and the exports to the south and east. This movement of water fits with the Water Resources Long Term Planning Framework report by WaterUK.

We have assessed imports on a like for like basis as our internal options and included them in our least cost and adaptive planning modelling approaches. None of our export options involves the transfer of water from a Water Resource Zone that is wholly or mainly in Wales.

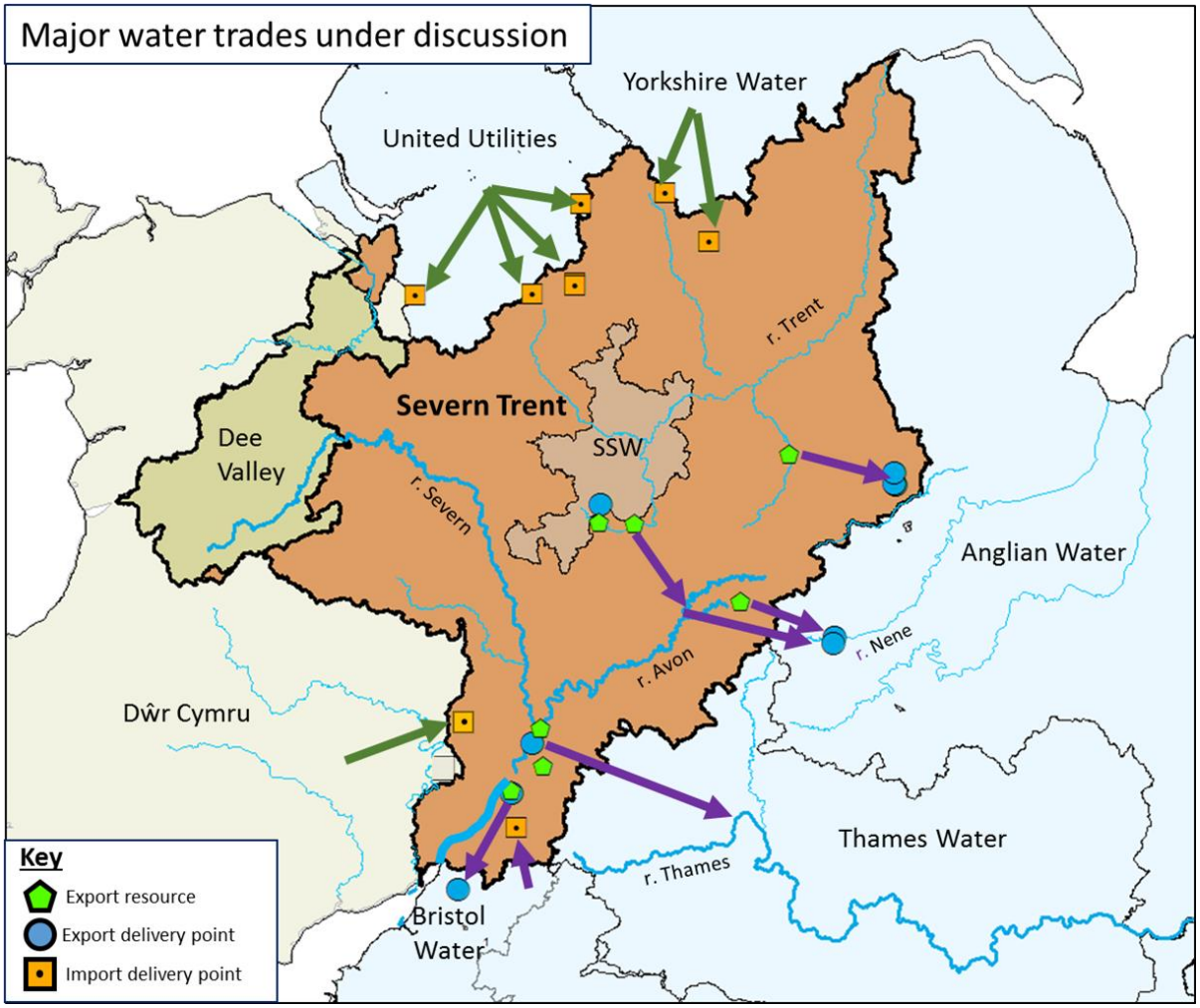
We offered Anglian, and the Water Resources East programme, five trades for inclusion in their cost benefit appraisal. Anglian's draft Water Resources management Plan includes one of these trades, 36Ml/day treated water trade in 2031. We have agreed to work together on the feasibility and wider implications of this option between draft and final plans.

We assessed potential imports options alongside our internal supply and demand side options. The outcome of this analysis is that a reduction in the Derwent Valley export to Yorkshire Water of approximately 15Ml/day by 2030 forms part of our best value plan. We intend to work with Yorkshire Water on the feasibility and wider implications of this option between draft and final plans.

Discussions with third parties to refine current offers are ongoing and we remain open to new ideas and offers. We have also published our Trading and Procurement code which clarifies the policies, principles and requirements that are applicable when third parties enter into trades with us. Our discussions are at different stages with each company and we will continue to work on the feasibility assessments with all parties to improve the confidence in costs and benefits so that options will be re-considered at the Final WRMP.

We will continue to work collaboratively with regional and national groups, for example Water Resources East, Water Resources North and the river Severn Working Group, to ensure alignment of our trades within our plans. We will also to continue to hold conversations with all neighbouring water companies and other potential trading partners.

Figure 12: Proposed major water trading schematic



Alternative options

We have set out our short, medium and long term investment proposals to maintain security of customers' water supplies in a sustainable and affordable way. In arriving at these proposed solutions, we have considered a wide range of feasible options and we have explored different possible future supply / demand scenarios. We believe that the options that we are proposing provide a balanced package of 'no-regret' leakage and demand management measures and flexible supply improvement schemes. The nature of the schemes being promoted is such that we can review and revise our decisions at future WRMP updates and we do not need to commit to large, very long term investment decisions at this stage.

However, we recognise that there is uncertainty around some of the schemes we are proposing for the medium to long term, and there is uncertainty around our long term supply / demand projections. We have considered what alternative schemes we would need to consider if our preferred schemes are unable to progress for technical, environmental or commercial reasons. We describe those likely alternatives here, and we will continue to explore these options between draft and final WRMP alongside our ongoing feasibility studies into our preferred schemes.

Shared South Staffordshire Asset

The shared South Staffordshire Asset is a water treatment works on the River Severn that is owned and operated by South Staffordshire Water, and also provides Severn Trent with a supply of treated water. The shared South Staffordshire Asset abstraction licence operates in conjunction with our neighbouring Site G water treatment works, and we work closely with South Staffordshire to make sure that the joint operation of both works is optimised. As part of our normal operation, we have transferred 20Ml/d of our shared South Staffordshire Asset abstraction licence entitelement to our Site G works.

In preparing our draft WRMPs, we and South Staffordshire Water agreed to include the same assumptions for the deployable output in our baseline forecasts, which are that Severn Trent continues to take an average supply from the treatment works of 41Ml/d, and up to 48Ml/d peak.

We explain in Chapter 5 of our draft WRMP how our plan seeks to reduce unsustainable groundwater abstractions, and put measures in place to prevent future deterioration of the environment. The groundwater sources in and around the Telford area will be affected by these environmental pressures, and our plan is to limit the amount we take from a number of these sources over the coming years. The result is that the supply / demand headroom in our Shelton water resource zone is much reduced.

Between draft and final WRMP we intend to further explore the sensitivity of the Shelton zone supply / demand and headroom position to these future groundwater sustainable abstraction changes. We will explore whether additional sources of supply are likely to be needed to support the Telford groundwater system, and how we would provide these. One option to provide an alternative source of supply would be to use the shared South Staffordshire Asset to deploy additional River Severn water into the Shelton water resource zone.

In preparing our WRMPs, we have requested that South Staffordshire Water explore future supply / demand and investment scenarios that would involve the shared South Staffordshire Asset output to Severn Trent increasing up to the original output of 61Ml/d average and 68Ml/d peak. We have agreed with South Staffordshire Water that we will continue to work through the detail of these options between draft and final plans, and take into account any feedback gathered through the consultation process. Our teams have agreed to keep each other informed and will work together to explore options so that we can ensure consistency for the final WRMP.

United Utilities trade

Based on United Utilities' published *Business and Non Household Charges* pricing schedule, we believe that a new transfer from Vyrnwy reservoir into the River Severn could offer a cost effective supply solution for our Strategic Grid zone. However, as part of our work exploring national trading options in support of water stressed areas in the south east, we are aware that this option may feature in Thames Water's draft WRMP. We have therefore developed a recommended supply / demand plan that can work without this trade.

We intend to continue exploring this option between draft and final WRMPs. Subject to how Thames intend to pursue this option, it could be used as part of our plan as an alternative short to medium term supply improvement measure, until Thames need the full amount around 2035-2040. This would need to involve tripartite discussions with United Utilities and Thames Water once we understand if, and how, this option features in Thames' long term planning.

New River Trent abstraction

We explain in Chapter 5 of our draft WRMP how our plan seeks to reduce unsustainable groundwater abstractions, and put measures in place to prevent future deterioration of the environment. The groundwater sources in our Nottinghamshire water resource zone are particularly affected by these environmental pressures. Our the proposals in our draft WRMP are to provide new strategic transfer links from our Strategic Grid into the Nottinghamshire zone to support the groundwater sources using water from our Derwent Valley Aqueduct. These new links will increase abstraction from our River Derwent sources.

If we do not proceed with the solutions proposed in our draft WRMP, then we will need to find an alternative way of providing additional water into the Nottinghamshire zone. One feasible alternative we have considered in our options appraisal is the development of a new water treatment works on the River Trent. We have assessed the costs and benefits of developing a potential new water treatment works on the lower River Trent, along with the capability to transfer this water into north Nottinghmam and Newark supply areas. Our assessment has considered a new 50Ml/d water treatment works and bankside storage. This option was not selected as part of our optimised investment programme on the basis that the preferred schemes can deliver a supply improvement at a lower whole life cost. However, we will continue to explore this option as a potential alternative Nottinghamshire water resource zones supply scheme.

7 Using input from customers and stakeholders to shape our plan

We have worked with regulators, stakeholders and customers to shape our long term water resources strategy and the proposals set out in this draft WRMP. A summary of how we have engaged with stakeholders at the different stages of producing our plan is as follows:

- We held our first stakeholder forum in September 2016.
- We issued the WRMP pre-consultation letter in December 2016.
- We have completed consultation with planning authorities across the region to get an update on housing growth outlook.
- We published the PR19 Shaping Our Future consultation describing the water resource challenge.
- We consulted on the scope of our Strategic Environmental Assessment.
- We have worked with the regulators and stakeholders to understand priorities.
- We met twice with Ofwat in 2017 to share the emerging WRMP needs and likely impacts.
- We have updated our website to sign-post the WRMP work and to make it easier to access information.
- We held our second stakeholder forum in April 2017.
- We held two Welsh facing stakeholder forum events in July 2017.
- We held English and Welsh stakeholder forums in October 2017 to signpost and engage on what solutions are likely to feature in the draft WRMP.
- We held a number of customer engagement workshops during October 2017 to understand their priorities, attitudes to metering and willingness to pay.

Through the water resources stakeholder forum events we gathered hundreds of items of feedback through the interactive breakout sessions and follow up correspondence. The material presented at the forum events along with the stakeholder feedback is visible on our website here https://www.severntrent.com/about-us/future-plans/water-resource-management/water-resource-managment-plan/

Throughout our stakeholder engagement and discussions with regulators, we heard some clear messages.

- We need to be more ambitious with our leakage reduction targets.
- Improving customer understanding is the biggest issue when tackling water efficiency and we need to better explain our company's drivers and needs.
- We should explore opportunities for more partnership working.
- We should explore innovative ways of broadening our catchment management thinking beyond just drinking water quality protection to deliver wider benefits such as biodiversity and flow attenuation/slow flow etc.
- New water supply schemes should deliver multi-benefits and we should explore options for water / waste water catchment thinking.

We have used this inisght to shape our plan, and to guide our thinking as we worked through our different supply / demand scenarios and options. We have also used it to guide our more focussed customer engagement workshops, where we have conducted more deliberative research into customer attitudes to drought restrictions, water metering and environmental impacts of abstraction.

We have set out below some examples of how our ongoing stakeholder engagement has helped us to make some key decisions in this draft WRMP.

Balancing the risk between the environment and customers' security of supply

We have already described how our long term water resources plan is largely driven by the need to address the legacy of unsustainable abstraction and meeting future Water Framework Directive objectives. The scale of impact of these environmental needs became apparent to us early in 2016 when the Environment Agency launched its Sustainable Catchments initiative and made clear the expectations for water resources planning. Since then we have been actively exploring this challenge with the Environment Agency, and evaluating what the impacts could mean for our customers' security of supply and where me would need investment in alternative supplies. In early 2016, over 130 of our sources of supply were identified by Environment Agency as posing a risk to future WFD status and could cause environmental deterioration in the future.

We shared this new and emerging issue with stakeholders at our September 2016 water resources forum, and we began trailing our idea of phasing any changes over more than one AMP period in order to maintain security of supply.

We continued to share our thinking as it developed through 2016/17, and at our September 2017 event we shared our proposal to take a multi-AMP approach to meeting the sustainable abstraction challenge. We discussed with stakeholders our recommendation for a package of measures that focussed on catchment improvements in the short term and strategic supply reconfiguration over a longer time period. Stakeholders broadly supported the approach, and we were encouraged to explore ways of partnering with other organisations to help deliver wider catchment benefits.

We have shared and developed our evolving work on this topic with the Environment Agency throughout the production of the WRMP, and have used their technical feedback to inform our processes. As a result, our risk and prioritisation approach has directly informed the Agency's latest version of the Water Industry National Environment Programme (WINEP) which in turn is used to inform the scope of our PR19 investment programme.

We believe that we have taken a balanced approach to meeting environmental objectives without putting security of supply at risk. We have tested our approach at a conceptual and technical level with stakeholders throughout.

Setting our leakage ambition

We know that leakage is a priority issue for customers and stakeholders, and we know our leakage performance has reputational impacts that go beyond a simple economic appraisal.

Stakeholders confirmed this view from an early stage in our development of our latest draft WRMP. Throughout our stakeholder engagement, we have heard a clear expectation that we need to do more to reduce leakage on our network. Stakeholders told us that they expect us to prioritise leakage reduction as part of our supply / demand approach before we seek to develop new sources of supply. Discussion at our water resource forums also made clear that without an ambitious leakage plan, we will find it difficult to engage with customers on broader demand management needs.

Finally, our regulators have set an ambition that the industry needs to continue to drive leakage down, and most recently Ofwat has set an expectation that companies will reduce leakage by at least 15% by 2025.

We have used these expectations to test a range of leakage ambitions, and we have used our investment modelling techniques to test what these mean for our economic level of leakage. Our AMP7 economic level of leakage reduction of around 15%, is driven by our supply / demand investment planning needs, and contributes to a package of 'no-regret' demand management measures. We know that in the long term we need to develop

new sources of supply to replace environmentally unsustainable ones, and to secure stakeholder support for these we will need to demonstrate that we have taken an ambitious approach to leakage reduction.

Making a change to our metering strategy

Up until now, our household metering policy has been to offer free meters to customers when they want one, and so the rate of uptake has been led by customers' demand for meters. We have already explained that stakeholders have given us a clear message that our future leakage and demand management plans need to be more ambitious, and we believe that metering could play a crucial role in achieving that ambition. We have seen other water companies reporting that their proactive metering programmes have delivered significant demand savings, and we know that increased meter coverage will help us be more effective in finding and fixing leaks. As a result, this draft WRMP proposes a change in our metering strategy to become more proactive in increasing the use of household metering.

We have worked with stakeholders to help us shape our proposed new metering strategy. At our first water resources stakeholder forum, we explored the different types of supply and demand options we might consider in our planning, and we discussed our decision making process. At the second stakeholder forum we focussed on the potential demand management benefits that metering could bring, and we discussed the potential barriers to increasing meter uptake. Our breakout discussions covered the different aspects of water metering, including customer perceptions and ways to improve engagement. At our third stakeholder event we sought feedback on our intentions to increase customer metering as a crucial part of our wider demand management and leakage ambition.

In addition to seeking wider stakeholder views on metering, we have held more focussed customer research on attitudes to water metering. Through October 2017 we held customer deliberative research workshops in Birmingham, Mansfield and Stoke to explore attitudes and concerns around water metering. At these events, customers told us that Severn Trent should ultimately be aiming to move all customers to a meter, and they favoured an approach where we seek to persuade customers to voluntarily make the shift.

We are therefore proposing an enhanced meter installation programme to accelerate meter penetration. This would follow the area by area approach, installing meters at the customer boundary, first targeting the water resource zones with the greatest supply/demand deficit (Nottinghamshire, North Staffordshire and Strategic Grid). Customers would not be automatically transferred to metered charges, instead we propose a persuaded optant programme through sharing a billing comparison to encourage customers to switch to metered charges. We then propose to roll this enhanced programme out across all zones, with a target of achieving full coverage by the end of AMP9.

Screening new water resource options

As we developed this latest draft WRMP, we have tried to be unconstrained in our thinking and we have explored a wide range of potential new supply options. Early on in the process we began an unconstrained list of potential options, and we then put them through a screening process that would help focus in on the most feasible options. We worked with stakeholders to test our option screening approach and criteria, and we invited them to offer any ideas that we may have missed in our unconstrained thinking.

We wrote to our key stakeholders in December 2016 officially launching the pre-consultation phase of our latest WRMP and we set out the high level issues we expected the plan to cover. We invited stakeholders to offer early views on the issues and potential options that they expected us to consider within the plan. At the same time we published and sought views on our Strategic Environmental Assessment scoping report, which described the environmental objectives and criteria we would be using when assessing scheme options in our plan.

At our September 2016 water resources stakeholder forum we shared our options screening approach, the screening criteria we proposed to use and the scope of our Strategic Environmental Assessment. We held breakout discussions on the proposed screening criteria and we sought views on our decision making framework.

At our April 2017 stakeholder forum we held more focussed discussions on demand management options and on options to increase river abstraction. We shared our thinking about the sorts of environmental and planning issues that would need to be included in any decisions about river abstraction, and we held breakout discussions to understand if we had missed any potential issues or opportunities.

At our October 2017 stakeholder forum we signposted that the draft WRMP is likely to include supply options that could involve increasing abstraction from rivers in our region. We also highlighted that the plan would likely include options to make better use of some of our existing strategic sources of supply. Our breakout discussions sought early views on the options being presented and we wanted to understand any potential concerns or opportunities that we should factor into our thinking.

Throughout our water resource options development, we have worked with the Environment Agency and Natural Resources Wales to share our thinking and to get their input to our options design and scoping. We held initial workshops with the Environment Agency in December 2016 to share our early thinking on the emerging supply / demand needs, and to share our unconstrained list of scheme options. At that early stage the Environment Agency helped us to refine the scope of a number of schemes based on Water Framework Directive impacts, 'hands off flow' requirements and abstraction licensing constraints.

In January 2017 we issued the Environment Agency with our first iteration of a constrained list of options and the supporting assumptions. We then continued to work with the Environment Agency through 2017 to get their thoughts on the environmental or abstraction licensing considerations we need to give to the more feasible options. Environment Agency teams fed comments back through spring 2017, and their comments and data was used to inform our ongoing options screening and scoping process. As a result of Environmenta Agency input, six of these schemes were rejected / screened out, and a we refined the scope and design of a further 28 schemes to reflect concerns such as abstraction licence considerations, non-native species risks, Water Framework Directive requirements and fish migration.

Using this screening and engagement process, we generated a constrained list of 111 possible new water supply options which we have then used in our investment modelling to inform this draft WRMP.

Informing our customer engagement approach

One key theme that emerged from our early stakeholder engagement was the question of how we engage with our customers on the issues dealt with by the WRMP. At our stakeholder forum events, we discussed the potential barriers to our demand management and metering options and the importance of engaging customers on these issues. We also explored the difficulties of communicating complex issues such as drought risk and environmental impacts of water abstraction.

We used the outputs from these stakeholder discussions to inform our customer research approach. We held customer deliberative research workshops and in home inveterviews during October 2017 where we discussed water resources and demand issues and then asked participants about their attitudes to these topics and their preferences for different supply and demand options. We used deliberative techniques to engage customers because this approach allowed us to provide information on complex topics, building participants' knowledge over the course of the day so that they are able to make informed decisions about different options and priorities to address the supply and demand challenge.

Three deliberative workshops, with a total of 48 participants, were held in different locations across the Midlands, including two in areas facing challenging supply / demand situations. The main day long workshop focused on the general supply / demand problem, while two half day workshops focussed on metering and balancing water supply sources in areas facing a supply / demand challenge. We also held ten in depth, in home interviews in order to capture the views of customers facing more vulnerable circumstances (from both a financial and a service perspective). These interviews covered a summarised set of the workshop material. The participants recruited for the workshops covered a mix of demographics (age, socio-economic group, life stage, ethnicity and tenure type) and bill payment methods.

The topics covered at these workshops included:

- Understanding customer views on the impact of drought.
- Exploring levels of tolerance regarding risk and impact of drought.
- Exploring informed reactions to proposed solutions regarding supply options (e.g. water transfer, effluent reuse, alternative use of sources) and demand management solutions (e.g. metering, behavioural change), and attitudes towards leakage and leakage reduction.
- Exploring attitudes towards short term versus long term investment options;
- Exploring attitudes to metering
- Exploring attitudes to balancing water supply sources in areas with a supply / demand challenge
- Gauging willingness to pay for investment to improve supply / demand balance.

The key findings from the supply/demand workshop and in depth interviews were as follows:

- Customers have a strong moral framework when thinking about water usage, resulting in an emphasis on personal and corporate responsibility to use less water.
- Awareness of the supply / demand challenge is very low amongst customers. For most, drought is not an issue that they anticipate will affect the UK.
- Because of the emphasis they place on personal responsibility, customers tend to favour demand management approaches over supply side approaches. However, they recognise that any solution will need to include a blend of both.

Customers used four questions when evaluating the solutions that they were shown:

- Does it encourage responsible use of water?
- Is this a long term / sustainable solution?
- Is it value for money?
- Does it avoid harming the environment?

Of the options presented to customers, metering is the one that best satisfied their key questions, and which therefore received the most support. The key findings from the half day workshops on metering and managing our water resources were as follows:

- Customers feel that metering offers real benefits to both customers and us.
- Most notably, the possibility of saving money through a water meter is highly motivating.
- In addition, customers welcome the enhanced level of personal responsibility meters bring about.

As a result, customers told us that we should ultimately be aiming to move all customers to a meter, and they favoured an approach where we seek to persuade customers to voluntarily make the shift.

8 How we have developed a cost effective and sustainable plan

Our draft WRMP recommends a programme of short, medium and long term investment in leakage reduction, demand management, water metering and supply improvements. This recommended programme reflects our current understanding of the future water supply and demand challenges facing our region.

We believe that the proposed solutions include 'low regret' solutions that we can commence with confidence in the next five years. The plan also includes proposals for the next ten years and beyond which are flexible and do not require investment decisions to be made before the next WRMP is updated in 2024. Overall, the proposals set out in our draft WRMP represent a sustainable and affordable balance of demand management and supply improvement measures that mean we can meet demand for water from our current and future customers over the next 25 years and beyond.

The options we have considered and the decisions we have taken have all been shaped by a framework which considers the following aspects:

- Understanding regulators' expectations
- Understanding stakeholders' and customers' expectations
- Costs and benefits of options
- Supply / demand investment modelling
- Environmental impacts of our options
- Sensitivity testing of future scenarios
- Governance and assurance

The supply / demand recommendations in our WRMP have tried to balance all of these factors to produce a flexible, sustainable and affordable plan. We explain below how we have taken these into consideration as we have formed our recommended plan.

Understanding regulators' expectations

The Water Resources Management Plan follows a well-established statutory process which is supported by clear policy and technical guidelines set by Government and regulators. We need to demonstrate that we have taken account of Defra's high level policy objectives, and that we have satisfied technical guidance given by EA, NRW, DWI and Ofwat.

Defra published its *Guiding principles for water resources planning* in May 2016, in which it explains the key policy priorities the government expects WRMPs to address. There are clear environmental expectations that the WRMP should demonstrate that it supports River Basin Management Plan objectives, including preventing the deterioration of water body status. There are also clear government expectations that the plan should include challenging leakage and demand management proposals with an ambition that customer consumption should reduce over time. The WRMP should also demonstrate that we have considered the widest possible range of supply and demand options, and consider the costs, benefits and environmental impacts of these.

Alongside these Defra guiding principles, the Environment Agency and Natural Resources Wales have published water resources planning guidelines that are designed to help companies write a plan that complies with all the relevant statutory requirements and government policy. The guidelines include expectations that the WRMP should include statutory environmental objectives, set ambitious leakage reduction and demand management targets and should consider a wide range of possible supply options. Overall, the WRMP should demonstrate how we contribute to the delivery of Water Framework Directive objectives by:

- Setting out a secure and sustainable set of options to supply our customers with water over the long-term, negating the need to make unplanned abstractions therefore helping to build sustainable and resilient catchments;
- Showing how we will implement alternative supply or demand management options where current abstraction is identified as causing or at risk of causing environmental damage, including schemes to prevent deterioration in status, achieve protected area objectives or improve water body status (potential);
- Showing how our plans reduce leakage and operational use of water;
- Demonstrating how we will fulfil our obligation to promote water efficiency and our plans for increased customer metering, thereby reducing abstraction and its impact on flows and groundwater levels;
- Setting out how you we manage resources during a drought, including stating where and under what conditions you will seek drought permits / orders to take more water.

In September 2017 the Drinking Water Inspectorate (DWI) also published supplementary guidance on how the WRMP should take drinking water obligations into account. The DWI guidance requires that the draft WRMP should take account of all statutory drinking water quality obligations and drinking water quality legislation.

Throughout the development of this draft WRMP, we have had regard to these clear government policy objectives and regulatory expectations. These have shaped our thinking, and in particular our approach to achieving Water Framework Directive objectives, and the role that leakage and demand management can play in our long term planning.

Understanding stakeholders' and customers' expectations

We have worked with stakeholders and customers to shape our long term water resources strategy and the proposals set out in this draft WRMP. Chapter 7 of this draft WRMP explains how we have engaged with stakeholders and describes what we have learned. Throughout our stakeholder engagement and discussions with regulators, we heard some clear messages that:

- We need to be more ambitious with our leakage reduction targets;
- Improving customer understanding is the biggest issue when tackling water efficiency, they need to be educated on the company's drivers and engagement needs to be tailored to different communities;
- We should explore opportunities for more partnership working;
- We should explore innovative ways of broadening our catchment management thinking beyond just drinking water quality protection to deliver wider benefits such as biodiversity and flow attenuation/slow flow etc;

New water supply schemes should deliver multi-benefits and we should explore options for water / waste water catchment thinking;

We have used these clear stakeholder messages to help shape our plan, and to guide our thinking as we worked through our different supply / demand scenarios and options. In particular, stakeholders' views have helped us to set the challenging leakage and demand management targets proposed in this draft WRMP. We recognise that our stakeholders expect us to focus on reducing leakage and demand before developing new sources of water.

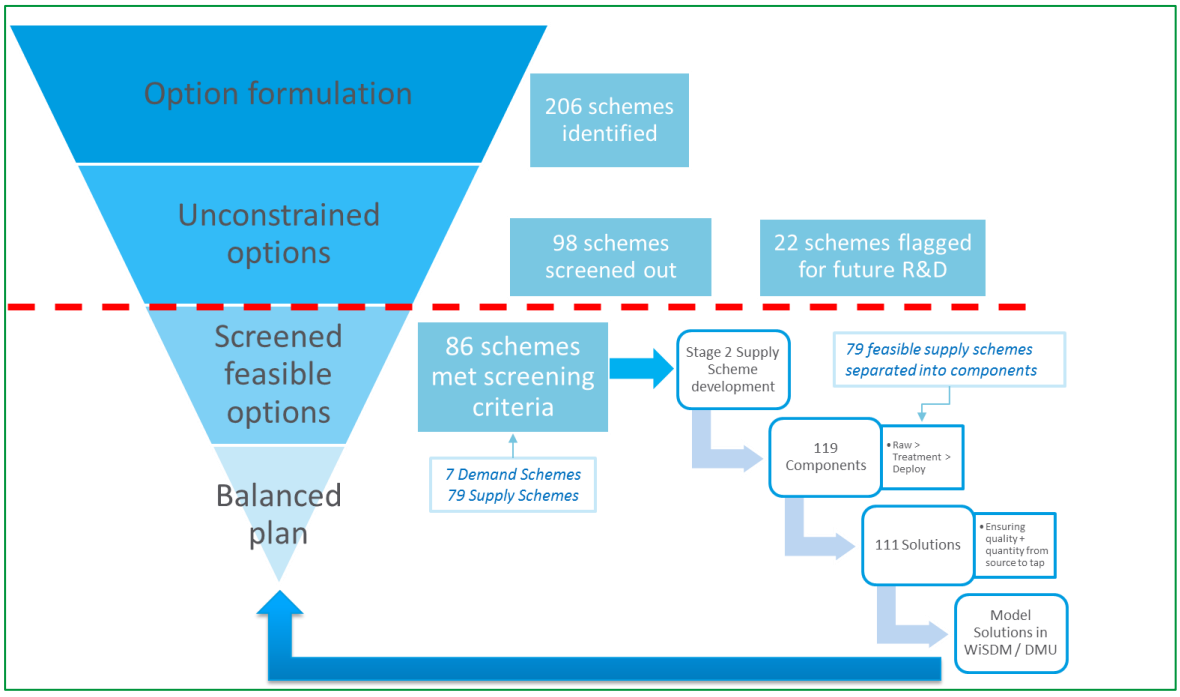
Costs and benefits of options

We have considered a wide range of leakage, demand management and new supply investment options before arriving at our recommended plan. We have also explored potential new water trading opportunities with

neighbouring water companies, and we have worked with other third parties to develop innovative commercial opportunities.

We have followed an option screening process to help us capture a wide range of these potential options early on, and that has helped us to screen out those options that we don't consider feasible for consideration in this plan. The screening process and screening criteria were shared with Environment Agency, Natural Resource Wales and our wider stakeholders and their input helped us to refine our unconstrained list into a shorter list of feasible options. Figure 13 illustrates the stages of our option formulation and screening process, and shows how we moved from over 200 possible options on our early unconstrained list, to around 111 options that were taken forward for cost / benefit appraisal.

Figure 13: The stages in our options appraisal process



The stages of our options appraisal process are described in Appendix D.

The most feasible options were then taken forward for outline design, costing and environmental appraisal. For these feasible options we assessed the likely construction and operating costs, the potential volume of supply or demand benefit they might deliver, the likely time it would take to plan, build and commission the scheme, and the environmental impacts. These cost and benefit values were then then used in our investment modelling so that we could understand what the optimised balance of leakage reduction, demand management and new supply investment might look like.

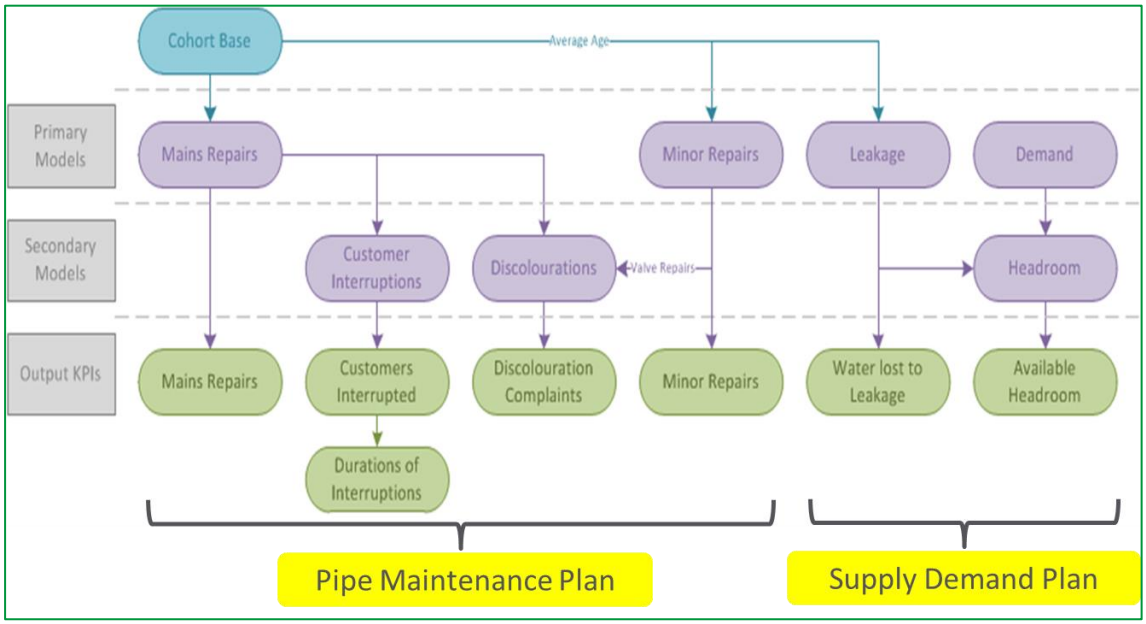
Investment optimisation and least cost planning

We have used advanced investment modelling techniques to derive the optimised investment programme that could be used to meet our supply / demand challenges. Our Water Infrastructure and Supply / Demand investment model (WISDM) allows us to test the very long term, holistic investment decisions needed to both maintain the performance of our water distribution network and improve the balance between future supply and demand.

The WISDM model tests the costs and benefits of different levels of mains renewal, leakage reduction, demand management and metering alongside options to increase supply capability. The model allows us to predict the

future performance of our water distribution assets, the investment needed to achieve different levels of performance, and the scale of investment needed to make sure we have sufficient water supply to meet future demand. As a result, we can be confident that we are able to generate a truly optimised package of demand and supply investment measures, and we can fully explore the economics of different leakage decisions. Our approach means that the supply and demand solutions included in our draft WRMP are fully integrated into the broader PR19 investment plans. Figure 14 illustrates the how the different elements of WISDM model combine to derive the holistic least cost plan to achieve supply / demand and infrastructure maintenance needs.

Figure 14: The components of the WISDM investment model



Our investment optimisation approach follows elements of the "intermediate" and "advanced" of the UKWIR / EA Economics of Balancing Supply and Demand (EBSD) approach. Using WISDM, we have generated many 'least cost plans' that could be used to solve different potential supply / demand scenarios. We have also used complex scenario and uncertainty modelling to test how sensitive certain investment decisions are to our supply and demand assumptions.

The outputs of our approach have allowed us to generate a number of potential long term investment programmes which represent different ways of securing our long term supply and demand objectives. We have also used the model to test the costs and benefits of adopting different top-down policy decisions on issues such as leakage, metering and the pace at which we adapt to Water Framework Directive requirements. We have also been able to examine how water trading options could impact on our long term investment needs, and what investment would be needed to achieve the strategic objectives of Water UK's Water Resources Long Term Planning Framework.

As a result, we have been able to generate a range of different feasible investment programmes and use these test the cost implications of maintaining the supply / demand balance while achieving stakeholders' expectations. Through this approach, we arrived at three feasible supply / demand investment programmes that could be used to achieve our long term supply / demand needs at very similar overall programme costs, but using different options. The overall net present value difference between these three feasible programmes was approximately 3.5%, and was not considered material.

The headline difference between the supply and demand options recommended in this draft WRMP and the two alternative programmes of similar NPV, relates to the potential impacts on a strategic water trade with Thames Water. The two alternative least cost programmes we derived included differing levels of leakage and

metering ambition, but both included an option to develop a new water import to our region from United Utilities via the River Severn. This transfer option also has the potential to feature in Thames Water's draft WRMP as part of a larger scale, national water trade. We have not included this water trade in our recommended preferred plan, but we will continue to explore this option with United Utilities as we prepare our final WRMP and we better understand the interdependencies between WRMPs at a national level once the draft plans are published.

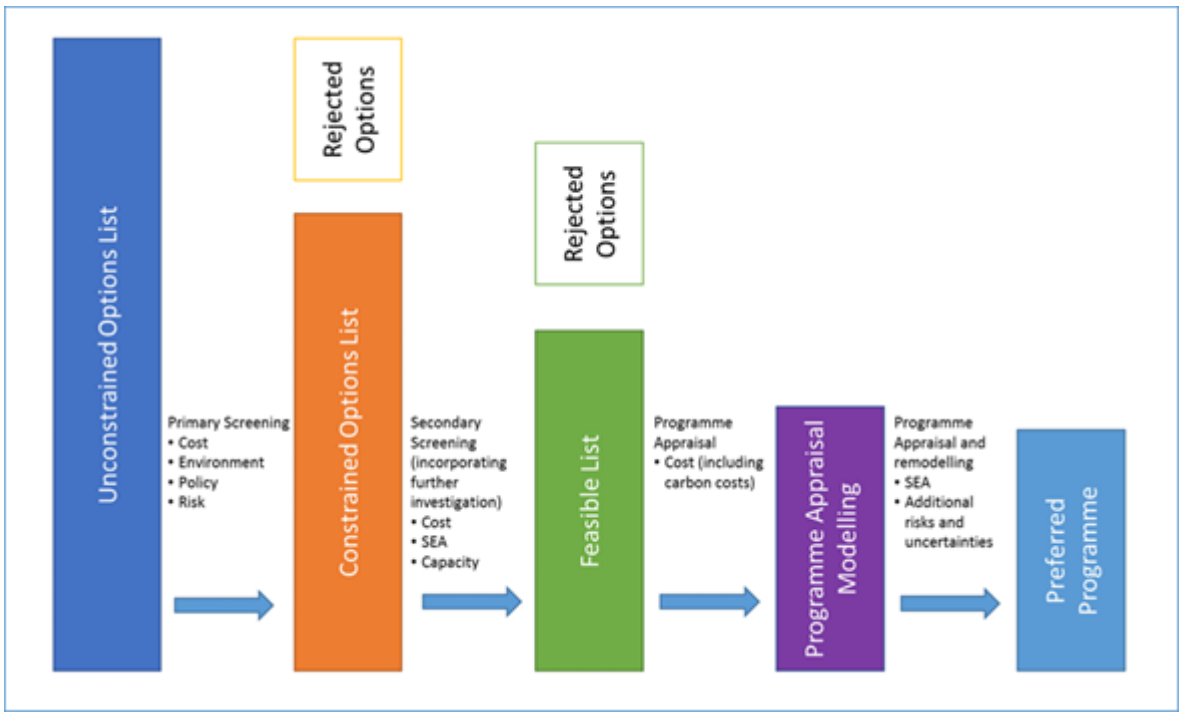
Instead, our recommended least cost programme includes a new scheme to purchase a third party asset and develop it into raw water storage to help meet our long term supply / demand needs. This is an innovative solution to develop strategic raw water storage in a way that minimises environmental impact. This scheme option features in our proposed investment plan for the period 2025-2030, and which means that we have flexibility to continue exploring it alongside the water trading alternative during AMP7.

Appendix E explains our investment modelling and decision making approach.

Environmental impacts of our options

We have followed national water industry guidance on applying SEA to the development of WRMPs. Figure 15 below summarises the overall approach to the application of SEA to the evolution of the draft WRMP19, from the initial screening of a large number of 'unconstrained' list of options through to the application of SEA in considering a wide range of alternative programmes produced through the investment modelling approach.

Figure 15: Application of SEA to draft WRMP19



Initially, SEA screening was carried out of the very large set of options in the unconstrained list. The screening included consideration of key environmental and social criteria, including:

- Habitats Risk Assessment (HRA) and Water Framework Directive (WFD) compliance risks;
- key risks to the water environment;
- key risks to important landscape, recreation and heritage features.

This screening identified options with unacceptable adverse environmental effects which were rejected from the options list and were not taken further in the option appraisal process.

More detailed environmental and social assessment was then applied to the screening of the 'constrained' list of options. HRA and WFD risks were assessed on a scale from negligible to high; other potential effects were assessed against the SEA effects scale ranging from major beneficial to major adverse – beneficial and adverse effects were assessed separately in line with best practice. The screening assessment of the constrained options list was also discussed with the Environment Agency and Natural England, and feedback from these regulatory bodies was used to refine assessments. Options assessed as having unacceptable adverse environmental or social effects were removed from the options list; remaining options were then included in the 'Feasible' List of options. The Feasible list options were included in the investment model for consideration for inclusion in the preferred programmes; for each option, the carbon costs and some monetised environmental and social costs were input to model, alongside the construction and operational costs.

SEA was carried out of all of the options on the Feasible List, along with HRA and WFD assessments, to provide us with information on the environmental performance of each option to help inform the appraisal of the various alternative programmes produce from the investment model. In this way, we were able to assess and consider the environmental and social effects of different alternative programmes to inform our decision-making process for determining the recommended plan for the draft WRMP19.

Our decision-making process ultimately led us to three feasible, alternative supply-demand investment programmes that could be used to secure the long-term supply-demand requirements at very similar overall programme costs, but involving different options. These programmes were assessed for their environmental performance as well through SEA, HRA and WFD assessment, and we used the findings to help us reach the final decision on which programme to adopt for the draft WRMP19.

Sensitivity testing of future scenarios

We have described above how our WISDM model allows us derive the optimised supply and demand investment programme that could be used to meet our supply / demand challenges. For this WRMP we made enhancements to our WISDM model to allow the investment optimisation to more explicitly account for uncertainty parameters around the supply and demand options, as well as considering a range of alternative future scenarios. This Decision Making Upgrade (DMU) to our WISDM investment model has given us the ability to compute large amounts of supply / demand and options data and present it in a repeatable format. This has informed our internal decision making, and our ability to test the cost implications of meeting different stakeholders' expectations and what our whole life cost investment plan might look like under a range of alternative futures.

We have used the DMU to model a large number of different supply / demand scenarios to examine how sensitive our investment decisions are to different planning assumptions. These scenarios represent different possible 'alternative futures' which have allowed us to test the sensitivity of our plan to different combinations of events. These alternative futures were generated by varying those supply / demand factors that have the greatest uncertainty, including sustainability reductions, impacts of Water Framework Directive, climate change and future demand for water. Each scenario used a bespoke "water available for use" profile reflecting the deployable output impacts of the component being investigated and a "high", "mid" or "low" demand profile.

In August 2017 we ran 6000 DMU supply/demand investment optimisations, covering 60 different possible future scenarios. Scenarios covered the range of high / medium / low demand, WFD and climate change scenarios, along with multiple combinations of these different possible futures. We used frequency analysis to examine how different scheme options are chosen in the 6000 different optimisations, how certain we can be

that different options will deliver the expected benefits, and to investigate how sensitive our investment programme is to the different supply / demand planning assumptions.

The outputs of this analysis informed the pace and magnitude of our chosen leakage and demand management targets, and tested how robust our supply / demand choices are in a range of possible futures. For example, the DMU scenario testing demonstrated that it would be preferable to stagger the abstraction changes needed to meet WFD and sustainable abstraction objectives in our Strategic Grid and Nottinghamshire water resource zones over a ten year period. Our DMU modelling showed that making these abstraction licence reductions in a shorter time period would put security of supply at severe risk, and would drive very high cost, short term investment decisions. The DMU showed us that if these changes were to be made over a ten year period, this would produce a lower whole life cost investment programme and would mean much lower risk to security of supply. It was through this kind of analysis that the DMU outputs shaped the underlying supply / demand planning assumptions used in this recommended draft WRMP and the investment decisions that we are proposing.

Governance and assurance

Throughout the development of this draft WRMP, we have engaged with the Severn Trent Executive Team, the Severn Trent plc Board and with our PR19 Water Forum. We have used this ongoing engagement to agree the strategic decisions set out in this draft WRMP. A summary of the key stages of engagement is given below.

Severn Trent PLC Board

- November 2016 – emerging PR19 Strategic Challenges, highlighting WFD and supply / demand needs
- July 2017 – emerging SDB challenge, highlighting choices, agreed timeline and governance route.
- Sept 2017 – climate change and drought deep dive with individual Board members.
- Nov 2017 – Seek Board approval to submit draft WRMP

Severn Trent Executive Committee:

- August 2016 – emerging PR19 Strategic Challenges, highlighting WFD and supply / demand needs
- June 2017 – emerging SDB challenge, WFD impacts, stakeholder views, highlighting choices.
- Sept 2017 – findings from WISDM and DMU investment scenarios, testing leakage and metering choices, decisions on strategic directions.
- Oct 2017 – deep dive costs and benefits of leakage and metering choices.
- Nov 2017 – agreed SDB programme to include in draft WRMP consultation, explored choices and decisions.

Water Forum

- May 2017 - Water Forum Investment sub-group supply / demand and investment modelling deep dive
- June 2017 – a technical review of our drought and climate change modelling approach
- August 2017 – Water Forum Investment sub-group deep dive into the leakage investment modelling approach.
- October 2017 – Water Forum overview of water resources and resilience investment approach.

Our decision making and recommendations are supported by a robust assurance framework. As explained in our annual assurance plans, and assurance summary which accompanies our Annual Performance Report, we use an established three lines of defence model for our regulatory submissions. We employ third line assurance in areas of greatest risk and where that assurance requires specialist engineering, financial or regulatory knowledge, we use external parties to undertake that assurance. This draft WRMP submission has been reviewed through our established governance and controls framework.

Given the importance of this submission we have employed third line assurance, delivered by expert external parties for those areas of greatest risk. Jacobs Consulting (Jacobs), our established independent technical assuror, has undertaken a two stage approach to assurance that included both desk-top reviews and face-to face interviews.

Phase one focussed on the proposed WRMP including:

- Review of process documentation and methodology.
- Test and challenge the robustness of our approach to forecasting.
- Review the sufficiency of our stakeholder involvement in the development of our plan.
- Review the methodology, process and controls to demand, supply, trading and third party solutions. Specifically the range of solutions considered and how the final solutions where selected.
- Integration with Drought Plan and Ofwat methodology.
- Test and challenge the plan is a cost effective and sustainable proposal.

Phase two provided a review of the accompanying data tables to confirm accuracy and completeness of the data.

Having reviewed the draft WRMP, the supporting assurance and having taken Jacobs' conclusions into account, the Severn Trent Water Board makes the following statement:

- The Board is satisfied the plan represents the most cost effective and sustainable long term solution.
- The Board believes it has sufficiently collaborated with customers, partners and regulators to develop a strong understanding of future needs, explore every option, and build consensus on delivery plans.
- The Board confirms the integrity of the risk assessment process put in place by the company for all of its water supplies.
- The Board is satisfied that the WRMP takes account of all statutory drinking water quality obligations, and plans to meet all drinking water quality legislation in full.
- The Board confirms that Severn Trent complies with its duties on drinking water quality matters in its broader resilience and resource planning arrangements.