Decarbonising water resources

Business case 02

Severn Trent
29 January 2021

WONDERFUL ON TAP

SEVERN TRENT

Executive summary

The impacts of climate change are irrefutable – we have experienced the hottest recorded summers in two of the last three years and at the same time we are seeing record levels of flooding. When combined with changes in consumer behaviour that Covid-19 has brought to the fore, there is a compelling need for significant investment in water resource capacity.

Our sector has already commenced this journey and is developing a number of schemes for the Water Resources West regional plan and PR24. However, there is an urgent need to find lower carbon solutions and we have identified opportunities to proceed quickly with no-regret options that will help us meet the needs of our region. Traditional solutions are carbon intensive, with 1Ml/day of new capacity creating 400 tonnes of carbon emissions. Our proposals seek to break free of this paradigm, by working with our customers and other stakeholders, along with trialling new approaches to reducing and offsetting unavoidable chemical and energy use. This will create our first net-zero carbon water resource solutions to drought risk while also improving resilience to the increasing incidence of extreme flooding events in our region.

We are proposing three schemes to meet the challenges of efficiently reducing the water supply deficit without creating any net carbon emissions and simultaneously improving biodiversity and well-being, for our customers now and in the future. Our three schemes will result in 109Ml/day of additional capacity at a total cost of £206m. They include:

- Reducing non-household demand for water by 4Ml/day through innovative partnerships with 3,000 high use business customers in the East Midlands, by setting up grey water systems, thereby reducing reliance on the mains water supply.
- Creating new low-carbon/reduced-chemical treatment capacity for 65Ml/day, split across two existing treatment works ([redacted] and [redacted]) in the East Midlands. This will involve a new abstraction on the River Trent using a licence we have already procured and new reduced-chemical treatment facilities that seek to maximise the use of natural processes, improving 46 hectares of habitat. The energy to operate these upgrades will be generated from new renewable energy capacity. We will share insights on technology for low carbon/reduced-chemical and biodiversity enhancing water treatment.
- Establishing a new dual-purpose drought – flood storage capability on the River Severn at Shrewsbury [redacted] and then reusing this water by gravity transfer to our existing water treatment works further down the River Severn. This will be a collaborative scheme to increase drought resilience by 40Ml/day, protect 4,000 homes and businesses from flooding while creating a public amenity to improve well-being.
- Pilots of smart metering and tackling customer pipe leakage are also part of our Green Recovery proposal and covered in detail elsewhere[1].

Our proposals reflect the evolution of the policy debate on carbon emissions and the data confirming the consensus over the necessity for action that has developed since the last round of water resources management plans. For example, the National Infrastructure Committee (NIC) and the Environment Agency have both said that water companies should plan to a new, higher standard for a 1-in-500-year drought event. In terms of data, the UKCP18 projections for climate change confirm previous

[1] The costs and benefits associated with leakage reduction and metering are set out in separate business cases and therefore not included in the total presented in this case.

projections of increased chance of warmer, wetter winters and hotter, drier summers. This means we are more certain of the size of our future water resource deficit and there is a greater urgency to bring forward investment. On the demand side, the data consistently show customer demand becoming more accentuated. In addition, the water sector has publicly committed to achieve net-zero carbon emissions by 2030 and we must ensure that all future investment maintains this level of ambition.

We have considered a wide-ranging set of options for achieving resilient water resources covering both demand and supply side options. We have engaged with our stakeholders to develop the new benefits criteria that go beyond the traditional least cost planning approach, which resulted in us placing a stronger emphasis on low-carbon and environmentally beneficial schemes, in line with the Environment Agency's National Framework. From this optioneering process we identified the two supply schemes and demand reduction schemes as best meeting the requirements of resilient water resources, that do not add net carbon emissions, and which improve the natural environment.

Our water resilience schemes have clear customer support. Through three forms of engagement; our online panel of customers; smaller online community of in depth conversations and a large scale quantitative independent survey; we see 75% support for low-carbon water resources with a further 20% saying they did not mind in principle.

We are fully committed to delivering these schemes to improve the resilience of our water resources for our customers. We have considered a range of options for setting ourselves performance commitments that provide customers and regulators with a transparent tool for us to account for and measure progress.

These schemes will act as pathfinders for future projects, revealing new data on low-carbon water resources that also seek to drive cost efficiencies that we are committed to making open-source, so that our regulators and customer representatives can refer to and learn from in the future.

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1. The need for investment

We see the Green Recovery as an opportunity to disrupt the current water-carbon paradigm. With the Government identifying significant need for new supply-demand capacity by 2050, we need to break the equation that each additional megalitre per day of new water resource will lead to 400 tonnes of carbon in the atmosphere.

1.1 Now is the right time

Accelerating the achievement of Government priorities

Since finalising our current Water Resource Management plan in 2019 there have been four key policy documents published which all emphasise the need for more urgent action to ensure resilient water supplies that also meet the wider environmental ambitions. The full costs and benefits of the bolder ambitions set out in guidance and framework documents are not fully understood. Taking a bold first step now, will help the sector make more informed decisions in PR24, fast tracking action by at least five years.

Skills and jobs for the UK's green recovery

The pandemic has caused record levels of redundancies and unemployment across the UK, levels not seen in 150-years. Since March 2020, the city of Birmingham has seen the second largest increase in the Claimant Count[2], with the unemployment rate in the West Midlands and East Midlands region for August to October 2020 rising to 5.4% (0.5% above the UK average)[3]. This likely reflects the nature of the economy of the region. Delivering our proposal will directly create 240 much-needed jobs within the supply chain in our region and protect a further 220 other jobs across the wider economy, which are exposed to the downturn from Covid-19.

Near-term, visible customer benefits that meet changing expectations

Hot weather events are becoming more frequent and lasting longer, while peak demand increased 9% between 2007-2020. This trend accelerated during the pandemic as the volume of peak demand increased by a further 2% compared to historic hot weather periods (peak pandemic demand was up to 40% higher than average demand). Yet our customers expect our systems to be resilient to changing weather and demand patterns.

Sharing learning across the industry

The costs and value of the benefits of decarbonising water resources are not fully known. Our proposal includes creating a demonstrator water treatment works, the findings of which we will make available for others to learn from. Current events have also revealed the fragility of the sector's chemical supply chain. By trialling new reduced-chemical water resource solutions we can enhance the sector's resilience to external shocks.

[2] Those claiming unemployment benefits.
[3] https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/regionallabourmarket/december2020

Time bound opportunity to share costs and benefits with other organisations

The opportunity to join with partner organisations to coordinate their flood protection initiatives with our drought resilience plans is time bound. Given the potential for this type of dual function resource to reduce cost, we estimate by c.20% lower than the industry unit cost £1.2m/Ml/day[4], we want to lock-in long term savings for our customers, while borrowing costs are low.

Unlocking constraints

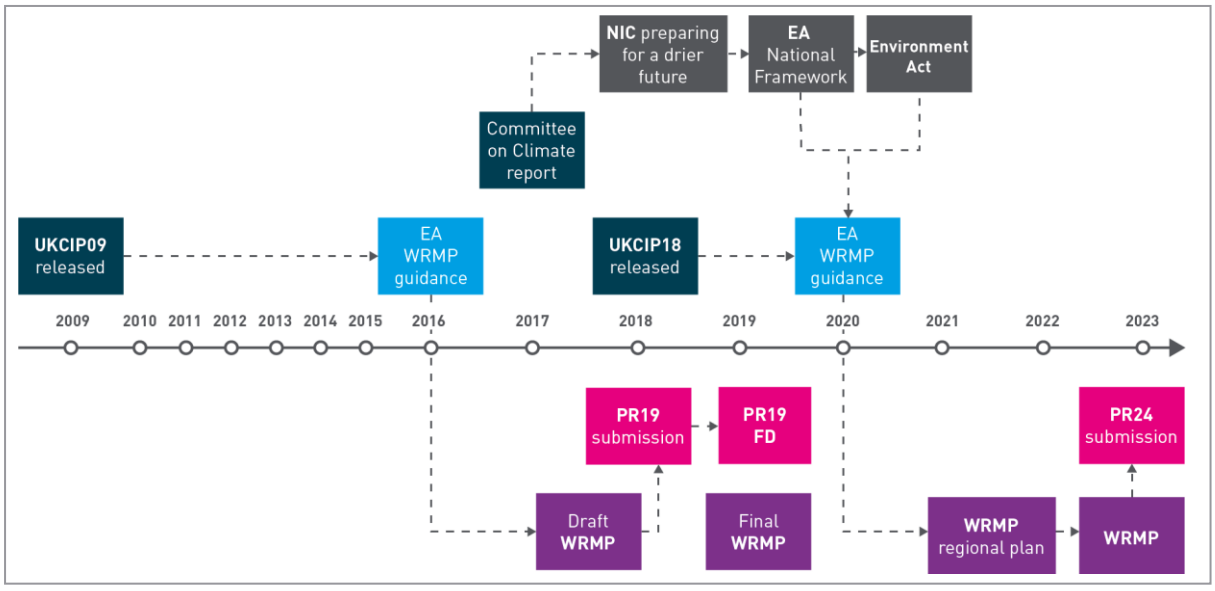
We are also in a good position to meet the challenges of the Green Recovery because we have unlocked some of the time-consuming constraints to scheme delivery. For example, in 2019 we secured the 65Ml/day water abstraction licence from the decommissioned Rugeley power station. Having already invested means that we can move quickly on the Green Recovery.

1.2 Accelerating the achievement of Government priorities

Climate and environmental experts are unequivocal in the need to move faster towards achieving sustainable water supplies that address the challenges of climate change, population growth, increased water demand in hot, dry weather, and improve the environment.

Our last Water Resources Management Plan (WRMP) reflected the level of ambition set by Defra, the Environment Agency and Ofwat in their "Final Water Resources Planning Guideline" in May 2016. Since that date we have seen a number of policy changes and key publications that stress the need for the water sector to make a step change in its ambition, as set out in Figure 1.

Figure 1: Timeline of policy statements and guidance documents



In June 2017, the Committee on Climate Change identified[5] *tackling water resource issues* as one of the five priority risks for the UK. It predicts that demand for water in England will exceed supply by between 1.1 and 3.1bn litres a day by 2050. This work was a key driver for the NIC report in April 2018, *Preparing for a drier future*[6], that recommended that we plan for a more extreme drought event (1 in

[4] Based on PR19 supply demand models.
[5] https://www.theccc.org.uk/2017/09/12/pressure-preparing-uk-water-shortages/
[6] https://nic.org.uk/app/uploads/NIC-Preparing-for-a-Drier-Future-26-April-2018.pdf

500 years) than that used in the WRMP19 guideline (1 in 200 years). The Commission estimated that this would require significant additional capacity across the country not just in the south and east. This planning requirement has subsequently been confirmed by Government in its *National Infrastructure Strategy*[7].

The Environment Agency report in March 2020, *Meeting our future water needs, a national framework*[8], determined the scale of action needed to ensure resilient water supplies available to:

- meet a 1 in 500 year drought event;
- deliver a greater level of ambition for restoring, protecting and improving the environment by considering changes to water abstractions beyond those already identified in water company plans, and;
- include the needs of other sectors.

The report identified a gap of 639 Ml/day in the Water Resource West region for the public water supply.

The Government's *25 year Environment Plan*[9] pledged that we will be the first generation to leave the environment in a better condition than we found it. The plan also mandates that all infrastructure development leads to an environmental net gain.

This greater ambition has been taken forward into the revised ***WRMP guideline*** that was published for consultation in July 2020. We support the greater ambition in securing sustainable water resources over the long term and our analysis confirms that this will necessitate greater demand measures and new water resource capacity to replace unsustainable sources of abstraction.

In July 2019, the UK was the first major economy to pass a net-zero carbon emissions law. The new target will require the UK to bring all greenhouse gas emissions to net-zero by 2050. This is a very important consideration when examining our most recent plan for 2020-25, within which each 1Ml/day of deficit addressed equates to an increase of 400 tonnes of carbon. This means that, perversely, a policy of improving the local environment by replacing unsustainable sources of abstraction with new, alternative supplies will take us further away from our global environmental ambition of achieving net-zero carbon emissions. The direction of policy is clear and consistent across regulators and Government, we must address the growing water deficit, enhance the environment and without adding to net carbon emissions. For example, the Chair of the Environment Agency in her speech on 25 November 2020 emphasised the need to *"shift gears on the climate emergency"* and that the sector is not *"doing enough, fast enough."*

This conflict between local, water body scale environmental improvements and global environmental impacts of increasing emissions is not unique to Severn Trent or water resource planning but is prevalent across the water sector.

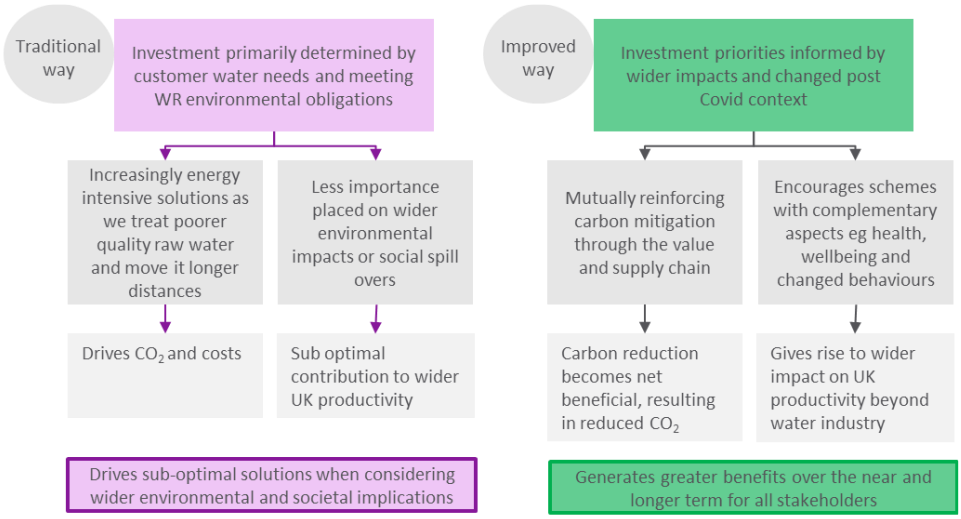
The sector is resolved to significant investment to achieve greater resilience to drought, further improve the environment and adapt to the climate emergency. The NIC estimated that as much as 1,300 MI/day in additional capacity will be needed by the 2030s. If, as a sector, we do not develop low carbon and high biodiversity solutions, then this investment is at risk of generating more emissions

[7] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/938539/NIS_Report_Web_Accessible.pdf
[8] https://www.gov.uk/government/publications/meeting-our-future-water-needs-a-national-framework-for-water-resources
[9] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf

that will only exacerbate the situation. Applying our estimate of 400 tonnes to the NIC forecast deficit by the 2030s would increase emissions by 520,000 tonnes.

We see an opportunity to rethink our approach and break the cycle, see figure 2 below. Specifically taking a first step towards decarbonising the whole water system – where securing water resources no longer means more carbon. To do this we need to find new low carbon, biodiversity enhancing options and technology, explore new ways of using energy and water markets, and drive cross sector collaboration. By doing so we will reveal the costs, technology and policy barriers, which in turn, will help the sector make better informed decisions and unlock more decisive action when long term plans are reset in 2024.

Figure 2: Alternative approaches to meet the supply demand challenge



Likely impact of greater policy ambition across our region's supply demand balance

The combined challenges described above result in a significant shortfall in water by 2040 in our strategic grid, Nottinghamshire and North Staffordshire water resource zones.

Greater ambition to protect customer supplies during more extreme droughts and improve the environment and biodiversity, means that we will need to find and develop new and replacement water resource capacity as well as reducing leakage by 50% and helping customers reduce their daily consumption by 10% by 2040.

We are in the process of working with Water Resources West to undertake the detailed analysis to inform the Regional Plan 2023, WRMP24 and PR24 over the next 18-months. However, we have made conservative, interim assessments to understand the scale and pace of our changed needs to inform our Green Recovery proposals.

Drought resilience: The Water Resources West initial resource position[10] that was published in March 2020 identified that moving to a 1 in 500 year measure of drought resilience would further increase the deficit. Our most recent assessment based on the available data and analysis from WRMP19 indicates that the deficit will increase in our three key zones by 22Ml/day (6%) by 2040.

[10] https://waterresourceswest.co.uk/publications

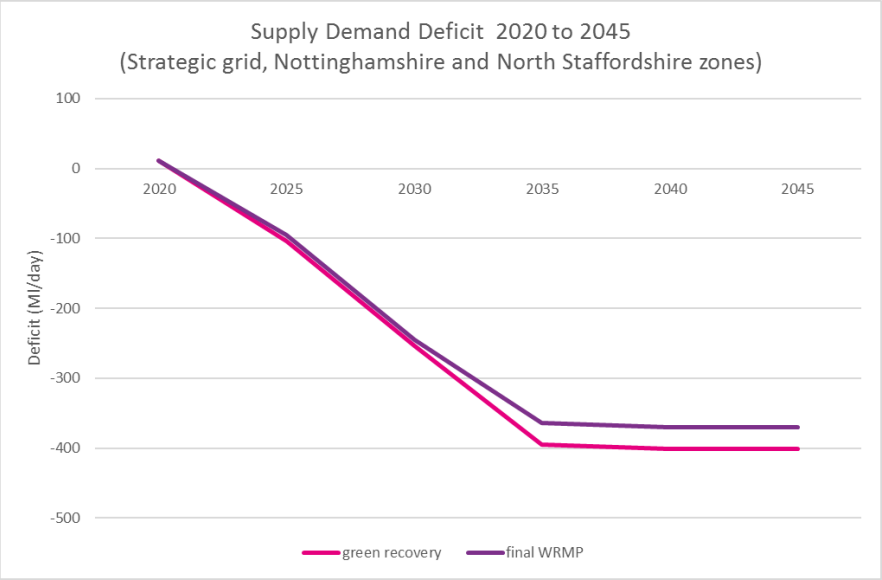
Environmental ambition: Since completion of our WRMP19 we have made agreements with the Environment Agency on two areas within existing legislation that will reduce our abstraction licences above that which were included at WRMP19. These are:

- The principle by which we would implement licence changes to comply with the Water Framework Directive No Deterioration regulations (August 2019); and
- Licence reductions to implement our Restoring Sustainable Abstractions programme in AMP7 (March 2020).

These changes reduce groundwater deployable in our key zones by 9Ml/day by 2025.

The combined impact of these two new pressures increases our deficit from 370Ml/day (at WRMP19) to 400Ml/day by 2040 as shown in figure 3.

Figure 3: Supply demand deficit



We have more certainty over long term climate change impact

In addition to the scale of the deficit increasing, we are more certain that it will be happening on the timescales we previously estimated. Our WRMP19 plan used the UKCP09 set of climate change projections to assess future supply deficits, in accordance with the regulatory guidelines at the time. At PR19, in order to manage customer bill affordability, we held off implementing the full supply side response. This was on the basis that a new set of climate projections, reflecting advances in climate science and adaption response, were due for release and would give us, and our customers, more certainty that the investment was needed.

In November 2018 the UK Met Office released a new set of climate change projections for the UK (UKCP18) which are based on the latest versions of the Met Office Hadley Centre climate models and provide an update to the UKCP09 set of projections. Our initial comparison on these two datasets in December 2019 indicated that:

- the new UKCP18 projections are broadly consistent with UKCP09 in showing an increased chance of warmer, wetter winters and hotter, drier summers along with an increase in the frequency and intensity of extreme climatic events;

- the overall impacts of climate change on reducing river flows, and therefore the amount of water we can reliably deploy, are very similar between UKCP18 and UKCP09 under a medium emissions scenario for the 2030s period; and
- some UKCP18 scenarios, for example RCP8.5, have higher rates of warming and are therefore likely to have a greater impact.

Our Regional Plan and WRMP24 will consider the full impact of the new climate change projections. However, this interim analysis means that we have more confidence in the climate change projections used at WRMP19, that the deficit is more certain in its size and timing and we therefore need to act with urgency.

Our AMP7 actions to help close the deficit are on track (see Appendix 1) but this new evidence indicates we need to do more. We are not proposing to close the entire gap but to bring forward those 'no regrets' schemes to mitigate the impacts of climate change but also support peak demand resilience.

1.3 Skills and jobs to support the green recovery

The Government has set out its objective of a new and more resilient future[11] and, as a socially purposeful company, we believe it is our duty to respond proportionately to the call for action and meet the expectation to design more innovative long-term solutions.

Our proposals will unlock significant economic, social and environmental benefits in both the short and long term. By taking action now, we will also create jobs and the new skills required for the recently announced green industrial revolution. Our proposed investment will generate approximately 240 jobs across our business and partners, to deliver the schemes with a further 220 indirect jobs created through the multiplier effect. This will provide much needed economic stimulus to local communities and businesses. We set out the full analysis and evidence to support this view in *Annex 5 Creating jobs and improving skills*.

1.4 Changing customer expectations and behaviour

Our customers expect to receive a continuous supply of excellent quality water every minute of every day and be resilient to changing weather patterns. Research at PR19 revealed that customers accepted that the measures to resolve future deficits would be needed and that we should prioritise long term, sustainable solutions.

They are supportive of investment to make our system more resilient and have given us a clear mandate for this proposal. In our most recent research, customers were positive about our green recovery proposal to increase water supply resilience, without emitting more carbon. Customers feel this a very sensible objective for a water company – *"Carbon reduction should be a key objective for any organisation nowadays and Severn Trent should be commended for its ambition. Increasing green policies are also seen as economically positive*" Customer, Tap Chat.

The results of our re-testing of customer views on our green recovery proposals set out in *Annex 3 Customer Engagement*.

[11] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/902487/green-recovery-letter-to-water-companies-200720.pdf

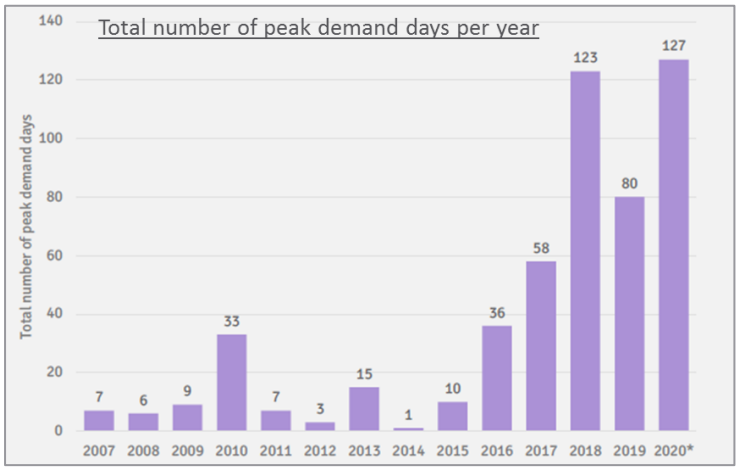
Climate change is increasing the scale and frequency of peak demand events

In addition to affecting the long-term changes in water resource yields, evidence suggests that climate change is increasing the frequency, extent and duration of peak demand events. These short-term events are managed through the 'buffering' provided by raw and treated water storage, and through the ability of our treatment works to ramp up supplies. We need to ensure that the capacity of our assets, from source to tap keep pace as these events hit us harder, more often and for longer periods. Inaction means our customers' levels of service will deteriorate.

We have analysed data from 2010 to 2020, on our strategic grid zone, that covers 65% of our customer base, to determine the rate of change in these events and assess the likely impact on our supply system. The following charts summarise the findings and illustrate that the frequency, size and duration of peak events is increasing.

Figure 4 shows that since 2015, there has been a significant and sustained increase in the frequency of peak demand days compared to the period between 2007 and 2015. A peak demand day is where daily demand is above the upper decile of daily demand for the period between 2010 and 2020.

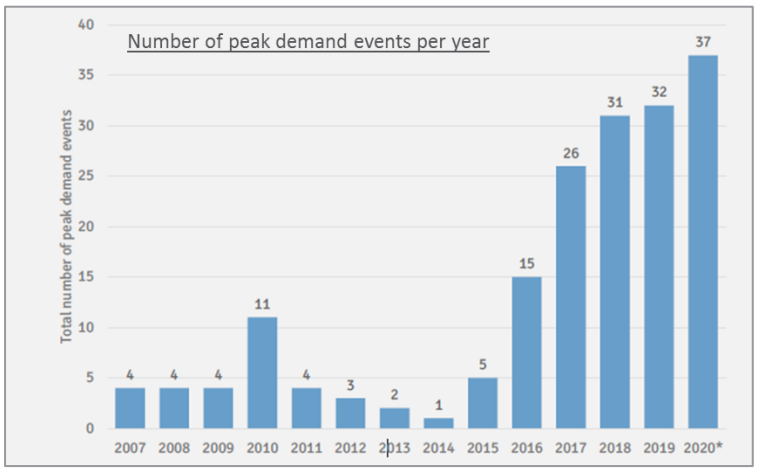
Figure 4: Total number of peak demand days per year



*Note: * 2020 data runs until October only*

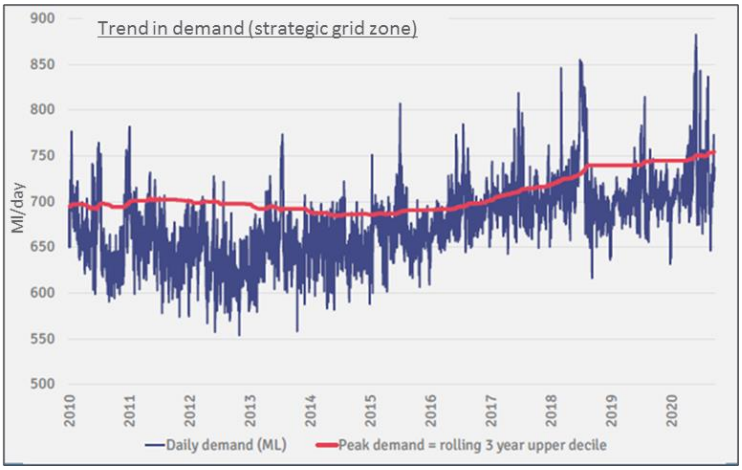
This trend is reflected in the number of peak demand events shown in figure 5. A peak demand event is where consecutive days exceed peak demand. This means that our water resources, treatment works need to sustain peak output for longer and our strategic service reservoirs must be able to buffer greater levels of demand.

Figure 5: Number of peak demand events per year



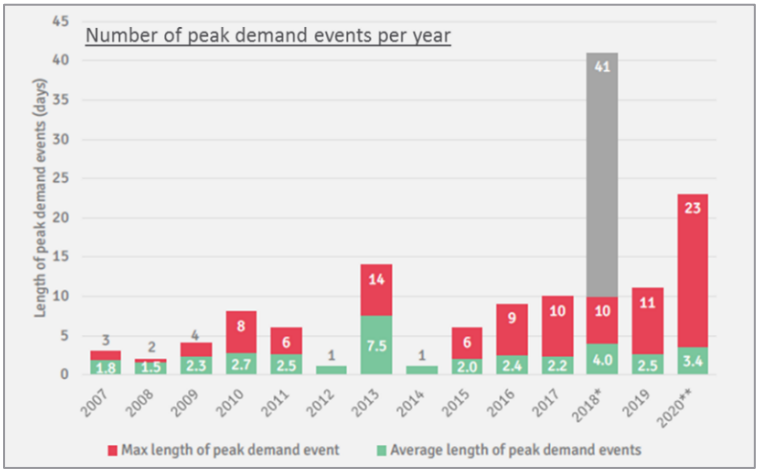
The scale of peak demand that has to be met is also growing as shown in figure 6 where the peak demand level, as defined as the 3-year rolling upper decile of daily demand, has increased by 8.6% between 2007-2020.

Figure 6: Trend in peak demand



Our analysis also shows that the maximum duration of peak demand events has generally trended higher over the period with an exceptional series of linked events in June 2018. As climate change brings warmer drier summers these trends may continue.

Figure 7: Peak demand events by year

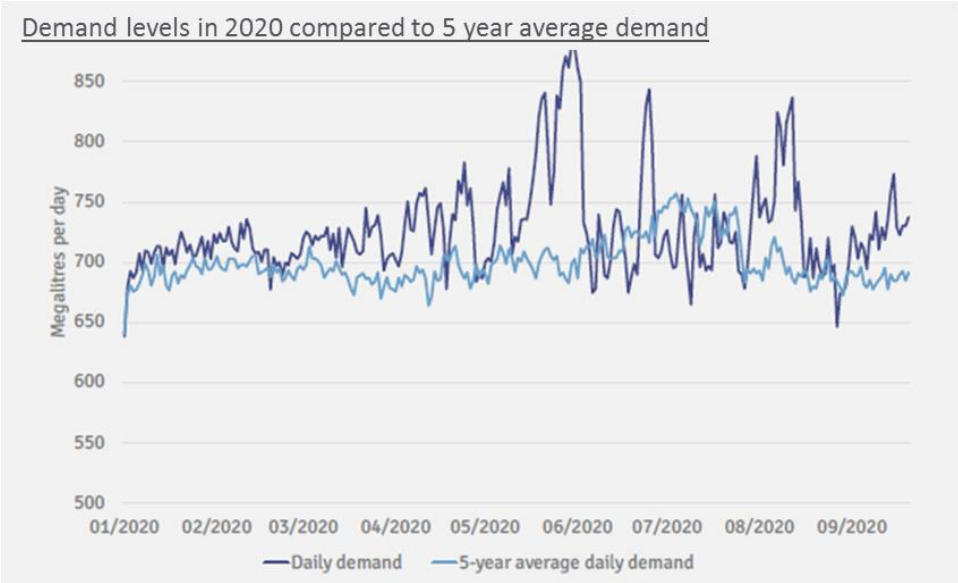


*Note: * the summer of 2018 exceptional event is shown by the grey bar to reveal the underlying trend*

Our treatment and distribution systems have fixed physical capacities and our ability to increase production constrained by abstraction licences that have peak day as well and annual average conditions. If the trends in increased severity and persistence of peak demands continue, then eventually these systems will fail to sustain supplies or breach abstraction licence limits.

We have also analysed the impact of the response to the Covid-19 pandemic on demand for water so that we can determine the materiality of any impact on future trends in peak demand that we have experienced since 2015. A simple comparison of total demand (both household and non-household) between this year and the five-year average shows an earlier start and later finish to the peak demand season indicating that we may have to extend the period over which we must sustain peak production and abstraction.

Figure 8: Peak demand last year compared to the 5-year average

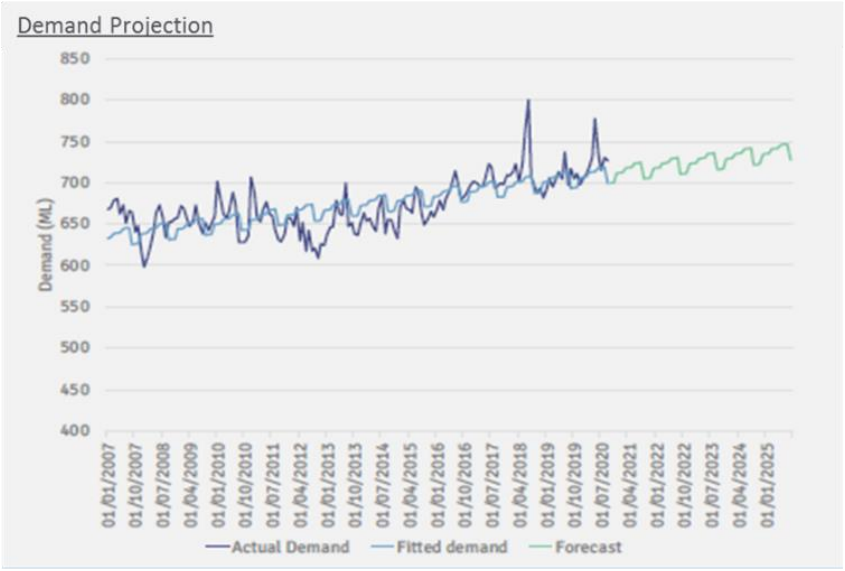


We created a regression model to derive a relationship between water demand, the pandemic, climate factors such as rainfall, temperature and seasonality. The results indicate that, on average, the pandemic is associated with an increase in demand of 20Ml/day or 2%. We used this number in a scenario to test the robustness of our Green Recovery proposals (see section 4.1, figure 36)

Planning for peak demand is becoming increasingly urgent

We generated peak demand projections from the above information to assess the ability of our current water resources and treatment assets and water to sustain supplies to customers in the future. Figure 9 shows the results of this regression model and indicates that peak demand is likely to continue to increase.

Figure 9: Past demand and demand projection



The impact of projected peak demand events was modelled against five triggers: gold, silver, bronze incident response and <20% and <10% storage level in our treated water strategic storage reservoirs.

This analysis indicates that from 2022, 'typical' July peak demand events are expected to consistently result in storage levels falling below the silver trigger level and, under scenarios that mirror recently observed severe peak demand events, by 2027 stored water volumes may plausibly fall below the critical 10% trigger level.

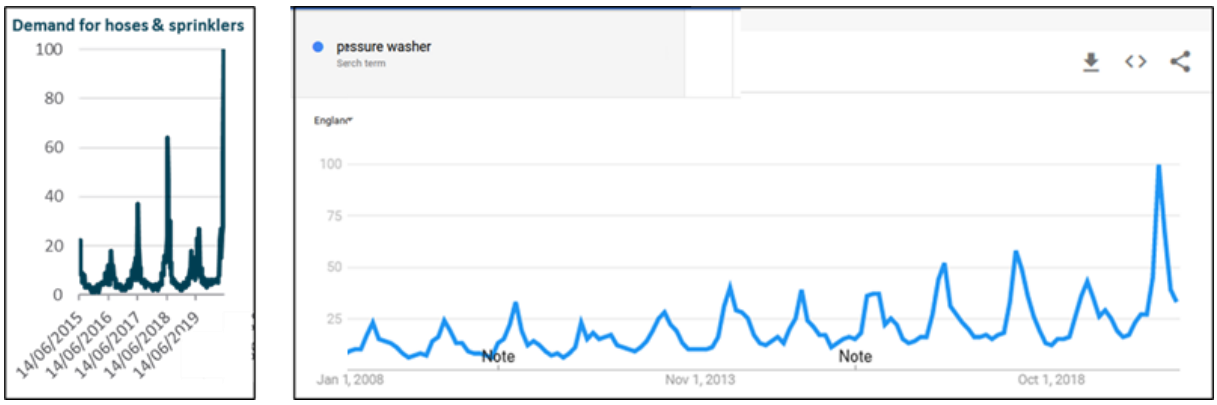
If we breach a 10% trigger, we would need to take unprecedented action, for example sacrificing supplies to a community the size of Nuneaton and Bedworth, in order to protect the majority of customers.

Initial analysis on the impact on our raw water reservoir storage indicates that, as production capacity tries to keep pace with increasing peak demand levels, impounding reservoirs are being drawn down at a faster rate than previously assumed. We intend to undertake further studies to better understand the future 'dry year critical period' risks within our larger water resource zones.

Behaviour change is increasing peak demand events

Peak demand events in spring and summer appear to be driven by customers using more water outside the home for recreation. For example, paddling pools; gardening; and general property maintenance. The trend in usage appears to be increasing with the availability of relatively inexpensive products, as illustrated by the Google search analysis below for hoses, sprinklers and pressure washers.

Figure 10: Demand for hoses, sprinklers and pressure washers



Next day delivery makes for easier access to low-cost, high-volume products. For example, a 3-metre diameter, 0.5-meter deep pool holding 3,500 litres can be bought for £60 including next day delivery. The relatively low cost of water means that it would cost a further £5.50 for metered customers to fill the pool, unmetered customers would face no additional charge.

These activities intensified during the Covid-19 lockdown period as people sought solace and wellbeing in their gardens. For instance, Office of National Statistics data shows a 150% increase in gardening activity. In the Midlands, people who normally head to the coast or abroad for holidays were unable to.

We believe that these lockdown behaviours may become engrained. Further, we want our services to meet unexpected demand events that provide satisfaction, in an affordable manner to our customers and be responsive to increasing 'normal' peak demand.

The options to control peak demand by trying to further control demand or creating more capacity are set out in Section 3. Regardless of the solution the increasing size and frequency of peak demands mean that we need to act with urgency.

1.5 Sharing learning across the industry

The costs and value of the benefits of decarbonising water resources are not fully known. Our proposal includes creating a demonstrator water treatment works. The findings of which we will make available for others to learn from. Current events have also revealed the fragility of the sector's chemical supply chain. By trialling new reduced-chemical water resource solutions we can enhance the sector's resilience to external shocks.

1.6 Time bound opportunity to share costs and benefits

The timing is also critical as we look to join our plans up with those of other organisations, who are also responding to the plea to support the Green Recovery, for example the Environment Agency inspired River Severn Partnership (RSP) are planning flood protection initiatives along the River Severn that need to be completed by March 2027. It would be beneficial to develop any joint drought –flood protection scheme along these timelines of the next flood risk management capital investment cycle.

2. Our future strategy

This section describes how our green recovery proposals fit in to our long term strategy and why investing in them now is a no-regrets decision.

2.1 Emerging long-term strategy

The direction of policy is clear and consistent across regulators and Government in that we must address a growing and more certain water deficit, enhance the environment, and reduce carbon emissions. We have choices over how we meet this challenge.

Our vision is to decarbonise our water supply system into one that provides all the needs of our customers whatever the weather, at net zero carbon, whilst enhancing biodiversity, facilitating the well-being of our customers and keeping bills affordable over the long term.

In doing so we need to find new low carbon, biodiversity enhancing options and technology, work with the natural environment, explore new ways of using energy and water markets and drive cross sector collaboration in the water and energy cycles.

We have identified new options through an internal review of how we can leverage our water and waste asset base, bi-lateral discussions with other sectors and groups, participation in the regional water resource planning process, leadership of the River Severn and River Trent Working Groups and in our Green Recovery stakeholder workshops. These opportunities are described in section 3.

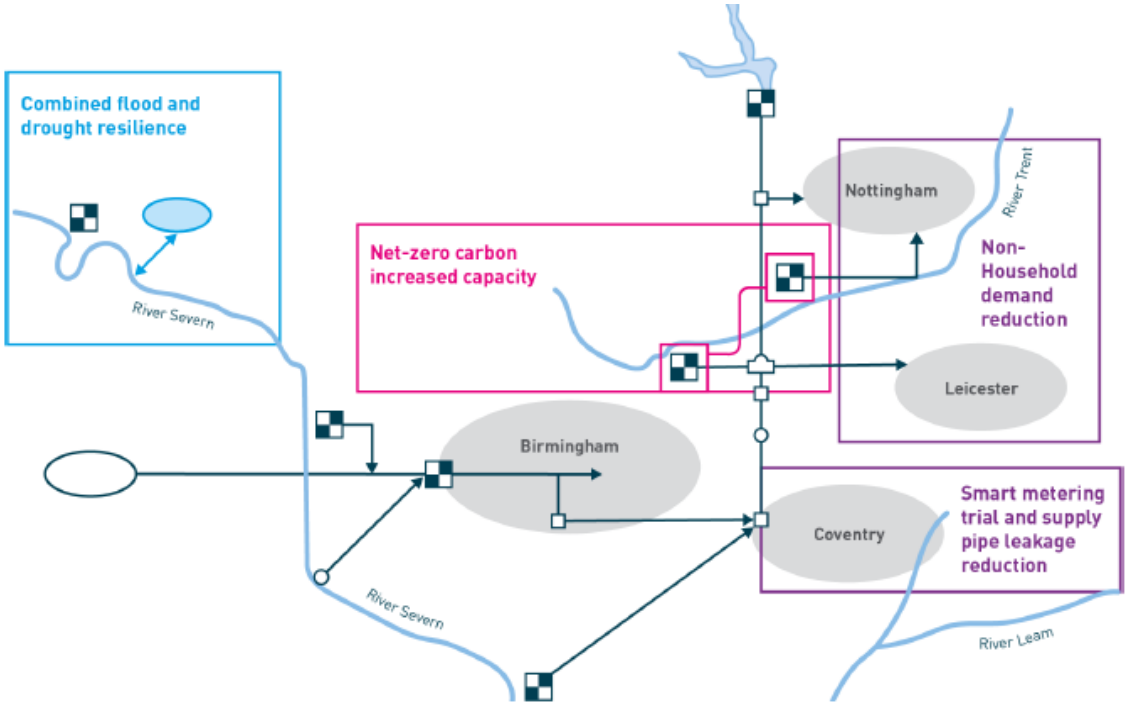
We have taken the policy aims, the size, shape and timeline of our deficit, and a revised set of options to develop a vision of how our system could look in the 2050s. We have not worked out every detail, dependency and cost of this long term vision but we believe it provides a framework for our future strategy.

Figure 11 below shows how our Green Recovery proposals fit into our emerging long-term strategy. The other key elements of this vision that we will continue to develop and consider when building the Water Resources West Regional plan, WRMP24 and at PR24 are;

- maximising the use of gravity by extending an existing [redacted] dam to provide more resource and help decarbonise our northern operations;
- developing local catchment partnerships with farmers and landowners to share resources;
- exploiting effluent reuse in areas where we are enhancing river water quality to bathing water standards;
- exploring further opportunities with energy sector as they decarbonise generation along the River Trent; and
- enhancing demand management through Smart metering and leakage reduction.

Figure 11: Strategic water resource vision

[redacted version of figure]



The Green Recovery provides an opportunity to take a cost beneficial, first step towards decarbonising the whole water system as well as helping to tackle our near-term water resource deficit and peak demand issues. Our process to select the best options, described in detail in section 4, has identified three schemes that are a no regrets start on this journey. These options are in our strategic grid water resource zone and therefore do not overlap with our AMP7 resource schemes in our Nottinghamshire and north Staffordshire zones.

Figure 12: Green Recovery Proposals

Green Recovery scheme	Cost £m 2017/18 prices	Ml/day	Direct jobs created
[redacted] and [redacted] expansion	[Redacted]	65	165
Shrewsbury combined drought – flood resilience[1]		40	60
Renewables to offset carbon emissions[1]		-	15
Non-household demand reduction		4	
Total	**206.3**	**109**	**240**

Notes: [1]Net of contributions

2.2 Why this is a no regrets investment

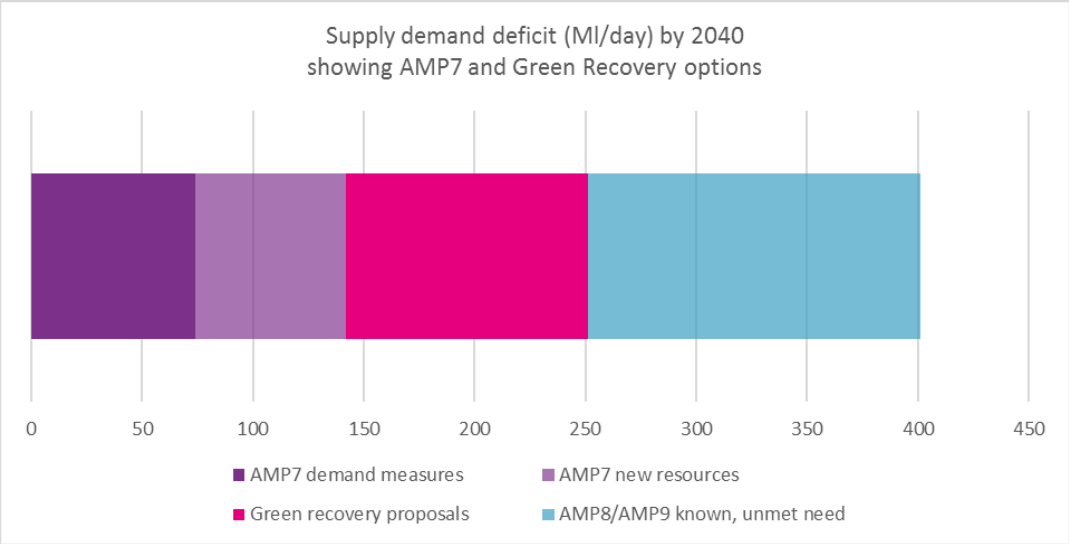
This section sets out why we believe investing now in our Green Recovery proposals is a no regrets decision.

More balanced investment profiles

The scale of investment seems large compared to our PR19 supply-demand balance enhancement and investigations funding. However, the WRMP19 identified the need for increased supply capacity of 96Ml/day by 2028 and a further 93Ml/day by 2031 to meet the combined challenges of environmental reductions to supply, growth and climate change that will require a significant increase in investment over AMP8.

Our proposal advances only a proportion of this total requirement for new water resources. Figure 13 below shows how much our three Green Recovery proposals will contribute to the known deficit we are facing by 2040.

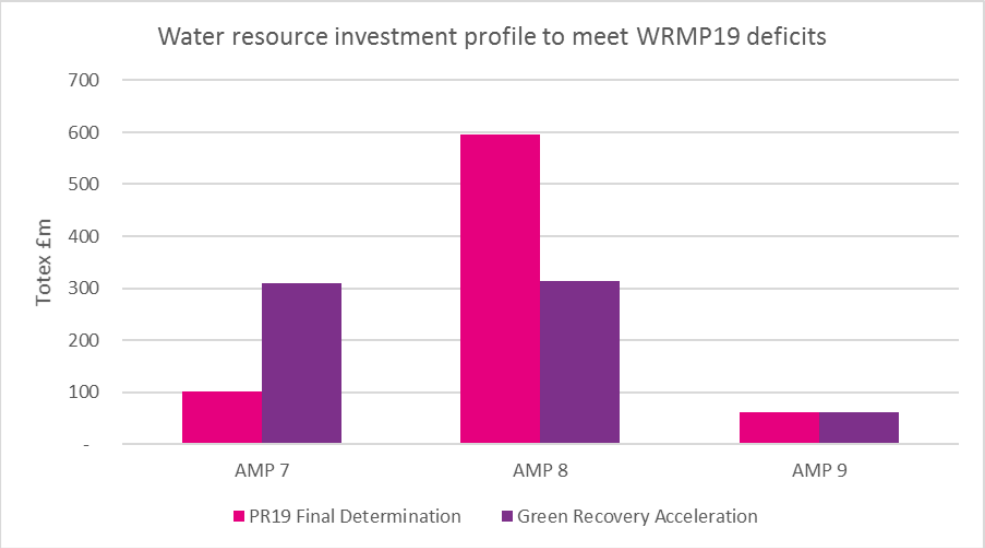
Figure 13: Green Recovery contribution to future deficits



The 2028 delivery timescale of the 96Ml/day is driven primarily by the environment programme, specifically the need to achieve good ecological status or good ecological potential, with the 2031 date more influenced by water framework directive sustainability reductions and climate change impacts. We are now more certain over the scale and timing of the climate change element of deficit (see section 1.4).

We will need significant investment in AMP8 to deliver against these commitments and timelines. Figure 14 shows that bringing forward this investment will smooth the investment profile and allow us to lock in the benefit of the current lower cost of financing and deliver more efficiently, both of which will help keep bills affordable.

Figure 14: Comparison of investment profiles



The Green Recovery schemes will reduce the overall cost to customers

Compared with our preferred plan at WRMP 2019 we have found better solutions that will reduce the total expenditure over three AMP periods, by approximately 10%. Figure 15 shows the total cost with the Green Recovery investment displacing options in the WRMP19 of an equivalent volume and figure 16 shows the costs of the preferred programme from WRMP19.

Figure 15: Long term investment in water resources with Green Recovery

£m (2017/18 prices)	AMP 7	AMP 8	AMP 9	Total
Capex				
Opex per annum		[redacted]		
Totex		**[redacted]**		**683**

Figure 16: Long term investment in water resources without accelerated Green Recovery

£m (2017/18 prices)	AMP 7	AMP 8	AMP 9	Total
Capex £m				
Opex £m per annum		[redacted]		
Totex		**[redacted]**		**757**

The reason for this overall cost reduction is that our Green Recovery options are lower cost than those in our preferred plan at WRMP19.

[redacted] and [redacted] expansion: We have found a lower cost means of delivering these schemes than was envisaged at WRMP19 by purchasing and securing approval of an abstraction licence for 65Ml/day (93Ml/day peak). The licence was approved based our need as set out in the WRMP2019.

This option addresses the portion of the WRMP19 deficit that we deferred at PR19 until we were more certain of the scale and timing of the deficit. The peak element of the licence will enable us to keep pace with customer demands in hot and dry weather that our analysis shows is increasingly prevalent year-on-year.

Further detail of are set out in sections 3.8 and 4.3.

Shrewsbury combined flood-drought: [redacted] represents good value in terms of cost benefit at [redacted] Ml/day and deals with the longer term deficits related to climate change by storing water in times of plenty. This option, without the flood benefit but with additional costs to transfer and treat the water, was screened out at WRMP19. Utilising assets built as part of the Birmingham resilience programme and including a cost contribution from [redacted] reduces investment cost.

The scheme is viable as a stand-alone water resource option that will ensure we remain resilient to a 1 in 200 year drought.

Further detail of are set out in sections 3.4 and 4.3.

3. Options considered

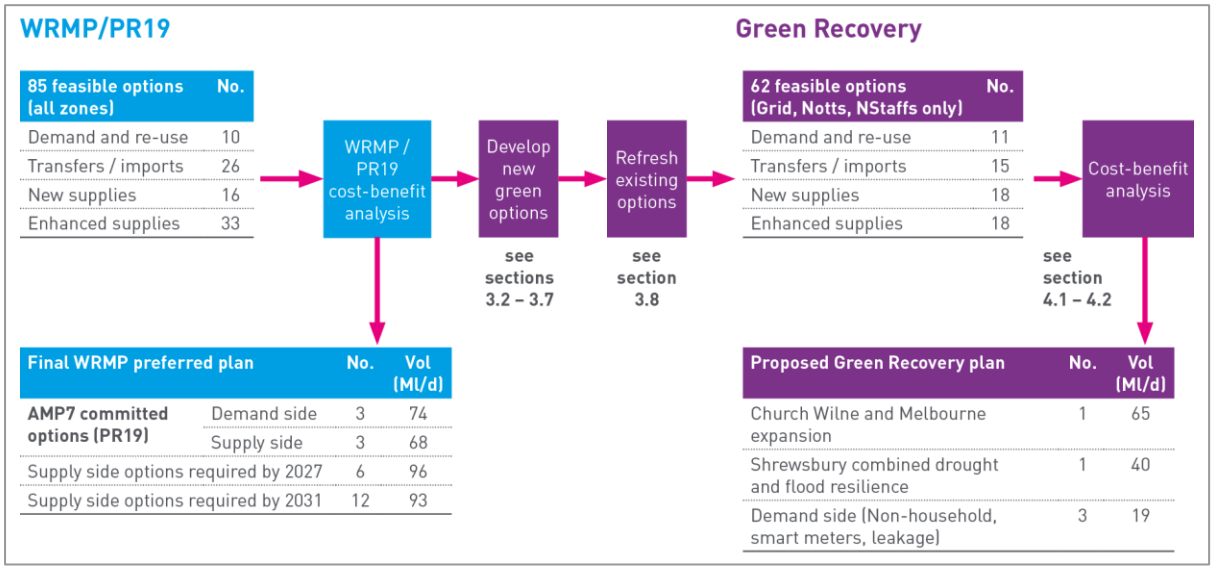
This section describes the approach we have taken to investigate and identify the best options to help close our deficit and start to decarbonise water resources. It covers:

- Our approach to developing options.
- Demand side options.
- Supply side options.
- Innovation to decarbonise and increase biodiversity.
- Partnership working to get more for customers at a lower cost.
- How we have refined existing options as new information on cost and benefit becomes available.

3.1 Process

Our PR19 final determination included £3.3m to investigate the need for, and appraisal of, large supply options that would be required at PR24. We have accelerated and expanded the scope of this work as part of the Green Recovery initiative. To ensure we considered the best set of options available we have considered both those generated through the WRMP19 screening process, updated to factor in new information on costs, benefits and deliverability, and new options that may not have been available during previous plan formation. Figure 17 below summarises the process used, and subsequent sections go into detail of the work undertaken, new opportunities identified and changes to pre-existing options.

Figure 17: Mapping our solutions process



The outcome of the review process is summarised in figure 18 below. Key points to note are:

- The colour of bubbles represents delivery time driven by complexity, risk and other constraints.
- The options being implemented in AMP7 are included for comparison.
- New or significantly altered options are marked with a star.
- The chart does not attempt to depict options that are mutually exclusive, for example variants of options that share the same raw water source.

Figure 18: Chart showing cost, benefit and delivery timescales of options
[redacted]

3.2 Approach to developing new options

The direction of policy is clear and consistent in that we must address the growing water deficit and drive down carbon emissions. Until recently we developed our water resilience strategy under three constraints:

- We primarily used traditional WRMP best practice approaches to assessing financial, environmental and social costs to develop a best value, adaptive plan;
- We developed options to meet the needs of the public water supply (both in our region and nationally) with less regard to the needs of other sectors, and;
- We restricted our environmental ambition largely to applying Strategic Environmental Assessment rules and other legislation to ensure we minimised harm.

5These approaches have tended to recommend water resources investments that are least cost, least environmental harm, relying on traditional engineering solutions to meet shorter-term deficits and, whilst this has kept customer bills low, we can do more to get even better outcomes for the environment and wider society. For example, a perverse outcome of these 'near least cost' planning approaches is that they seek to mitigate the impact of climate change whilst increasing greenhouse gas emissions in themselves. Had we optimised our last water resource plan to resolve deficits AND minimise climate impacts, we would have increased construction costs by approximately 10% but reduced future carbon emissions by 30%.

We need a different mindset so that our solutions will be net zero carbon, deliver net bio-diversity gain and work for other sectors. In doing so it is our ambition to drive down the unit cost and keep our customers' bills affordable.

We have used the principles and initiatives set out in figure 19 below to develop new options and revise options considered in previous plans. Many of these types of options have been looked at from a traditional engineering, environmental impact and cost minimisation perspective rather than one that seeks to maximise value to customers, the environment and wider society. The search for cost effective means to decarbonise water resources has stimulated a thorough and systematic review.

Figure 19: Principles and corresponding initiatives

Option development principles	Initiatives / opportunities
Prioritise demand side options as they are inherently carbon neutral and environmentally beneficial whilst being mindful of the risk that benefits might not be sustained.	• Improve our metering technology and pace of delivery. • Greater engagement with non-household users to reduce demand. • Innovation to drive leakage levels down faster and change the economics.
Make more use of gravity – a perpetual and carbon free energy supply.	• Review existing impounding reservoirs to see if they can be extended. • Consider strategic gravity raw water transfers.
Work with the water cycle not in isolation.	• Look for effluent re-use and transfer to reservoirs • Exploit synergies with waste-water investments.
Work across the weather cycle by linking drought and flood issues wherever possible.	• Work with the Environment Agency and River Severn Partnership to identify dual benefit schemes. • Review the opportunities outlined by the Environment Agency's Priority Catchment work.
Work with other sectors to combine needs and synergistic options.	• Energy sector: decarbonisation along the River Trent. • Agriculture: development of dual-purpose assets. • Industry: change the purpose of end of life hard rock quarries.
Design out carbon and design in biodiversity through the value chain.	• Review how to maximise natural processes to treat water. • Reduce chemical intensive processes and so limit emissions from their synthesis and harm from waste stream disposal.
Ensure all options have net-zero carbon impact.	• Consider on or off-site renewables for residual energy. • Consider other offsetting activity such as tree planting.

The following sections describe the key options that have been developed using this new mindset.

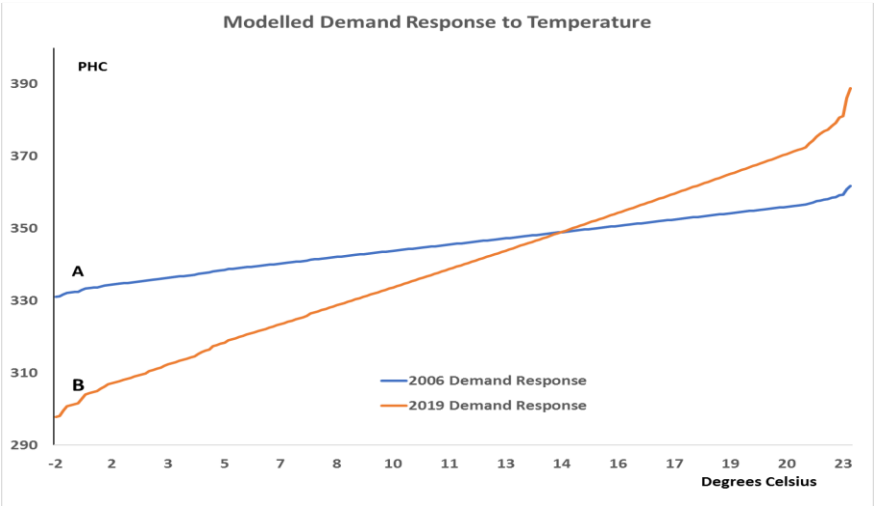
3.3 Demand side options

Demand side options have the advantage of being quick to mobilise and are labour intensive, both important objectives of the green recovery. We have considered ways to accelerate and improve demand side options by looking to increase benefit and reduce cost.

Domestic household metering and water efficiency: Using demand management to control peak events requires customer education, so that they are aware of the environmental consequences of high-water usage and incentives through a metered tariff. We are not designated as a seriously stressed area by the Environment Agency which means we are unable to put customers on a metered tariff without their agreement. The EA is reviewing designations and will recommend to Government new company categorisations in April 2021.

There is emerging evidence that metering is of limited benefit under peak demand conditions. Figure 20 below shows that demand management is successful in reducing 'base' demand but that this is not sustained when temperatures increase. Our model of per household consumption indicates that the structural downward shift in demand at lower temperatures, most likely due to water efficiency education, does not hold when temperatures increase above 20^{o}C.

Figure 20: Demand for water as the temperature changes



Our conclusion from this evidence is that, in the short to medium term, we need to find means other than metering to control demand during hot weather peak demand events, for example by investing in more system capacity.

The options to improve our metering programme by a switch to smart metering are set out in our **Smart Metering business case.**

Non-household demand: Our AMP7 demand management plan focusses primarily on helping our domestic customers use water more wisely. Water use on non-household sites makes up approximately 20% of total water produced and it is critical that we include those customers in all water efficiency activity. In addition to saving water, working with non-household customers is an important way of supporting businesses, by saving them costs as they recover from the lockdown.

We have engaged with retailers and reviewed our current approach to develop options that will help non-household consumers reduce their consumption. The options are based on benchmarking with other organisations, including Singapore's national water agency, trials that we undertook in AMP6 working with hotels, universities, and leisure centres, and the initiatives we implemented in spring 2020. The options that we have considered are:

- a service that would assess consumption, recommend and retrofit water saving devices free of charge;
- find and fix leaks, and;
- a technical support and a capital grant scheme to incentivise large users to improve their processes.

The regulatory landscape is complicated between retailers, Wholesalers and the market operator MOSL. We need to shape options so that they comply with market regulations and the Competition Act.

Some customers are very keen on the idea of grey water recycling and rainwater capture. In recent discussion on Tap Chat, customers have suggested that we should help to facilitate this. Our demand management proposal focusses on non-households as this is where we believe the greatest opportunity exists for grey water recycling.

We have included proposals within this business case to do more with commercial and industrial users. We expect that this will reduce consumption by 4Ml/day. See section 4.3, Scheme 3 for details of our proposal.

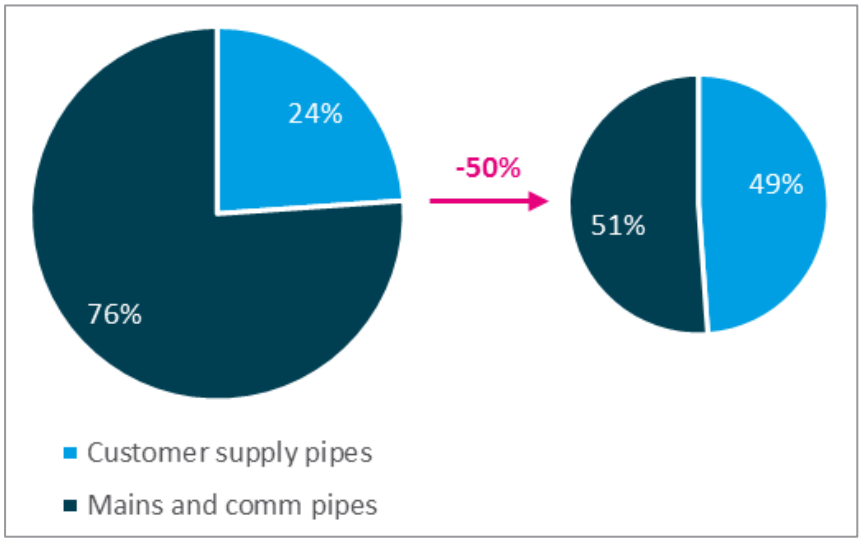
Leakage: We are committed to reducing leakage by 50% over the long term and are on track to achieve our AMP7 reduction target. The options we have considered to go beyond our existing commitments are:

- doing more on innovation;
- tackling supply side proactively;
- more mains renewal; and
- accelerating real time monitoring and control on our network.

In our Green Recovery proposal, we are not proposing any specific activities to accelerate beyond our 15% target as we have flexibility in the existing PR19 Outcome Delivery Incentive to do so.

However, as part of the Green Recovery we want to explore the barriers to proactively renewing customer supply pipes. Our current plan to achieve 50% reduction in leakage assumes that innovation will drive a 50% increase in 'find and fix' efficiency and that we will double our mains renewal rate from AMP8 onwards. This approach will increase infrastructure renewals expenditure (IRE) by [redacted] per AMP period and increase leakage repairs by over 200%. When this is delivered it will mean that almost 50% of leakage will be from customer supply pipes by 2045.

Figure 21: Leakage reduction target for 2045



We believe that restricting proactive renewal to assets that we own introduces unnecessary barriers to finding the most cost-effective way of reducing leakage. Removing the barriers to tackling customer leakage, by being able to proactively renew customer supply pipes rather than responding to ever more frequent leaks, is essential for us to optimise costs and drive leakage lower.

We need to gather better data on the cost and benefits of supply pipe replacement and adoption. To this end we have incorporated leakage into the large-scale supply pipe renewal trial that we propose in our **Taking care of customers' supply pipes business case**.

3.4 Supply side options

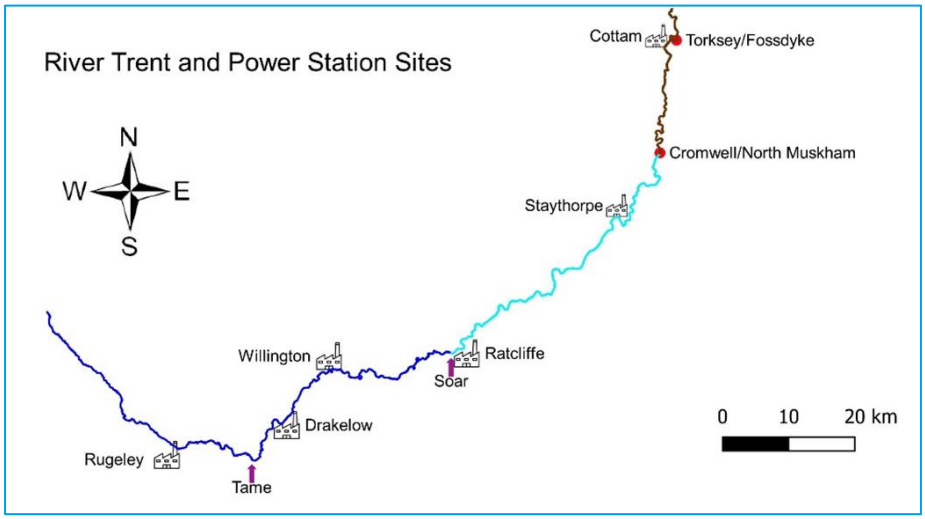
We have worked closely with other sectors to generate new net-zero carbon and multi benefit schemes. We have identified opportunities as a result of participation in the regional water resource planning process, through leadership of the River Severn and River Trent Working Groups and in stakeholder workshops. In developing our green recovery plan, we have prioritised:

- Working with sectors undergoing structural change where licence trading or joint development may be mutually beneficial, for example the decarbonisation of the energy sector;
- Working with third parties that are already active and where we need to move quickly to exploit synergies, for example the River Severn Partnership;
- Opportunities that leverage our existing asset base, are large scale and carbon neutral, for example major dam raising.

The following section describes four areas with the greatest potential. We will continue to develop further options within Water Resources West and Water Resources East and through continued engagement with other sectors through our Bid Assessment Framework.

Decarbonisation in the energy sector: Since accepting our PR19 final determination we have collaborated with energy companies along the River Trent to identify partnership opportunities as decarbonisation of the sector accelerates. The map below shows significant coal and gas fired power generation facilities from Rugeley in Staffordshire to Staythorpe at the northern edge of our region.

Figure 22: The River Trent and Power Station Sites

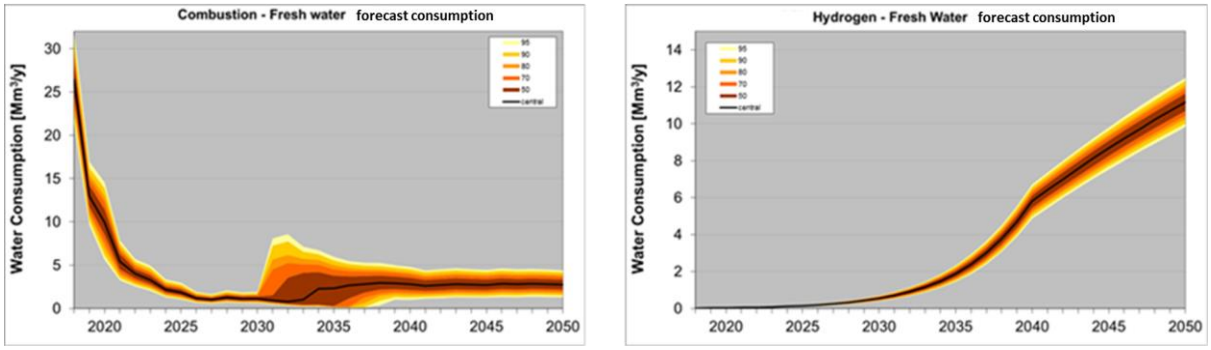


Decarbonising the power sector is a significant contribution to the UK meeting net-zero carbon by 2050 and the Government recently announced its intention to bring forward the deadline for removing coal power altogether from 2025 to 2024. Energy companies are each developing future generation strategies to manage coal and gas plant closure and to decide what, if anything, to replace them with.

The Energy UK[12] report on scenarios for future water use by the power sector by 2050 sets out how water use by the energy sector may change over time. In the short-term water abstraction for cooling coal and gas fired stations will reduce but is then replaced in some scenarios by water for Hydrogen generation as shown in figure 23.

[12] https://www.energy-uk.org.uk/publication.html?task=file.download&id=7666

Figure 23: Fresh water use of combustion and hydrogen power generation compared



This situation presents two opportunities:

- To purchase abstraction licences from those companies exiting power generation. Our most recent acquisition was the Rugeley power station abstraction licence in October 2019. The Environment Agency has approved the transfer of the licence (65Ml/day annual average and 93Ml/day peak) to [redacted] on the River Trent on the basis of our need; and
- To develop partnerships with companies switching to hydrogen production. Proton exchange membrane electrolysers, a technology which enables the generation of hydrogen from water, was highlighted in the ten-point plan for a green industrial revolution[13]. A pre-requisite for efficient hydrolysis is water quality equivalent to drinking water standard. This presents an opportunity to co-develop and share facilities. We have started discussions with several companies who are developing strategies to switch from carbon-based generation to renewables.

Customers express some concerns about the environmental impact of abstracting more water from rivers but consider the option to be relatively simple and certain if regulated correctly. One advantage of the Rugeley licence is that it is already factored into existing regulation regime so there is no detrimental impact. In fact, moving the licence downstream will have a positive impact on the stretch of river between the old abstraction site at Rugeley and the new site at [redacted].

We have developed options to deploy the full annual average (65Ml/day) and peak day (93Ml/day) Rugeley abstraction licence. These are considered within our cost benefit analysis in section 4.

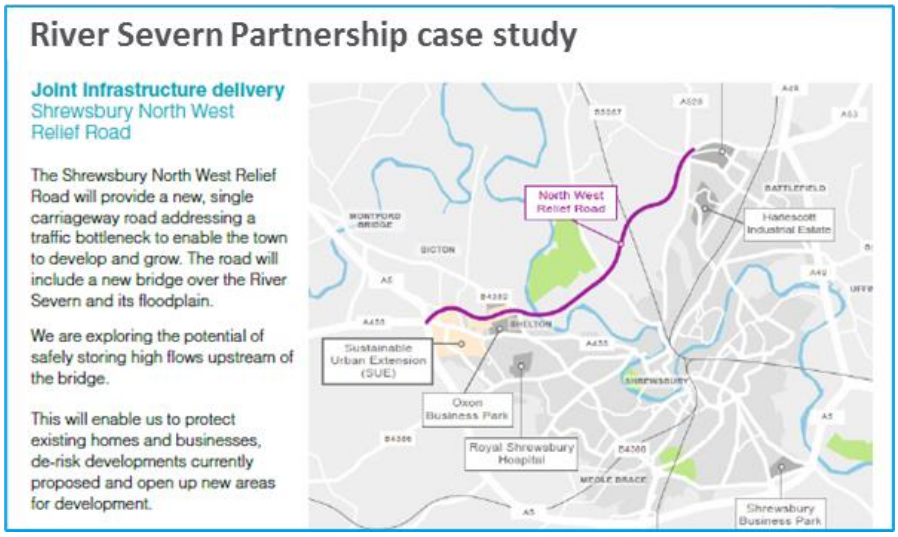
Combining flood and drought: This is something customers are increasingly becoming frustrated about – part of the year suffering flooding and then part of it hearing messages about droughts. The two problems are not so simply linked, however. The obvious challenge is that structures built for flood protection need to be kept relatively empty to accept flood waters and drought structure should be kept full to provide maximum resilience. However, we need to try harder in this area and we are working closely with the River Seven Partnership (RSP) to see where we can join up flood and drought schemes. The RSP, formed in early 2020, has united local authorities, local enterprise partnerships, water companies, Water Resources West, and the Environment Agency around a shared vision to deliver a long-term programme which unlocks growth by addressing interdependencies between water management, housing, employment, transport and other infrastructure delivery.

The key opportunities that we have assessed are on the River Severn at Shrewsbury and between Stratford upon Avon and Vale of Evesham. Figure 24 below, from the RSP publication *Unlocking*

[13]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936567/10_POINT_PLAN_BOOKLET.pdf

opportunities for the Severn Regional Growth Zone[14] shows one example of their early thinking to hold water upstream of Shrewsbury to prevent flooding.

Figure 24: River Severn infrastructure partnership case study



The RSP has secured a £40m grant from Government to undertake feasibility studies. Further Government funding to build the flood defence scheme will be contingent on it being operational by the end of March 2027.

Discussions with the RSP we have identified two opportunities to link up to:

- the Shrewsbury flood scheme by providing the means to capture flood water when it is released from their structure; and
- water resource issues affecting the agricultural sector and flooding on the River Avon.

At Shrewsbury we identified how our West Midlands raw water storage option that was screened out at WRMP (see **appendix D** option 143) [redacted], could be adapted to contribute to flood alleviation withing the RSP deadline. The scheme would bring significant water resource benefit to our strategic grid zone. Linking the two schemes improves the cost benefit of both and bring efficiencies during feasibility, planning and construction.

A combined drought-flood resilience scheme at Shrewsbury is considered in our cost benefit analysis in section 4.2

The RSP thinking on the river Avon is less advanced and so we have agreed to work in together to see if we could join up our Bathing Rivers proposal and water resource development ideas at [redacted] reservoir. Any combined scheme, if viable, would be considered at WRMP24.

We also developed a small-scale water resource / flood protection scheme with landowners in the Idle and Torne catchment in north Nottinghamshire. The idea is to convert a large redundant sand and gravel quarry near Bawtry to hold flood water captured from the local river in the wetter, winter months. In summer, growers would irrigate their fields using the stored water and release groundwater licence to Severn Trent. The scheme would give flood protection to Scrooby and Bawtry, a biodiversity benefit by restoring quarry and a small water resource benefit in a priority catchment.

[14] https://shropshire.gov.uk/committee-services/documents/s25232/a%20River%20Severn%20Appendix%20A.pdf

Our customers have often suggested that Severn Trent ought to invest in infrastructure that would allow us to store more rainwater for use in drier periods. For example, one customer said "*It is ridiculous that most autumns and winters we are flooded and [then in the] first period of sunshine for 2 or 3 consecutive days and there are hose pipe bans, etc.*"

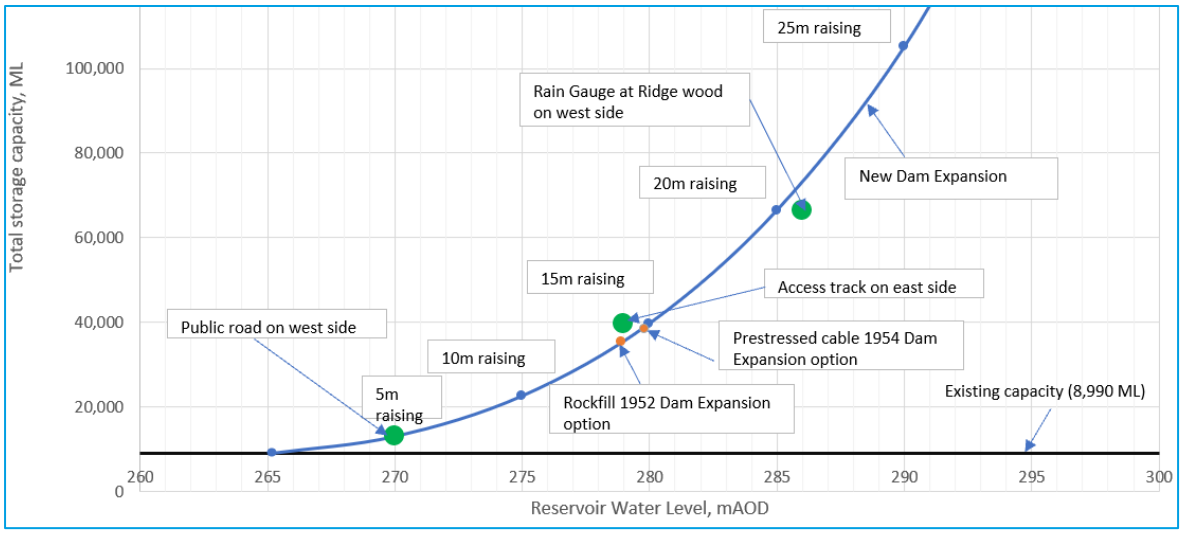
Working with the Environment Agency, River Severn Partnership, and landowners in the Idle and Torne allows us to do just that with dual purpose drought-flood schemes. Customers also say that reservoirs provide a sustainable option with potential for wider environmental benefits such as creation of habitats for wildlife after the initial disruption of construction for the surrounding community. Our proposal will minimise construction and help remediate the area affected by active quarrying.

The Idle and Torne scheme will be considered for possible inclusion in our PR24 business plan and is not included in the Green Recovery proposals.

Relooking at gravity: An internal review of options has identified new opportunities to maximise the use of gravity that were previously overlooked in favour of lower cost but energy intensive options. For example, extending [redacted] reservoir in [redacted] was considered in the late 1950s before our predecessors opted to build [redacted] pumped storage reservoir.

Our initial assessment is that raising [redacted] is technically feasible, in terms of engineering and catchment flows, but that risks around the geology need to be further investigated. Figure 25 below shows that a significant increase in storage capacity could be obtained for a relatively modest increase in dam wall height.

Figure 25: Raising [redacted] – impact on storage



A 15-metre increase in height would give additional storage equivalent to [redacted] reservoir and a 20 metre increase would double the capacity of [redacted].

Having a major new storage reservoir at [redacted] would allow a gravity driven reconfiguration of the northern section of our asset base and significantly lower our operational greenhouse gas emissions. Raising [redacted] would take up to 15 years and is therefore not part of our Green Recovery proposal. However, the options we pursue during for the green recovery may help pave the way for this significant green option. We have initiated further feasibility studies to understand the cost, risk and benefits.

Customers view reservoirs positively believing they provide a long term, sustainable solution with potential for wider environmental benefits such as creation of habitats for wildlife after the initial disruption of construction for the surrounding community. Our option to expand [redacted] would deliver these wider benefits at minimal disruption due to the remote location.

We have developed an option, of sufficient scale to be a Strategic Regional Option, but there is a lot more work to do to understand the cost, risk and benefit. Also, the timescale of reservoir development, typically a minimum of ten years, means that it does not meet some of the criteria for the Green Recovery. We will continue to develop the option for WRMP24.

Effluent reuse: The advanced effluent treatment in our bathing rivers proposal will remove some of the barriers that have caused us to be reticent on re-using effluent in the past. For example, ozone treatment will reduce chemical and pharmaceutical residues that are of concern to the DWI and make it easier to comply with the invasive non-native species regulations.

The very high-quality final effluent produced at Finham sewage works is less than 16 km from our [redacted] reservoir that supplies water to Rugby. We have looked at the opportunity to transfer a proportion of final effluent via a new pumping station and pipeline. To gain maximum benefit we would need to expand the reservoir capacity by 6%, use natural processes for further purification at the reservoir site and expand [redacted]. We have developed an option to combine the effluent transfer element into our pre-existing dam raising and enhanced treatment options.

Customer views on effluent reuse is mixed with concern over longer term sustainability, high energy requirements and costs. A significant proportion of participants felt they might not wish to drink water from this source. We have listened to customers and shaped the Finham to [redacted] option to use natural processes to further purify the water following the advanced treatment at the works and then use [redacted] reservoir for dilution.

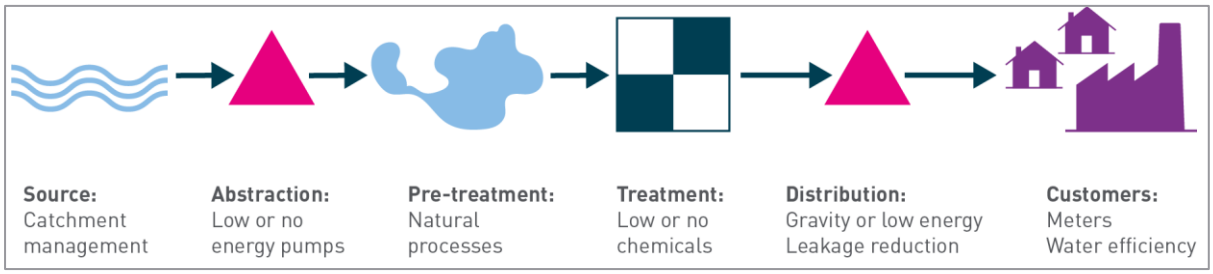
We have developed an option to transfer Finham effluent to an expanded [redacted] scheme and included it in our green recovery cost benefit analysis for further consideration (in section 4), but it has later been discounted because it is not possible to construct and put into operation within the timescales of the Green Recovery.

3.5 Innovation to reduce carbon emissions and increase biodiversity

Sections 3.3 and 3.4 show how we have evolved and generated options to meet our ambition to decarbonise water resources and improve biodiversity. But we haven't stopped there – over the last four months we have engaged with innovation partners to understand the scope for innovation within options. These are shifts in technology that would maximise green energy and utilise natural treatment processes that will improve biodiversity within the options outlined above.

We commissioned Isle Utilities to identify innovative technology which can reduce carbon and increase biodiversity across and within the value chain as shown in figure 26 below.

Figure 26: From source to customer, the water chain



We looked at both innovative man-made technologies and natural processes. Natural processes are attractive as they may simultaneously reduce carbon emissions and produce gains in biodiversity and habitat. The types of technology options and initiatives we considered are shown in Figure 27.

Figure 27: Technology choices considered in our Green Recovery proposals

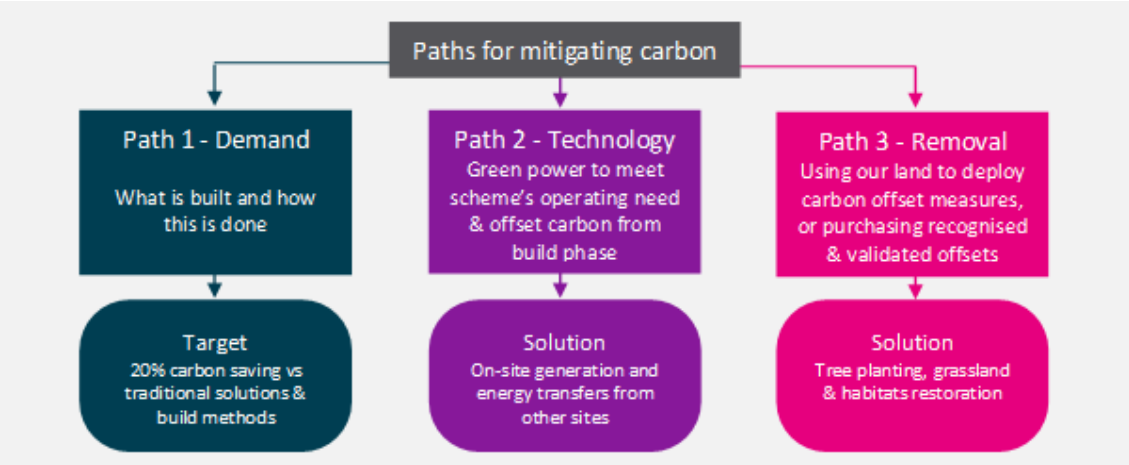
Source	Abstraction	Pre-treatment	Treatment	Distribution
Catchment management to ensure hard to remove pollutants (pesticides and industrial chemicals) are dealt with at source	• No-power pumps that use differences in hydraulic gradient • Magnetic coupling pumps • Solar/wind energy to power pumps • Water wheels	• Constructed wetlands with reed beds • Riverbank filtration used in Dusseldorf as the first stage treatment	• Ion exchange • Ceramic membranes • Active media filtration • Hollow-fibre nanofiltration	• No-power pumps • Magnetic coupling pumps

Not all technology choices are suitable for every option due to the specific site characteristics and water quality challenges. For example, deploying our new River Trent licence from [redacted] to [redacted] has a relatively low pumping head requirement and a large area suitable for constructed wetlands compared to other options.

The sections below summarise the key opportunities across carbon and biodiversity drivers. The full description of how we have applied this thinking to our Green Recovery proposals is set out in section 4.3.

Carbon: The diagram below shows the three-stage approach we have used to decarbonise our options. This business case considers how we can design out carbon, i.e. pathway one. Our strategy to account for and offset remaining, unavoidable emissions (pathways two and three) is described in *Annex 6 Net zero carbon*.

Figure 28: Mitigating carbon impact approach



The opportunities to design out carbon in construction and operation by using new technology, methods and maximising the natural environment are to:

- eliminate the need for pumping from source to the treatment works by using gravity, or where not possible use positive displacement pumps to move water from river to the inlet of the water treatment works, using the natural flow of the river;
- maximise natural pre-treatment processes, for example riverbank filtration and constructed wetlands, so that low energy intensity and chemical free treatment processes may be used; and
- use lower-carbon construction materials and off-site construction methods.

We estimate that adopting these innovative approaches will reduce carbon emissions by 20% in comparison to traditional approaches.

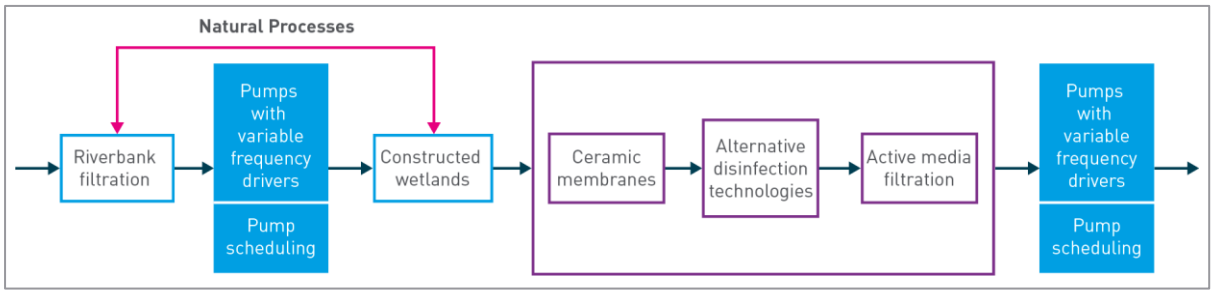
The limitations in designing out carbon emissions, driven by limitations of technology and natural processes to deliver high quality water to customers taps, means that renewables and offset will be required. Details of the renewables are set out in *Annex 6 Net zero carbon.*

This use of natural processes for pre-treatment to reduce carbon emissions has the further advantages of being good for biodiversity and lessens the reliance on the chemical industry.

Our chemical supply chain is extensive and subject to risks, for example fragility in production and disruption of transport capacity. The production and transport of chemicals also have a significant carbon footprint. Whilst we are well prepared for any disruption with significant stocks of all critical chemicals, extensive monitoring of their chemical supply chains and mutual agreements in place, lessening the reliance on global supply chains will increase resilience and reduce our wider carbon footprint.

Biodiversity: The key opportunity to ensure net biodiversity and habitat gain is to use natural processes prior to full treatment as shown in figure 29 below.

Figure 29: Natural processes in the water cycle



Natural processes in pre-treatment will reduce power use and chemicals in the treatment process. They tend to require a larger footprint as they are lower intensity. The availability of land and water in the area where the water is be abstracted is therefore important.

Figure 30 below shows how we have applied the theoretical opportunities to one of our Green Recovery proposals – the expansion of [redacted] to treat water from the River Trent. The Green Recovery has prompted us to review what may have been a traditional engineered solution to transfer the water direct from river to treatment process. This would have been energy and chemical intensive due to the challenging raw water quality.

Figure 30: [redacted] treatment overview

[Map redacted]

Both the in-river or riverbank filtration pre-treatment and the constructed wetlands will create an enhanced habitat for wildlife. Such uses of natural processes are commonplace in continental Europe for example in Dusseldorf and Amsterdam.

We need to undertake more detailed work to assure ourselves and the Drinking Water Inspectorate that any novel treatment processes produce water which continuously meets all water quality standards and does not present undue risk to our customers.

We estimate that this approach will improve 46 hectares of habitat and bring net biodiversity gain.

3.6 Partnership working

We recognise and support the need to work across the water cycle and consider flooding and river water quality issues, as well as water resources. We have started developing partnerships and opportunities by working at catchment level for example, we have identified opportunities with the River Severn Partnership (RSP) to join up with the Environment Agency on a scheme that will protect against both risks to flooding and drought is possible at Shrewsbury. We are meeting fortnightly with the RSP and have agreed as a minimum conduct joint feasibility on river hydrology and conceptual scheme design.

We will continue to jointly look for other opportunities including working with Retailers on our non-household demand reduction proposal.

We remain committed to working in partnership with other water companies in Water Resources West and Water Resources East to help resolve deficits regionally and to support transfers into the south east. We led the way with the Severn to Thames transfer and continue to explore more options.

Our intention is to work in partnership wherever possible to bring efficiency and wider benefits to our Green Recovery proposals.

We estimate that third parties will contribute a total of [redacted] which will be netted off our Green Recovery proposal through grants and contributions.

Annex 8 Stakeholders and third party funding provides more detail on our approach and commitment to continue to explore partnerships and third party funding.

3.7 Summary of new and substantially improved options

Figure 31 summarises the new and substantially revised options, whether they have gone through our screening process and had a strategic environmental assessment completed.

Figure 31: new and improved options

New or substantially revised options		Ml/day benefit annual average	Earliest delivery time	Screened as feasible	SEA completed
Metering	Enhanced	3	2025	Yes	Yes
Non-Household demand reduction	Enhanced	4	2025	Yes	Yes
[redacted WTW] expansion	New raw water source (Rugeley licence)	65 (93 peak)	2026	Yes	Yes
[redacted]	new	Not known	Discussions with partners at early stage	No	No
Shrewsbury combined drought – flood resilience	New dual-purpose concept	40	2025 aligns with RSP	Yes	Yes
Bawtry combined drought – flood resilience	New dual-purpose concept	2	2027	Yes	No
[redacted] Reservoir expansion to support River Derwent abstractions	new	165	2035	Yes	Yes
Transfer Finham final effluent to an expanded [redacted] reservoir	Enhanced quality of effluent	30	2028	Yes	Yes

3.8 Refreshing existing options

In addition to looking for new options we have also reviewed and updated the costs, benefits and dependencies of 55 pre-existing, feasible options that were considered for the strategic grid, Nottinghamshire and North Staffordshire water resource zones at WRMP19. A full list of these options is contained in **Appendix D** of final WRMP 2019.

Figure 32 below presents those options and that made up the preferred WRMP19 plan picks out those with the largest potential deployable output benefit and undergoing material change as a result of further investigations.

Figure 32: Water resource management options

Final Water Resource Management Plan preferred options	Water Resource Zone	Volume (Ml/day)	Indicated construction period
[redacted] expansion supported by the River Trent	**Grid**	**35.0**	**2022 - 2027**
River Trent support to [redacted]	**Grid**	**26.0**	**2020 - 2025**
[redacted] pipeline capacity increase	Grid	7.5	2023 - 2028
[redacted] **capacity increase with transfer to Coventry**	**Grid**	**9.0**	**2022 - 2027**
[redacted] WTW enhancements	Grid	3.6	2023 - 2028
[redacted] WTW expansion	Grid	15.0	2023 - 2028
Maximise [redacted] BHs	Grid	0.9	2025 - 2030
[redacted] **WTW enhancements**	**Grid**	**8.0**	**2025 - 2030**
[redacted] WTW expansion	Grid	10.0	2025 - 2030
East Midlands redacted (Site CQ) with new WTW	**Grid**	**45.0**	**2021 - 2031**
River Soar to support [redacted]	Grid	17.0	2021 - 2031
[redacted] BHs asset and water treatment enhancements	Grid	2.7	2026 - 2031
[redacted] capacity increase	Grid	2.5	2026 - 2031
[redacted] capacity increase	Grid	2.5	2026 - 2031
[redacted] capacity increase	Grid	2.5	2026 - 2031
[redacted] WTW enhancements	Grid	2.0	2026 - 2031
[redacted] to Mid Notts transfer from Grid	Notts	30.0	2026 - 2031
[redacted] to South Notts transfer from Grid	Notts	30.0	2026 - 2031
Improve[redacted] outputs during low water periods	N Staffs	7.0	2030 - 2035

East Midlands redacted storage: This scheme was included in the PR19 plan as a potential Direct Procurement for Customers scheme. Our more detailed feasibility indicated that the benefit of the scheme was reduced from 45Ml/day to **24Ml/day** because the flows [redacted] were less reliable than previous estimates suggested. This reduces the cost benefit ratio considerably as the cost remains at [redacted].

An alternative option to supply [redacted] from the River Trent was also developed for WRMP19. Both options are included in the cost benefit analysis for green recovery options.

[redacted] water treatment works enhancement: The WRMP version of the scheme included costs to provide a new source of raw water by diverting final effluent from Barnhurst sewage treatment works from the Shropshire Union Canal to the River Trent. This raw water supply option is now replaced by the Rugeley licence that we purchased in February 2020. The new licence has been transferred and issued to us by the Environment Agency for a site adjacent to [redacted] WTW. We have also optimised the deployment route of the water into our strategic grid and ensured that the full peak licence can be deployed. In combination these improvements reduced the cost of the scheme by 30%.

[redacted] water treatment works enhancement: The WRMP version of the scheme included costs to provide additional raw water to the existing intake on the River Dove to give a benefit of 26Ml/day without providing additional treatment facilities. This raw water supply option is now replaced by our new River Trent licence which reduces that element of the scheme costs by 40%.

More detail of the [redacted] schemes are set out in section 4.3.

[redacted] **options:** The two [redacted] schemes have been combined with the Finham effluent transfer to form a new scheme as described in section 3.4.

Other options: The other scheme costs and benefits have been updated where there has been a material change from the implementation of other schemes, for example the Birmingham Resilience Project provides greater treatment capacity and our commitment to the Severn to Thames transfer scheme means that other schemes utilising Minworth final effluent are no longer viable.

4. Best option for customers

This section explains how we have chosen the best set of options to start to decarbonise water resources. It covers:

- our cost benefit analysis approach;
- the outcome of the cost benefit and multi-criteria assessment;
- details of our proposed schemes:
  - [redacted WTW] expansion;
  - Shrewsbury combined drought – flood resilience;
  - non-household demand reduction; and
- how we have addressed residual carbon emissions that cannot be designed out.

4.1 Cost benefit and multi-criteria assessment

Customers have told us that we should build for the long term and invest in best value infrastructure that will serve future generations, not that which is lowest cost in the short term. For example, one customer said "*Do not slavishly look for the cheapest short-term solution. Take care and the long view, build for your grandchildren or even their grandchildren*". They also want us to balance issues such as affordability, long term sustainability and resilience to produce a best value plan.

We have taken these views on board and improved on the **robust method** that we used in our water resources and PR19 plans to assess and decide on our Green Recovery proposals. Our approach balances scheme cost, water resource benefit and uncertainties across multiple scenarios to derive a best value, least regrets adaptive plan. Although our previous approach took account of monetised carbon costs in the optimisation, it was not a primary driver because it was not as significant as construction and operational costs. The changing nature of societal expectations mean that we need to adopt methods that also enable us to balance wider, competing drivers. Our improved approach aims to:

- do more to mitigate the climate emergency and align to the WaterUK Roadmap to net-zero carbon;
- ensure that the solutions we choose also help tackle the biodiversity crisis;
- consider benefits of flood protection, and;
- consider multi-sector needs and the economy.

To achieve this aim, we have added a further step to our PR19 process and adopted the Water Resources West proposed Multi Criteria Assessment (MCA) approach.

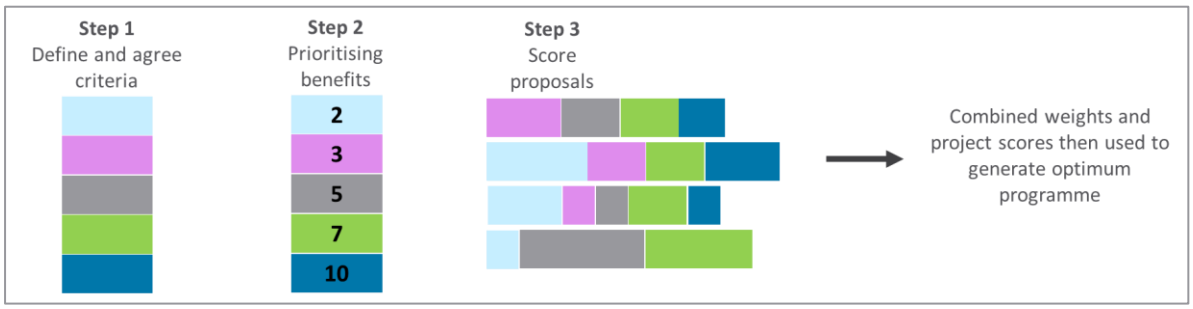
Multi criteria assessment

We have built the multi-criteria assessment as the final stage in our existing decision making process so that we can see the cost differential of selecting high biodiversity or net-zero carbon options and how they perform comparatively in various scenarios.

The MCA is a qualitative assessment of key criteria and crucially allows stakeholders and customers set these criteria and then prioritise them using weightings. For example, stakeholders and customers may want to prioritise carbon emission reduction over flooding benefit when faced with two schemes

that have broadly the same cost and supply demand benefit. The diagram below illustrates the MCA concept and how we have applied it.

Figure 33: Multi-criteria approach overview



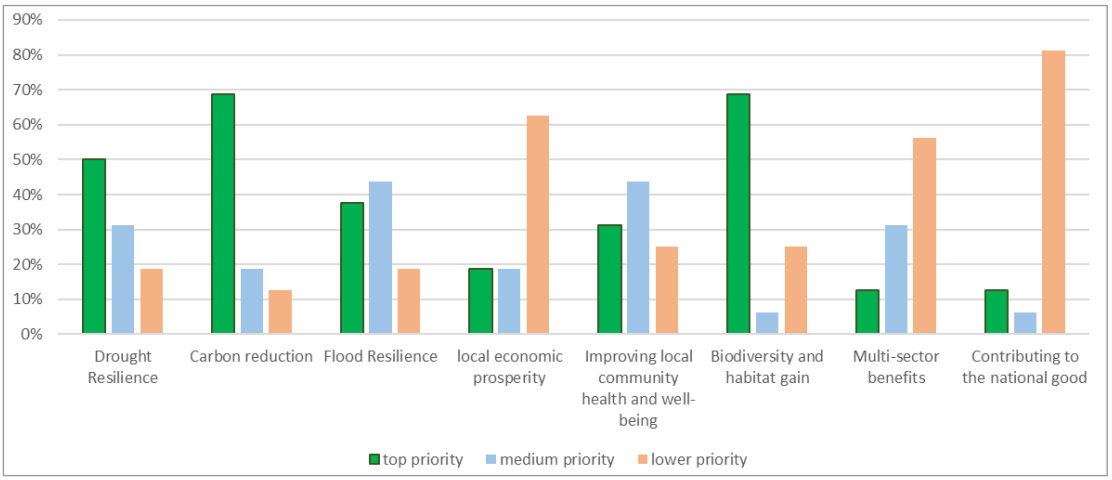
Steps 1 and 2: We held a virtual workshop on 1st October 2020 with key stakeholders to derive the criteria and weightings. The stakeholders invited to the workshop were from organisations interested in socio-economic, environmental and customer outcomes, and included representatives from the Environment Agency, Natural England, environmental NGOs, Local Enterprise Partnerships and Water Resources West (for a full list please see *Annex 8 Stakeholders and Third party funding*). The stakeholders confirmed the criteria, helped define how they should be measured and then prioritised them.

Figure 34: Evolving criteria

Initial criteria (based on Water Resources West)	Post workshop criteria (changes highlighted in bold)
Carbon reduction	Carbon reduction
Sustainable natural resources	**Biodiversity and habitat gain**
Drought Resilience	Drought Resilience
Flood Resilience	Flood Resilience
Improving community health and well-being	Improving **local** community health and well-being
Creating jobs	**Local economic prosperity**
Multi-sector benefits	Multi-sector benefits, **particularly agriculture**
Contributing to the national good	**Consider water trading after meeting regional deficits**

The priorities selected by stakeholders are shown below. The percentages relate to the number of times stakeholders picked each criterion in the top three, middle three or bottom three.

Figure 35: MCA workshop – stakeholder priorities



These priorities were then used as weightings in the Multi-criteria assessment to generate our Green Recovery plan. The top four weighted factors are:

- Biodiversity
- Carbon reduction
- Drought resilience
- Flood resilience

Step 3: All options, new, substantially revised, or pre-existing, were scored to give them a relative, qualitative score between 1-9 on their strength to contribute to the criteria. The qualitative scoring was based on a knowledge of scheme design and the outcome of the scheme level Strategic Environmental Assessment. The scores were checked as part of our assurance process. The exception to this approach was for carbon where we have carbon accounting methods in place for embodied and operational emissions. We are developing full natural capital accounting processes that will be used to produce scores for future plans.

Scenarios

Long term forecasts of supply and demand are uncertain and dependent on many different variables. We use scenarios to test that our plans are appropriately robust against these uncertainties. Our modelling approach is designed so that a number of scenarios may be analysed to understand the best options to resolve future supply demand deficits with sufficient headroom to cope in drought (known as target headroom). The scenarios test different forecasts for demand against different impacts of climate change projections on water resource availability to achieve target headroom risk profiles.

We have developed a set of scenarios to test the changes to supply and demand outlined in Section 1 plus updates to option costs and benefits from analysis completed after WRMP19. Figure 36 describes these new scenarios (1 to 4) and the two scenarios run for PR19 (5 and 6) used for comparison purposes. The table also shows the planning objective used in the optimisation process.

Figure 36: Scenarios used in the Green Recovery cost benefit analysis

No	Supply forecast	Demand forecast	Objective
1	Final WRMP19 supply forecasts updated to include: 1 in 500 year drought resilience standard. Confirmed and agreed Water Framework Directive licence reductions.	High	Cost benefit analysis to maintain supply demand balance.
2		Central estimate	
3		Low	
4	AMP7 commitments: supply and meter schemes, 50% leakage and 10% PCC reduction.	Central estimate with 2% uplift observed Covid-19 effect.	Then apply MCA benefit analysis.
5	Final WRMP19 supply forecasts Target headroom includes Climate change uncertainty.	Central estimate	Cost benefit analysis to maintain supply demand balance.
6	Final WRMP19 supply forecasts. Target Headroom excludes climate change uncertainty.		

All scenarios were tested against the new and substantially revised options (summary provided in section 3.7) and other exiting options with updated costs, benefits and constraints (section 3.8).

The core scenario used for the Green Recovery plan is number **two**. The core scenario for the PR19 plan was number **six** and for the WRMP19 number **five**.

The next section sets out the results of this analysis, our best value plan, and how this was informed by customer views.

4.2 Outcome of the assessment

This section describes the outcome of our analysis to decide the best value balance of options to resolve our forecast deficit, the priority of those options and those that we propose to start as part of the Green Recovery. Figure 37 depicts new and revised options assessed. The size of the bubbles represents multi-criteria benefits.

Figure 37: Water resilience investment options

[redacted]

Our cost benefit analysis approach generates many 'least cost plans' that could be used to solve different potential supply/demand scenarios reflecting the uncertainty in supply and demand projections, headroom and how certain the options are in terms of their cost, benefit and delivery time.

The outcome of our analysis in figure 38 shows those options selected more than 50% of the time to start in the first two years in our core scenario, indicating the most cost beneficial options in priority order.

Figure 38: Highest cost benefit options

Option	Percentage of times picked in scenario 2		
	2021	2022	Total
Non-household demand reduction	**100**	**-**	**100**
[redacted WTW] expansion	**92**	**4**	**96**
[redacted] drought – flood resilience	**67**	**21**	**88**
[redacted] WTW	68	13	81
[redacted] reservoir increase	45	24	69
[redacted] WTW (River Severn)	45	19	64
[redacted] WTW	52	10	62
[redacted] reservoir raising	38	21	59
Transfer final effluent to [redacted]	37	22	59
[redacted] reservoir raising	38	15	53

We used this initial view to narrow in on the schemes most suitable for our Green Recovery proposal. Figure 39 shows those schemes selected approximately two thirds of the time with their volumetric

contribution and the total MCA score. The maximum MCA score i.e. a scheme that delivers most for drivers other than water resource benefit is 225 and the minimum score is 25. It shows that the expansion of [redacted] and [redacted], as well as being highly favoured, based on the balance of whole life cost, benefit and ability to meet the timing of the deficit, scores well on MCA score. The Shrewsbury combined drought – flood resilience scheme is also highly cost beneficial and has a high MCA score due to environmental and flood benefits.

Figure 39: Highest cost beneficial options with MCA benefit score

Option	% of times selected in 2021 and 2022	Ml/day benefit	Total MCA benefit score
Non-household demand reduction	**100**	**4**	**95**
[redacted WTW] expansion	**96**	**65**	**107**
[redacted] drought – flood resilience	**88**	**40**	**155**
River Soar to [redacted]	81	17	99
[redacted] reservoir increase	69	3	95
[redacted] WTW (River Severn)	64	15	94

Figure 40 breaks out the MCA score to show the high priority criteria scores and Green Recovery criteria. The lower ranked schemes; [redacted], score relatively well but have modest benefits and are challenging to deliver within the required timeframes as we do not have abstraction licences. These schemes will be considered for AMP8.

Figure 40: Highest cost beneficial options with key MCA criteria scores and green recovery metrics

Option	Top priority criteria weighted scores (max 63, min 1)				Green Recovery criteria			
	Low carbon	Bio-diversity	Drought	Flood	Peak demand benefit	Can be largely constructed in AMP7	Totex £m per Ml/day	Jobs
Non-household demand reduction	**63**	**7**	**25**	**4**	**None**	**Yes**	[redacted]	**15**
[redacted WTW] expansion	**21**	**35**	**45**	**4**	**Yes**	**Yes- licence secured**	[redacted]	**165**
Shrewsbury combined drought -flood resilience	**21**	**63**	**45**	**36**	**None**	**uncertainty re licence and flood-drought interaction**	[redacted]	**60**
[redacted]	21	21	35	4	**None**	licence uncertain	[redacted]	20
[Redacted] WTW	21	21	35	4	**None**	licence highly uncertain	[redacted]	60
[redacted] reservoir increase	63	21	35	4	**None**	Yes	[redacted]	10

The most cost beneficial options both quantitatively and qualitatively have been selected for our Green Recovery proposal. They are:

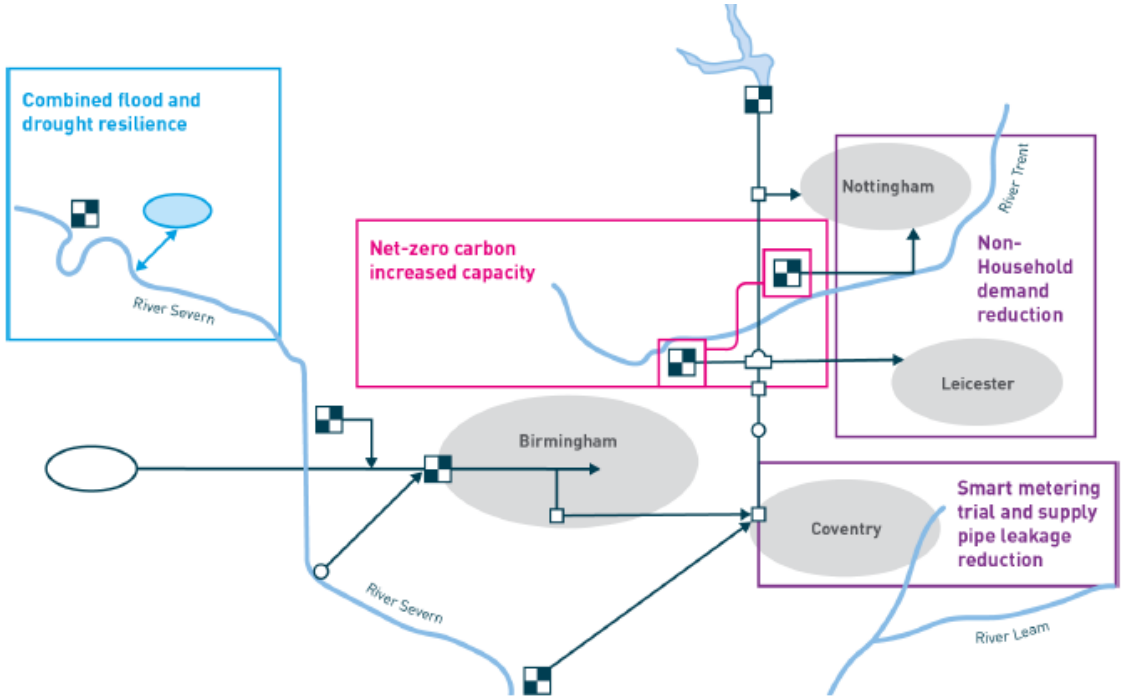
- Non-household demand reduction.
- [redacted] WTW expansion to deploy Rugeley licence.
- Shrewsbury combined drought and flood resilience schemes.

These three schemes are the focus of the remainder of this business case.

The map below shows how the two proposed supply schemes fit into our strategic grid. A further advantage of these schemes is that being geographically separate and drawing water from different river basin systems, they give better protection against localised water quality issues and drought events.

Figure 41: Proposed supply schemes and our strategic grid

[redacted version]



*Note: leakage reduction from **Taking care of customers' supply pipes** and **Smart metering** are covered in separate business cases*

4.3 Details of our proposed green recovery schemes

This section provides an overview of the schemes and outlines the risks of our two supply side schemes and one enhanced demand management scheme.

Overview of proposed cost

We have used our PR19 standard cost model to estimate capex and opex costs across all options and option types to maintain consistent costs. In instances where our unit costs, cost curves or equipment lists are not available, for example when adopting innovative technologies, we have used costs derived

from framework standard rates or 'bottom up' estimates obtained from our supply chain partners. A summary of cost estimates for each scheme is shown in figure 42.

Figure 42: Green Recovery scheme costs

[redacted]

The total investment of £206m is profiled to reflect the engineering delivery timescales for the [redacted] WTW expansion schemes and the need to align programmes with the River Severn Partnership / Environment Agency for the Shrewsbury combined drought – flood resilience scheme.

Figure 43: Scheme benefits profile

Scheme benefits	Water resource benefit (Ml/day)					Addresses growing peak demand	Direct jobs created
	2021/22	2022/23	2023/24	2024/25	Total		
[Redacted] WTW expansion			30	35	**65**	Yes	**165**
[redacted] drought – flood resilience				40	**40**	-	**60**
Non-household demand reduction	0.6	1.2	1.2	1.0	**4**	Yes	**15**
Total	**0.6**	**1.2**	**31.0**	**76.0**	**109**	**-**	**240**

*Note: leakage reduction from **Taking care of customers' supply pipes** and **Smart metering** are covered in separate business cases*

Interaction with AMP7: Our Green Recovery proposals for non-household demand do not interact with or contribute to any AMP7 performance commitments. There may be some interaction between our proposals at [redacted] WTW and AMP7 performance commitment for resilient supplies. *Annex 11 Customer Protection* describes this interaction and how we intend to deal with it to ensure fairness to customers.

Scheme delivery risk: We have investigated risks that may impact our ability to deliver within the Green Recovery timescales. The risk assessment covers engineering complexity, water quality, environmental and land and planning issues, constructability, legal and security aspects. The approach uses the standard risk categorisation approach detailed in figure 44.

Figure 44: Scheme delivery risks

Low	Medium	High	Showstopper
Risks as expected for similar schemes, no showstoppers	• Potential for identified risk to cause delays above those expected for similar schemes. • Further assessment required to confirm scheme viability during feasibility.	• Potential for identified risk to prevent implementation. • More detailed assessment required to validate scheme viability.	Show stopper, scheme cannot proceed with current issues or risk.

Further details of the checks we have carried out to ensure we can deliver our package of proposals is included in *Annex 10 Deliverability*.

The next three sections describe our Green Recovery proposals in detail.

Scheme 1: [redacted] WTW expansion

Objective

The objective of this scheme is to deploy the abstraction licence (65Ml/day annual average and 93Ml/day peak day) that we bought from Engie, in February 2020, after they ended power generation at Rugeley in Staffordshire. The Environment Agency granted us the licence based on our need and assigned it, at our request, to the [redacted] abstraction point on the River Trent. [redacted] is close to both [redacted] and [redacted] treatment works.

All new or varied licences are time limited by the EA for 12 years or the CAMS renewal date, whichever is sooner. Our new licence is time limited to 31 March 2027, which is the date at which the Lower Trent and Erewash abstraction licensing strategy will be reviewed. Time-limited licences carry a presumption of renewal provided that:

- environmental sustainability is not in question;
- there is a continued justification of need for the water; and
- the water is used efficiently.

We expect to meet the above criteria and we will apply for a continuation of the licence in 2027.

We propose to use the new licence between our [redacted] (35Ml/day annual average) and [redacted] (30Ml/day annual average) water treatment works sites. The reason for this is two-fold:

- it avoids significant cost to upgrade water distribution pumps and pipelines that would be necessary if we were to deploy the full amount at either site – building the full capacity solely at [redacted] would be 63% more expensive and solely at [redacted] 70% more expensive; and
- it gives the best balance of resilience and leverages the AMP7 investment at [redacted].

New treatment capacity is required at both sites to make use of the additional licence. Greater capacity across both sites will enable use of the peak licence (93Ml/day) to help our supply system cope with the increasing frequent and peak demand events.

Figure 45: Location map of [redacted] and potential abstraction points

Redacted map

The map above shows the locations of abstraction points and existing water treatment works that we propose to extend.

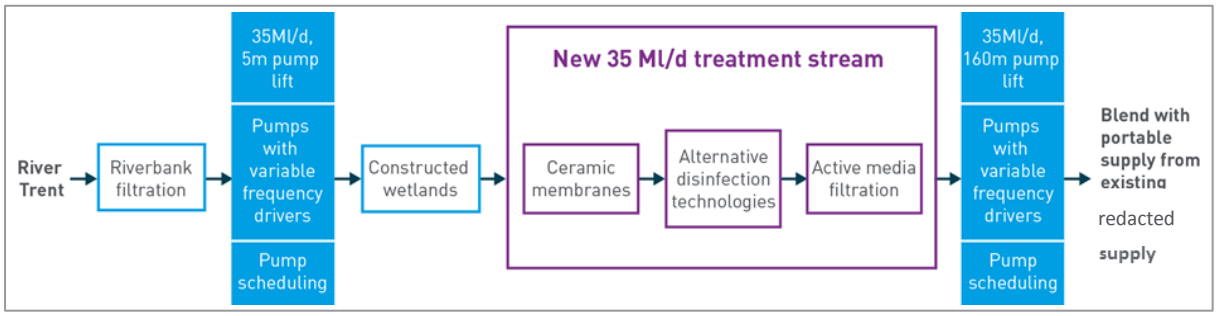
[redacted] WTW element

The new source of raw water will be treated in a new 50Ml/day stream to allow for forecast increase in peak capacity and for local growth expected between 2025 and 2030. The growth is both commercial, High Speed 2, the East Midlands Gateway and redevelopment of the Ratcliffe power station site are within a five mile radius, and substantial local housing growth concentrated in South Derbyshire (40%) and Rushcliffe (30%).

The outcome of our innovation study recommended adopting extensive pre-treatment to eliminate chemicals in the full treatment process and to reduce carbon and bring biodiversity gain. The options recommended (see diagram below) of ceramic membranes, alternative disinfection technologies followed by active media filtration are dependent on successful implementation of extensive wetland pre-treatment. Given the potential for innovation on the site, we will conduct in facility design to allow trialling of new technology, in much the same way as our Spernal site is used for waste water, as detailed as a case study in our PR19 plan.

The proposed components of the scheme are shown in figures 46 and 47.

Figure 46 and 47: Proposed components of the [redacted] scheme



Source abstraction	Pre-treatment	Treatment	Distribution	Annual energy offset MWh
• Construction of a river intake at [redacted] (Shardlow). • Pumps with variable frequency drivers and new 1000mm diameter raw water main.	• Riverbank treatment using gravels. • Constructed wetlands with reed beds.	• Ceramic membrane, alternative disinfection technologies and active media filtration. • Options dependent on further investigation of load removal from pre-treatment.	• New pumps and pipeline from [redacted] to the Derwent Valley Aqueduct.	• 2,460 of solar generation.

Note: More detail of the renewables are covered in Annex 6 Net Zero Carbon

[redacted] WTW element

The new source of raw water will be treated in a new 50Ml/day side stream that is being considered to provide resilience against a single point of failure within the existing treatment works. If it goes ahead it is scheduled to start construction in 2023. We have allocated funds proportionally on the basis that the Green Recovery requires 30Ml/day out of the 50Ml/day capacity.

There is less opportunity at the site and the surrounding area to utilise natural processes for pre-treatment. The proposed scheme components, shown in figure 48, have a more traditional treatment process element.

Figure 48: Proposed components of the [redacted] element

Source abstraction	Pre-treatment	Treatment	Distribution	Additional carbon offsetting
• Intake works with eel screens located on the River Trent [redacted]. • Pumps with variable frequency drivers. • 900mm diameter 4km long raw water pipeline.	• Limited riverbank treatment using gravels.	• Traditional process: clarification, rapid gravity filtration and granulated activated carbon.	• Additional treated water will be deployed by utilising existing transfers to our strategic service reservoirs.	• 2,100 of solar generation.

Note: More detail of the renewables are covered in Annex 6 Net Zero Carbon

Scheme risk assessment

The proposals detailed above have been investigated to provide a greater level of confidence of delivery to time and cost. These risks are used to inform our costs estimation, to define the uncertainty bounds used in our cost benefit analysis and provide a focus for the initial stages of feasibility studies. Figure 49 summarises the key findings of the solution investigation and risk assessment outputs.

Figure 49: Findings of the solution investigation and risks

Technical area	Risk	Comments
Engineering	Low / medium	• The river abstraction engineering works present a low risk as the percentage of flow abstracted compared to average flows is very small. • We are inexperienced in constructed wetlands on clean water applications. • The risks associated with pumping stations and pipelines are routine.
Water quality	Medium/ high	• We have applied our water safety planning approach to water quality management where each water quality risk from catchment to tap is assessed to consider: ○ Source of water quality data. ○ Existing Drinking Water Safety plans. ○ Key water quality risks associated with that source. ○ Water treatment processes selected as effective control measures. ○ Mitigation for residual risks not addressed by the process stream. ○ Recommendations for further work at feasibility with respect the water quality (WQ) risks. • The poor water quality in the River Trent has been a historical barrier to its use as a drinking water source. Other water companies using River Trent water have experienced issues with bromate and metaldehyde. However, a combination of extensive pre-treatment and known process technology will ensure drinking water standards will be met. • An extensive programme of river water sampling is required to fully understand the water quality. We need to understand the levels of soluble organics, bromates and metals from the legacy of industrial trade effluent treated in the Trent catchment. The planned sampling programme has been curtailed by Covid19 pandemic impact on laboratories.
Environmental	Low	• Environmental impacts are minor/moderate and should not impact viability, cost or programme. These will be reviewed as design progresses.
Land and planning	Low	• The only land acquisition required is for the new river intake and pumping station on the River Trent for the transfer to [redacted]. Water treatment works expansions and pre-treatment will be contained within the boundaries of the existing sites.
Constructability and operation	Low	• Constructability of the river abstraction, pumping station, pipeline infrastructure and water treatment works expansion is as expected.
Legal	Low	• The abstraction licence has already been acquired. • There is some land acquisition required for the new river intake.
Security	Low	• Most of the new assets will be on existing sites.

Water quality risk mitigation

In order to understand and mitigate the water quality risk, we have liaised with and visited sites of other companies that have, or are planning to, adopt novel membrane technology. We envisage using an initial pilot plant and monitoring over a specified six-month period to gain full confidence. Because we are adding to an existing treatment works we have the opportunity to blend with water produced through more traditional processes to mitigate any residual risk.

Figure 50: Scheme cost summary

Scheme costs £m 2017/18 prices	Capex 2021/22	2022/23	2023/24	2024/25	Total	Opex[1,2] per annum
[redacted]						
[redacted]			redacted			
Renewables						
Total	**17.3**	**33.2**	**46.3**	**56.6**	**153.4**	**0.18**

Notes: [1]*Net of avoided energy costs from renewables.*
[2] *Not included in our submission as costs will only be incurred towards the end of the AMP 7*

Cost robustness

Raw water: Variants of the [redacted] and [redacted] enhancements were both included as options at WRMP19 but had different means to obtain and transfer raw water to the sites. These raw water options, that had greater cost, environmental impact, and carbon emissions than the Rugeley licence, were:

- [redacted] – supported by an option to transfer water via canal from Wolverhampton, and;
- [redacted] – supported by transfer pipeline from [redacted] reservoir to the River Dove.

The opportunity to buy the licence from the owners of Rugeley power station came about during market testing with potential suppliers as part of our effort to create a sustainable Bid Assessment Framework. The cost to buy and transfer the licence from the Rugeley power station was ten times less than previous raw water development options. The environmental impact of the licence transfer was also much less than other options considered. The cost of the licence does not form part of this proposal as it has already been purchased during AMP6.

Cost efficiency

Our general approach to cost efficiency, including the benchmarking example below, are set out in our **PR19 Business Plan chapter 8**.

Benchmarking at PR19: Turner & Townsend (T&T) were commissioned to provide confidence of costs for the PR19 business plan by reviewing and then producing their own estimate for a selection of schemes. A variant of the [redacted] scheme, ie including its then raw water development and transfer component, was included in this project.

A direct comparison of T&T's estimate for the treatment element is not straightforward as they applied on-costs to the total scheme rather than to the individual components. However, reviewing individual components prior to any on-costs, the treatment expansion equates to approximately 62% of the total scheme cost. If we take 62% to the total project costs, the T&T estimate for treatment is [redacted]. This is close to our estimate of [redacted] (both estimates include optimism bias in line with the Treasury Green Book for business cases at an early stage). T&T concluded that our STW estimate was competitive.

We believe that, given the uncertainty in the natural treatment processes and a chemical free process then it is reasonable to retain the optimism bias at this stage of the process.

The investment at [redacted] has had greater investigation in year 1 of AMP7, as part of optioneering for resilience purposes, and we have therefore already removed optimism bias.

Green Recovery benchmarking: We commissioned Arup to carry out an independent review of our cost estimation approach for our Green Recovery proposals. The underlying basis of our estimation approach are cost curves known as STUCA. Arup concluded that "*STUCA cost curves offers a robust source of pricing given that the underlying data is based on outturn costs and derived from a reasonable number of data points across a variety of assets, this provides a high degree of confidence in estimates"*

85% of the costs of our Green Recovery proposals for [redacted] and [redacted] are based on these curves with the remaining 15% based on 'non-standard' costs estimates. Non-standard estimates are typically used for large diameter pipeline crossings of railways, motorways and rivers where data is scarce because it is an infrequent and bespoke activity.

We have used STUCA curves to estimate early stage project costs starting at PR09. At the end of each investment plan process they are refreshed with the most recent outturn costs. Figure 51 below shows that our capital investment commercial approach has progressively driven cost efficiency.

Figure 51: Cost curve change over time
[Redacted]

Delivery timescale

The [redacted] scheme will be delivered in AMP7. [redacted] would normally require five years to go from a standing start to an operational site, however given it's similarity to the [redacted] scheme and the fact that we have already secured the licence and own the land we have profiled for delivery in 2025.

Green Recovery benefit: Using nature to reduce carbon emissions and deliver biodiversity net gain

Our shift to nature-based pre-treatment using constructed wetlands will minimise carbon emissions, produce a net gain in biodiversity and habitat and also improve well-being. Wetlands incorporating reed beds reduce both the chemicals and the energy consumed in the treatment process thus reducing our carbon emissions. Reed beds can also act to off-set carbon emissions made elsewhere in the process by absorbing carbon from the atmosphere. They also provide new habitats and ecosystems, supporting increased biodiversity. The map below shows the sites at [redacted] and [redacted].

Figure 52: Wetland sites at [redacted] and [redacted]

We estimate that the carbon emissions from construction and operation will reduce by 20% and that the area with an improved habitat will be 46 hectares over both sites.

Green Recovery benefit: impact of biodiverse green spaces on well-being

The more extensive use of wetlands can also support human well-being. We commissioned Create Streets to help us understand how to maximise the well-being benefit associated with our proposals Their report, *see Annex 7 Wellbeing benefits*, provides evidence that this can happen in two ways:

- By providing green spaces for leisure and recreation activities such as walking, cycling, running, photography and bird watching, whose positive benefits are well known; and
- By providing increased biodiversity that in itself benefits health and well-being.

Reed beds are very biodiverse green spaces, with habitats for many different plant species, fungi, invertebrates, and rare birds. Research published in the *International Journal of Ecology in 2011* looking specifically at water treatment reed beds concluded that specially designed reed beds for water treatment '*may be at least as biodiverse as naturally occurring reed beds and will add to the overall biodiversity'*.

There is also a growing body of evidence that biodiversity can have a positive impact on health and well-being for example, research quoted by Create Streets found that green spaces with a higher diversity and richness of species have been linked with increased positive well-being.

These benefits of green spaces and biodiversity could be maximised through the extension of paths at [redacted], as well as the creation of an education and visitor centre at [redacted] to encourage visitors to enjoy the green spaces and learn about sustainable technology. A similar successful facility, called the Centre of Alternative Technology, is already in operation in mid Wales. This would be particularly beneficial for local people who face high levels of deprivation. The cities of Nottingham, Derby, Loughborough and smaller towns in north west Leicestershire have high levels of deprivation, as measured by the Index of Multiple Deprivation, and are within a one-hour public transport or cycling radius. The [redacted] site is relatively constrained, and numbers of visitors will be limited so we have not included any specific additional cost allowance for this small education facility in our proposals.

Green Recovery benefit: local economy and jobs

We have used our knowledge of the impact of our Birmingham Resilience project to estimate the number of jobs that we expect could be created directly by this project. We believe that approximately 165 direct jobs in the construction phase including 15 highly skilled designers will be needed, with 100 of these required in the key recovery period between 2021 and 2023. See *Annex 5 Jobs and skills.*

The innovative nature of what we are proposing to develop, constructed wetlands and nature-based treatment and potentially nano filtration, means that high skilled engineering jobs in green technology will be generated. Some of these skills may be transferable to the renewable energy sector, for example hydrogen generation. This will help with the objectives of the Government's Skills for a green economy'[15].

Scheme 2: Shrewsbury combined drought – flood resilience

Objective

The objective of this scheme is [redacted] for use as a pumped raw water storage reservoir. The [redacted] would be filled via a short pipeline from the River Severn during times of high river flow and when water is released by flood alleviation measures, currently being considered [redacted] upstream of Shrewsbury for delivery by 2027.

Water [redacted] could be used in two ways:

- Released back to the river, via the same pipeline, during times of low flow to support abstraction downstream at [redacted]. The water would then be treated using existing capacity at our [redacted] water treatment works near Birmingham.
- Used locally by building a new treatment works at the [redacted] site and shutting our existing [redacted] water treatment works to the west of Shrewsbury. The Shelton abstraction licence could then be transferred to [redacted].

Our Green Recovery proposal includes costs for the first option.

[15] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/32373/11-1315-skills-for-a-green-economy.pdf

Figure 53: Map showing location of the [*redacted****] and river intake***

[Redacted]

The second option would be more expensive but have some environmental, resilience and local economic advantages. Key to the decision are the costs and disruption to our [redacted] site from the planned northern relief road and any proposed flood alleviation works, both of which may necessitate the relocation of our existing river intake and potential loss of borehole capacity. We will continue to work closely with the Environment Agency, River Severn Partnership and Shropshire Council to better understand costs, benefits, and risks of this option and the consequent impact on our current proposal.

Description

- The Environment Agency, as part of the River Severn Partnership, is currently considering options for managing flood risk upstream of Shrewsbury. One of the options being considered is whether there is the potential to combine with the proposed northern relief road.
- Whilst the results of the options review are not yet known, there is a requirement to maximise water storage upstream of Shrewsbury during flood events. Water would subsequently need to be released shortly after a flood event to ensure sufficient capacity for a subsequent event. The severe flooding in February 2020 was characterised by three consecutive winter storm events in quick succession. The capacity that can be achieved in the catchment upstream of Shrewsbury is unlikely to be of sufficient scale to protect against multiple events. Developing interventions with greater capacity to deal with multiple, consecutive events is likely to be deemed non cost beneficial and therefore the additional capacity [redacted] may change these economics.
- A new river intake works is to be constructed complete with eel screens and pumping station capable of transferring raw water to [redacted].
- The intake works and pumping station will be located on the River Severn [redacted] and be capable of taking large volumes released from the potential flood alleviation measures above Shrewsbury.
- A new raw water pipeline will transfer the water [redacted]. This will operate as a bi-directional main that will also transfer water back to the river when support for abstraction is required.

- The [redacted] pumped storage reservoir. This will require engineering works to ensure watertightness together with the construction of other new assets such as a draw off.
- Now new assets are required for the downstream abstraction at [redacted] for transfer and treatment at [redacted] WTW.

Water resource benefit

In August 2018 we estimated the potential yield (deployable output) [redacted] using our Aquator water resources modelling system, at 52Ml/day. This estimate was based on [redacted] with abstraction above current River Severn regulation hands off flows in a 1 in 200 year drought scenario.

This analysis took no account of a potential flood benefit, that would require a proportion of the [redacted] to be kept empty, as the initial scheme concept was for water resources only.

[redacted]

Given the uncertainties over the loss of volume to flood resilience storage [redacted] we have estimated the deployable output yield to be 40Ml/day. We believe this is a reasonable and conservative value for a scheme at this stage of development.

We have agreed to work with the Environment Agency and River Severn Partnership to model the flood requirement/benefit and impact on water resource benefit to come up with an optimum mode of operation. The work started on the 15th of January and will take six weeks to complete. [redacted]

The scheme will also interact with the potential Severn to Thames Transfer scheme [redacted]. Discussions on the interaction with that scheme and river regulation have been started.

Flood risk protection benefits

[redacted]

Scheme risk assessment

The key findings of the solution investigation and risk assessment outputs are summarised below. These risks are used to inform our cost estimation, to define the uncertainty bounds used in our cost benefit analysis and provide a focus for the initial stages of feasibility studies. [Redacted]

Figure 54: Findings of the solution investigation and risks

Technical area	Risk	Comments
Engineering	Medium / high	• The scheme is designed to only abstract when river flow is high so there is some risk over availability. • [redacted]

- [redacted]

Water quality	Medium	• Storage [redacted] could result in stratification, with a risk of algae blooms and anaerobic conditions dominant in the deeper layers creating water quality issues. Reservoir mixing facilities may counteract.
Environmental	Low	• No significant environmental risks have currently been identified. • This project provides an excellent opportunity to enhance biodiversity
Land and planning	High	• [redacted] • Land for the new river abstraction and pumping station is required.
Constructability and operation	Medium	• Construction activities [redacted] are not typical of the works undertaken by our contractors. An additional assessment would need to be carried out during the feasibility and design stage to fully understand the range of buildability challenges.
Legal	Medium	• The required land purchase [redacted], new river abstraction and pumping station will require legal support. It is not yet understood whether this could be a challenging process [redacted].
Security	Low	• [Redacted]

Figure 55: Scheme cost summary

Scheme costs £m 2017/18 prices	**Capex** 2021/22	2022/23	2023/24	2024/25	Total	**Opex[1,2] per annum**
Shrewsbury combined drought – flood resilience (gross)	redacted					
Renewables						
Less contributions [redacted]						
Total (net)	**13.9**	**10.8**	**11.7**	**11.5**	**48.0**	**0.6**

Notes: [1]*Net of avoided energy costs from renewables.*
[2] *Not included in our submission as costs will only be incurred towards the end of the AMP 7.*

The option to build a new treatment works [redacted] has not been included in our Green Recover proposal.

Cost breakdown and robustness

The cost elements of the scheme are set out in figure 56 along with a short discussion of the risk, uncertainty and potential third-party funding scheme options.

Figure 56: Scheme component costs and risks

[Table redacted]

By working with the Environment Agency and River Severn Partnership, we will be able to jointly commission work on river flow, design of abstraction assets, operating regime and some planning matters. Discussions are at an early stage and we are meeting fortnightly to scope out areas of overlap and synergy and joint work. We have assumed a [redacted] cost contribution in forecast costs but there are a high level of other risks and uncertainties. We expect to be able to have agreement on the areas, high levels costs and an outline collaboration agreement in place by mid-May 2021.

Efficient costs

[redacted]

We are using the assets built by the Birmingham resilience project to abstract the water from the River Severn at [redacted] and to treat the water at [redacted] water treatment works. This means that 40Ml/day can be treated without needing to build any more assets – thus saving cost and carbon emissions that would have been generated during construction. We will not be able to use the assets when the [redacted] is undergoing planned maintenance. We have reflected the potential conflict in the assumed utilisation of the [redacted] as a water resource.

The Totex unit cost is £1m per Ml/day which is more efficient that the PR19 unit cost allowance for water resources of £1.2m per Ml/day.

Delivery timescale

We have aligned the programme [redacted] to complete the implementation of flood risk management works within the next 6 year capital investment programme due to end in March 2027.

[redacted]

Green Recovery benefit: Providing new blue spaces for recreation and leisure

[redacted] is a large, wooded area. Around 2km^2 of the area is a large public amenity. It is currently used for walking, horse riding, cycling and birdwatching. It was once a Site of Special Scientific Interest (SSSI), designated under the 1949 Act. The [redacted] opportunity to maximise the benefits of nature since it will provide a blue space for increased physical activity and recreation for the 170,000 annual visitors that currently visit the woods. It will also provide space for more recreational activities for children.

Figure 57: site map [redacted]

There is clear evidence that blue spaces have a positive impact on mental well-being. In Atlanta, Georgia a [redacted] water resources and a multifunctional space. One study of its impact, by the Massachusetts Institute of Technology found that 'visitors are astounded by the natural beauty [redacted] and the potential benefits and historic value it will provide for the city.'

Another example [redacted] is Brownstone Exploration and Discovery Park in Connecticut. [redacted] an adventure park with rock climbing, educational programmes and water sports. The park now has 500,000 visitors annually, has created local jobs, improved swim safety and created widespread wellbeing.

Figure 58: [redacted]

At [redacted] our intention over the long term is to bring the site back to SSSI ecological status and attract even more visitors to gain well-being benefits. No costs have been included for this.

Green Recovery benefit: local economy and jobs

As with the [redacted] scheme, we have used our knowledge of the impact of our Birmingham Resilience project to estimate the number of jobs that might be expected to be created directly in this project. We believe that approximately 60 direct jobs in the construction phase including five skilled designers phase will be needed, with 35 of these required in the key recovery period between 2021 and 2023.

Scheme 3: Non-Household demand reduction

Non-household demand accounts for approximately 20% of total distribution input. It is critical that we include these customers in our efforts to close our supply demand deficit. In addition to saving water, working with non-household customers is an important way of supporting businesses, by saving them costs as they recover from the effects of lockdown on the economy. This section describes our proposals to engage with and help customers reduce their consumption.

Figure 59: Scheme cost summary

Scheme Costs £m 2017/18 prices	Capex					Opex per annum
	2021/22	2022/23	2023/24	2024/25	Total	
Non-household audits at 3,000 businesses	redacted					
Remedial actions (eg retrofit devices)						
Total	**1.2**	**1.2**	**1.2**	**1.2**	**4.8**	**0.0**

Objective

We remain absolutely committed to deliver leakage and demand management options and are on track to deliver. To help meet AMP7 demand management challenges, and in addition to helping our domestic customers use water more wisely, we propose a dedicated activity to help our non-household customers reduce their consumption. Water use on non-household sites makes up approximately 20% of our total water demand in our key water stressed zones and it is critical that we include those customers in all water efficiency activity now and in future, to ensure the security of supply.

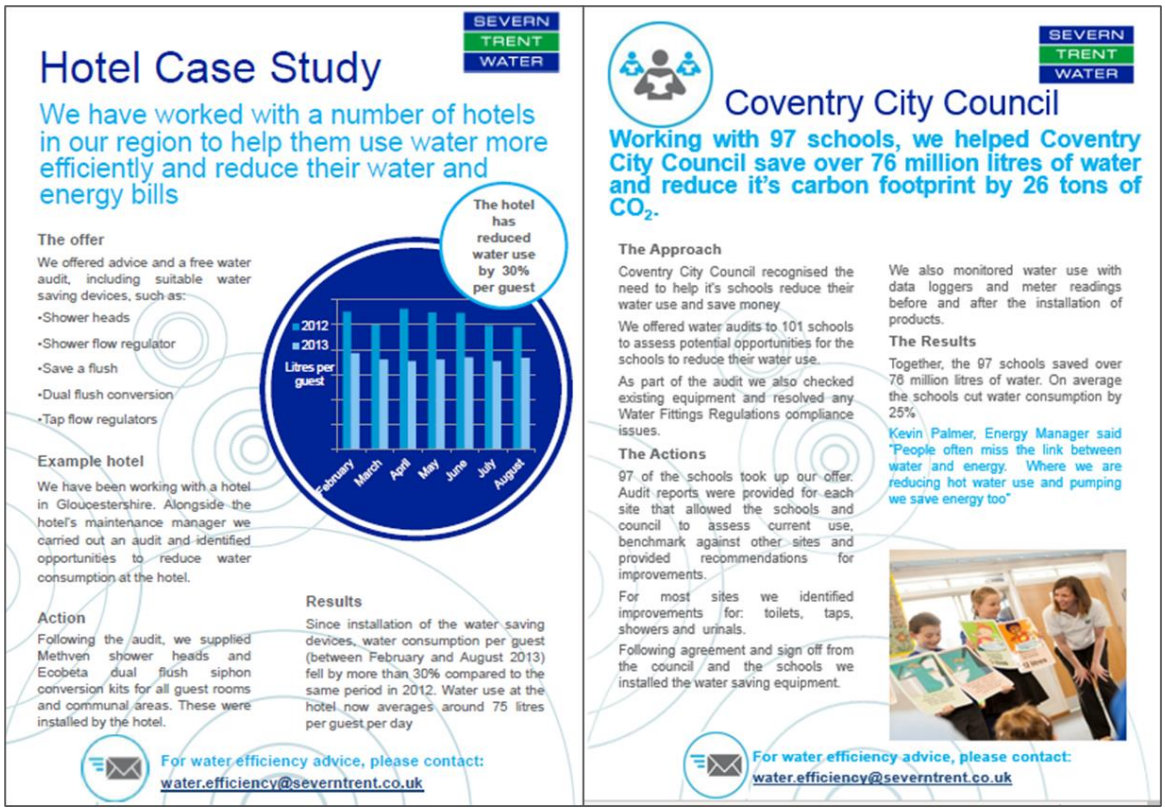
Our plan is to trial an approach with non-household customers primarily in the areas fed by [redacted] and [redacted] water treatment works; Nottingham, Derby and Leicester. Once we have established the optimum offer and way of working, we will extend the approach to the rest of our strategic grid water resource zone. In addition to helping our water resource and peak demand issues, non-household customers will reduce their water bills which should be of great benefit as they recover from the economic effects of multiple lockdowns.

Previous work with Non-household: Case Studies

In order to develop the best value approach to reducing water consumption in the commercial sector we have reviewed our past initiatives, consulted with the retail sector and conducted a wide-ranging benchmarking exercise.

Severn Trent wholesale: In the past we have worked directly and successfully with several customers including hotels, universities, sports grounds and schools. We have also worked with Aqualogic, a water efficiency partner, to contact small and medium enterprises in Nottingham conducting free audits and offering discounted water efficiency products. This work realised savings of around 30% per guest. We achieved this by providing shower heads or regulators, save a flush, tap flow regulators which were installed by the hotel maintenance team. We have also worked with councils, schools and universities.

Figure 60: Non-household customer case studies



Retail sector engagement: We consulted with the retail sector in June and July 2020 to establish their proposed approaches – activities, likely costs and benefits. The conclusions of this exercise are that the opportunities fall into three categories:

- Water efficiency audits (including the fitting of monitoring devices) and retrofitting of water saving devices including grey water recycling;
- Leakage detection and repair services for larger users; and
- Incentives for business customers to reduce demand.

World-wide benchmarking: We engaged Isle Utilities to look at best practice world-wide for Non-household consumption reduction interventions. The key finding was that, in addition to the approaches identified by ourselves and retailers, the provision of comparative water usage data alongside technical advice was a key means necessary to overcome the barrier in the minds of businesses. In particular, a Zoom call with the Singapore water utility revealed that "technical support was more valuable than the funding support of 50% capital grant contribution" to deliver sustainable savings.

We have shaped our approach based on the above intelligence.

Approach – promoting water efficiency to non-households

We will target large users and those in sectors most affected by the lockdown for example hospitality, gyms and hair and beauty businesses. We will work with the retail sector to target these sectors through this approach:

- Gather data to assess the size of the opportunity;

- Conduct site investigation and audits (including installation of monitoring equipment and undertaking leak detection); and,
- Provide the technical support to produce an agreed action plan.

The action plan that may include a mix of the following:

- Fitting of water saving devices (showerhead, taps, convert WCs to dual-flush);
- Installation of more strategic changes to water using processes, for example the adopting of some grey water recycling or ice pigging to clean production lines in food processing plants, and;
- Find and fix leaks both to water using equipment and pipework.

We believe that a manageable pilot programme would entail approximately 3,000 audits and would save 4Ml/day based on an average water saving of 1,300 litres per visit.

Figure 61: Breakdown of component costs

Component	Capex £m 2017/18 prices				
	2021/22	2022/23	2023/24	2024/25	Total
Technical support team					
Surveys and investigations			redacted		
Remedial actions					
Total	**1.20**	**1.20**	**1.20**	**1.20**	**4.78**

The above investment will generate approximately 15-jobs for technicians, plumbers, and apprentices.

4.4 Addressing residual carbon emissions

Our existing net-zero carbon commitment is based on current assets. This means that to maintain this pledge, we need to ensure that all enhancements to our water and waste systems are net-zero or it will be undoing considerable effort to reach net-zero carbon elsewhere in our business.

This proposal marks a radical shift in cultural mindset. In the short term we are going to design out as much carbon as possible and then rely on renewables to offset, but our ambition is to generate true carbon neutral options.

The sections above identify the options we have taken to design out 20% of the carbon emissions by natural processes and innovation in water treatment. The residual emissions will be offset by renewable generation. Details are in *Annex 6 Net zero carbon*.

5. Customer support and protection

We need to ensure that our customers support our ambition and are suitably protected. This section covers:

- customer support;
- customer protection mechanisms; and
- direct procurement for customers.

5.1 Customers support our proposals

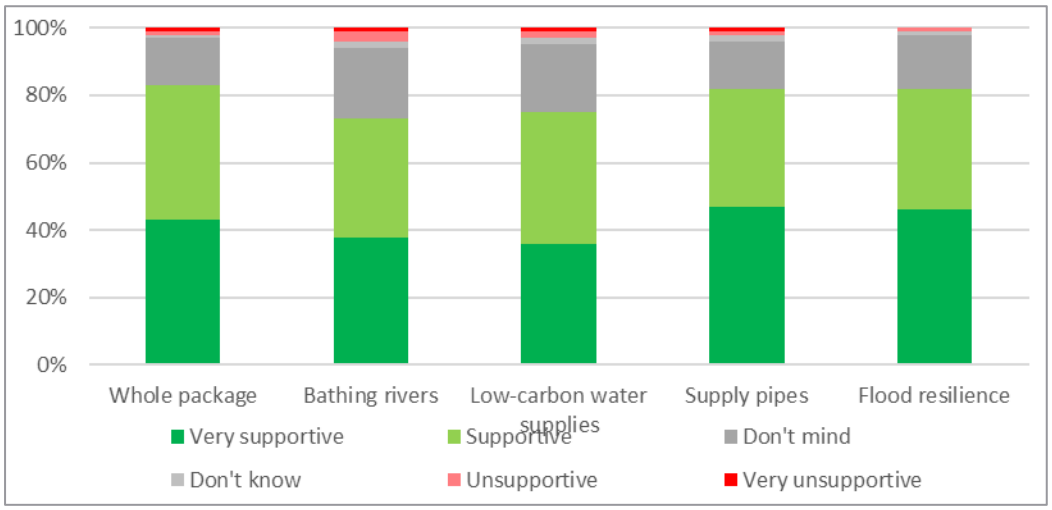
We are proposing schemes under the Green Recovery that take a new approach to balancing cost, deployable output, carbon emissions and environmental benefits. We have built on our extensive customer research for WRMP19 and PR19 in developing our Green Recovery schemes. We also undertook independently conducted, quantitative research in December 2020 to test our customers' views on our specific proposals.

Quantitative customer research findings (December 2020)

The independent research agency, QA research, surveyed a representative sample of 2,138 of our customers. This included telephone surveys with 138 digitally disenfranchised customers. Before carrying out the survey the agency had carried out cognitive testing with customers for usability and comprehension. The fieldwork took place in December 2020.

Figure 62 shows that customer support for all four proposals together as a package is 83%, with only 2% unsupportive. The support for this specific proposal was high with 75% of household customers in favour, 20% saying they did not mind in principle and only 5% unsupportive. Support was also high with non-household customers with 85% in favour.

Figure 62: Support for Severn Trent's green recovery projects



Qualitative research – customer views and how we responded

The key elements of the extensive research that we conducted for WRMP 2019, PR19 and more recently as part of our Green recovery plans are summarised in figure 63 below. We have also shown how we have taken account of these views in this proposal.

In general, our customers support the type of schemes we are promoting and the balanced pace at which we propose to implement.

Figure 63: Customers' views and how we have responded

Customer views at PR19	How our Green Recovery plan addresses concerns
Overview • Customers accepted that the overall package of solution to resolve future deficits would be a combination of supply and demand side. • They also expected us to prioritise long term sustainable supplies when selecting the solutions.	We are accelerating both demand and supply side solutions.
Reservoir expansion • Could provide a long term and sustainable, and straightforward solution compared to options such as effluent reuse. • Provide potential for wider environmental benefits such as creation of habitats for wildlife after the initial disruption of construction for the surrounding community. *"[You should] build new reservoirs to put the short term excess water so no more floods and no more droughts" Customer, Tap Chat (Consultation topics discussion)*	Our proposal [redacted] will minimise disruption during construction and our proposals will remediate the area [redacted].
Capturing flood water • On Tap Chat, customers have often suggested that Severn Trent ought to invest in infrastructure that would allow us to store more rainwater for use in drier periods. *"It is ridiculous that most autumns and winters we are flooded and [then in the] first period of sunshine for 2 or 3 consecutive days and there are hose pipe bans, etc." Customer, Tap Chat (Priorities and concerns for the next 30 years discussion).*	Working with the Environment Agency and River Severn Partnership to work together to develop just such a dual-purpose drought-flood scheme.
Abstracting more water from rivers • Some concerns about the environmental impacts, although customers were more reassured on learning that abstraction is regulated. • Option was considered to be relatively simple and certain.	The Rugeley licence is already factored into existing river regulation. Moving the licence 48 km downriver to [redacted] and [redacted] will have a positive impact on that stretch of river.
Effluent reuse • A divisive option, with concern over longer term sustainability and high energy requirements / costs. • A significant proportion of participants felt they might not wish to drink water from this source.	The Finham to [redacted] option developed but not proposed uses the natural environment to purify the water. It will be diluted by other water sources to reduce customer concerns.
Approaching uncertainty • Customers did not want us to ignore risks to future supplies but to balance issues such as affordability, long term sustainability and resilience (a best value plan). • Strong support for finding a middle position to manage uncertainty and for taking action to prepare for climate change but not undertaking significant investment now. • 69% of customers expressed support for our approach to prepare now but to avoid significant investment until further information is available.	We now believe that further information on the certainty of climate change (from UKCP18 and the increase in peak demand events) means that our customer would want us to act now. We have prepared the ground by investing in the Rugeley licence.
Building for the long term • Tap Chat members have also told us that we should invest in best value infrastructure, not necessarily the lowest cost in the short term, but infrastructure that will serve future generations too. *"Follow the example of the Victorian engineers, whose infrastructure is still working, and build to last. Do not slavishly look for the cheapest short-term solution. Take care and the long view, build for your grandchildren or even their grandchildren" Customer, Tap Chat (Priorities and concerns for the next 30 years discussion)*	We have developed a long term vision that will act as a framework for future decisions. Our [redacted] expansion option builds on the work of the Victorians and should secure water supplies into the next century

Customer views at PR19	How our Green Recovery plan addresses concerns
Metering and demand management: • In our PR19 'supply and demand' research, increased metering was the water resources option that received most support. The idea of saving money on a water meter is motivating for many customers. Some also like the enhanced level of personal responsibility that meters bring. Customers also told us that ultimately, we should aim to move all customers to a water meter – although there were concerns about higher bills for larger households • Some customers are very keen on the idea of grey water recycling and rainwater capture. In recent discussion on Tap Chat, customers have suggested that we should help to facilitate this.	Our metering and demand proposals are starting to move towards universal metering with a fair tariff for all. Our demand management proposal focusses on non-households as this is where we believe the greatest opportunity exists for grey water recycling
• In our recent research, customers were positive about this green recovery proposal to increase water supply resilience without creating a carbon impact. Customers feel this a very sensible objective for a water company. *"Carbon reduction should be a key objective for any organisation nowadays and Severn Trent should be commended for its ambition. Increasing green policies are also seen as economically positive" Customer, Tap Chat*	Our aim is to make all future water resource developments carbon neutral. The green recovery is the start of this process.

Further detail of our approach and findings are set out in *Annex 3 Customer Engagement*.

5.2 Customer protection mechanism

We need to ensure that this investment can be integrated into the regulatory framework, so that (i) customers are protected and avoid paying twice for service improvements and (ii) we are appropriately remunerated for successful delivery of the proposals.

Our approach to managing these issues is set out in *Annex 11 – Customer protections* which explains:

- how we propose to be held accountable to deliver each green recovery proposal, and in turn be remunerated for successful delivery (and includes the description of each new PC we propose to implement this using the PR19 template);
- what overlaps exist across each of our existing suite of PCs and the green recovery schemes how we will adjust for these to avoid any double remuneration;
- how the totex costs sharing should be applied to better protect customers; and
- how the funding of the green recovery proposals could be implemented within the current AMP.

5.3 Direct Procurement for Customers

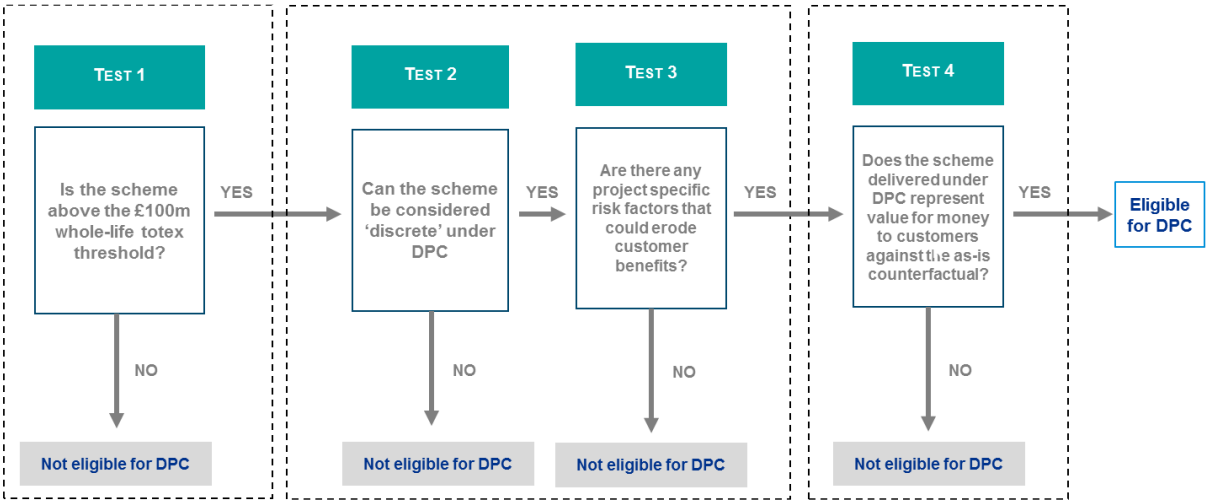
We are supportive of the use of Direct Procurement for Customer (DPC) where it benefits customers and have therefore assessed our Green Recovery proposals using the transparent, repeatable framework that we developed at PR19 with KPMG.

Our conclusion is that the proposal for expansion of [redacted] and [redacted] and for a Drought Flood Storage reservoir at Shrewsbury are not suitable for delivery by DPC because they are not sufficiently discrete.

Approach

Our methodology for assessing whether our capital schemes were potentially suitable for DPC was based on the Ofwat guidance[16] on what constitutes an eligible DPC project, and through the PR19 process was accepted as a reasonable approach. Figure 64 below sets out this four-stage process.

Figure 64: Direct Procurement approach overview



Totex threshold: Due to the compressed timescales of our Green Recovery process we had to run the DPC assessment in parallel with scheme development and selection. In other words, the Totex filtering process started without having certainty over costs or knowing whether they would pass through our cost benefit analysis and so we considered a reasonably wide sample of potential schemes.

On water resources the following potential schemes that passed through the size test:

- Shrewsbury Drought Flood storage;
- [redacted] and [redacted] enhancement;
- [redacted] reservoir to [redacted] reservoir (a single, gravity pipeline between reservoirs); and
- Finham final effluent transfer to [redacted] reservoir (linked to River Avon bathing river proposal).

As set out in section 4, the first two schemes form part of this submission, the remaining two will be considered for the Water Resources West Regional plan 2024.

Discreteness test: We assessed the extent to which the scheme when operational it is integrated as part of network management and considered the potential implications of third party delivery and operation. We evaluated the schemes against the six criteria developed for the PR19 submission.

The criteria were developed acknowledging the characteristics that Ofwat noted to impact discreteness as shown in figure 65 below.

[16] https://www.ofwat.gov.uk/wp-content/uploads/2017/12/Appendix-9-Direct-procurement-FM.pdf

Figure 65: Discreteness test criteria and considerations

Criteria	Considerations
1 Physical asset location	Is the scheme an extension to an existing asset or a new asset constructed on a separate site? Does the asset have its own function or is it highly integrated with SVT's current processes? Does the construction impact the operation of SVTs existing assets?
2 Interfaces	Does the asset have interfaces with SVT's wider network? If so, is it an information or physical interface with one or multiple assets and parties? Are any sensitive information, customer data involved requiring robust security and confidentiality arrangements?
3 Process	For similar type assets are raw material and energy sourced centrally or locally? Is there an automated control over the asset and if so is it run centrally or locally? Are resources shared with the wider SVT's operation? Does the operation require multi-skilled labour? Is the asset an explicit process stage with a clear input and output?
4 Impact on service delivery	Does the service delivery impact SVT's statutory and performance obligations (e.g. ODIs)? If so does it have an impact on quality or reliability metrics? Is the asset part of the water or the wastewater value chain? Does the operation of the asset directly impact customers? Is impact of asset failure well understood?
5 Flexibility	Is the asset's usage likely to change over time? How likely is it that the asset becomes stranded or underutilised over time? Is the asset's operation scalable? Are there alternative usage options for the asset available? Can the operation be easily adapted to changing needs?
6 Control	Is the asset needed for the day-to-day operation? Does the asset have a frequent interaction with the wider network? Is the asset required for resilience purposes? Can the contracting arrangements be designed efficiently and effectively? How comfortable are SVT giving responsibilities for resilience to 3rd parties?

Points are award against each criterion to reflect the level of 'discreteness':

- three where the asset is highly independent;
- two where the asset is partially independent, and;
- one where the asset is highly integrated.

A total score of ten or more indicates the asset may be suitable for DPC. The only scheme to pass the discreteness test was the assessment was the [redacted] reservoir to [redacted] reservoir, see figure 66 below.

Figure 66: Discreteness assessment

Criteria	Shrewsbury drought flood scheme	[redacted] and [redacted] enhancement	Finham – [redacted] reuse	[redacted] reservoir transfer
Asset location	Standalone asset with construction having limited impact on ongoing SVT operation.	Abstraction asset has limited impact on operation of current site Treatment asset would be on SVT site and may impact operation during construction and future operation. Use of natural treatment process requires dilution in bankside storage meaning raw water unlikely to be discrete.	Highly integrated with SVT's ongoing operation at the site.	Standalone asset with limited integration with wider network
	2	**1**	**1**	**3**
Interfaces	Complex physical and data interfaces with EA/SVT and River Severn regulation	Several interfaces with SVT including the managing abstraction licences, co-ordination of water demand	Complex physical and data interfaces with SVT Bathing rivers scheme operation	Interfaces considered relatively simple.
	1	**2**	**1**	**3**
Process	High degree of coordination with flood protection assets	Ongoing coordination required between DPC and SVT for WTW and river intake since water to distribution would mix	High degree of coordination with wider network and existing assets.	Minimal operational dependency
	1	**1**	**1**	**3**

Criteria	Shrewsbury drought flood scheme	[redacted] and [redacted] enhancement	Finham – [redacted] reuse	[redacted] reservoir transfer
Impact on service delivery	Impact of [redacted] failure could impact water quality but this risk is thought to be manageable.	Asset failure likely to impact customers and SVT's performance, however back up supplies available. Use of natural treatment process requires dilution in bankside storage – meaning raw water unlikely to be discrete.	Asset failure will impact quality and SVT's performance but risk somewhat manageable.	Asset failure likely to impact SVT customers back up available.
	2	**1**	**2**	**2**
Flexibility	Scalable and adaptable if needs change over time but heavily constrained by flood requirements.	Operational is potentially scalable in response to changing requirements.	Predictable asset usage with low volatility.	Asset scalable but with limited alternative uses.
	2	**2**	**3**	**2**
Control	Ongoing interaction required between wider network and EA flood scheme.	Ongoing co-ordination and frequent interaction with network. Separate monitoring of raw water intake will control some risk	Frequent and ongoing interaction required between wider network and existing assets.	Manageable and regular coordination required with network.
	1	**2**	**1**	**2**
Total score	**9**	**9**	**9**	**15**

We then assessed the [redacted] reservoir transfer scheme, that passed the discreteness test against the project risk and value for money tests.

Project risks focuses on the deliverability by a third party of potential schemes at each stage of the project lifecycle. The test looks to ensure that only schemes with manageable risks are taken forward as potential DPC schemes. Where an 'unmanageable risk' is identified, this indicates that delivery by Severn Trent would be more beneficial to customers because of the increased risk profile.

Figure 67: Project risk assessment

Lifecycle stage	*Risks*	*Description*
Design	• Planning/ consent permission • Design process, failure to build design • Operating costs	• The risk that the project has not been designed adequately for the purpose required. It spans from the feasibility study through the approval of designs up to changes to design.
Build	• Time and overrun • Subcontractor default/ bankruptcy • Poor project management	• Cost overruns during construction, or failure to complete the assets on time (or at all).
Finance	• Interest rate and inflation risk • Tax risk • Insurance risk	• The risk that certain financial rates change over the course of a scheme rendering a project or scheme un-financeable.
Operate	• Service performance risk • Resource/input/demand risk • Maintenance risk	• Ongoing operational risk for delivery of performance and service.
Transfer	• Asset condition and performance at asset handover	• Risks related to poor condition and performance of the asset; and uncertainty about its future performance and maintenance need.

Value for money compares the total cost to customers of a scheme delivered through DPC versus a scheme delivered in-house under PR19 assumptions. The test uses a financial model to compare the two procurement options, based on a set of key assumptions.

The overall outcome was that the [redacted] reservoir transfer scheme, if selected at WRMP24 is a suitable candidate for Direct Procurement for Customers.

Figure 68: Overall outcome of DPC analysis

[redacted]

Although our Green Recovery proposals did not pass the discreteness test we undertook further tests because we were working at pace and in parallel. This work revealed:

- significant project risks working on a dual drought-flood scheme with the Environment Agency/River Severn Partnership, and;
- that over a twenty-five year contract period, investment to replace key assets, makes in-house delivery of the [redacted]/[redacted] enhancement better value for money than Direct Procurement.

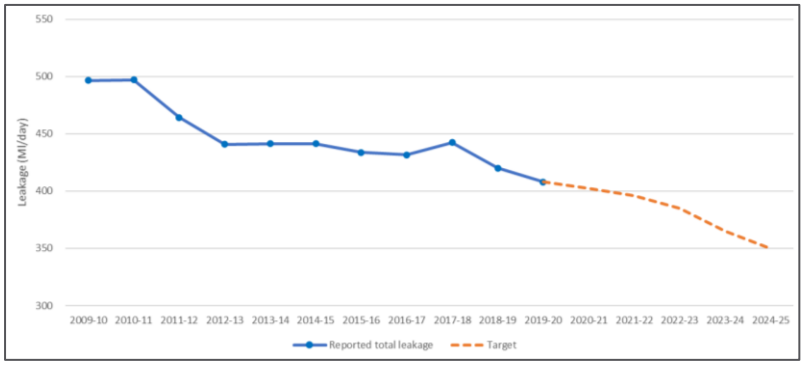
Appendix A: Current performance

We are on track with our AMP7 commitments, so we are confident we can deliver on top of our existing plans. The detail of our performance to date in AMP7 including the impact on Outcome Delivery Incentives is set out in *Annex 1 AMP7 On track performance*. This appendix summarises the relevant measures for this particular proposal.

In overview the Environment Agency's annual review of water resource plans in November 2020 raised no concerns on our performance.

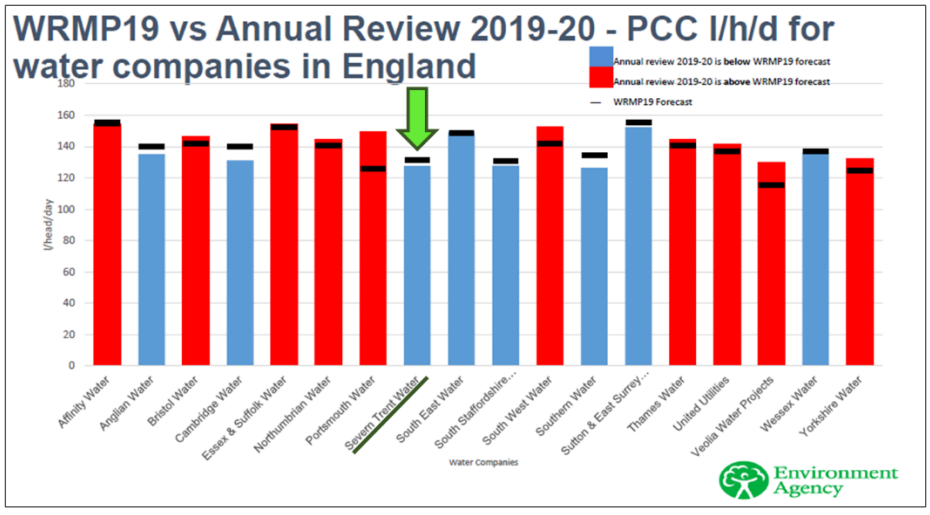
Leakage: Our AMP7 commitment is to reduce leakage by 15% over AMP7 on our journey to a 50% reduction by 2040. We have driven down leakage by 18% since 2010 (see figure 69) and achieved our target last year. In the current year we maintained all operational leakage activities through both lockdown periods and achieved our lowest ever level of leakage in October 2020. [redacted].

Figure 69: Total leakage outturn 2010 to 2020 and target to 2025



Per capita consumption: We achieved our target last year and continue to have one of the lowest per capita consumptions in the industry (see figure 70 below).

Figure 70: Performance of water companies in England



Performance in the current year has been challenging as the lockdown has shifted significant consumption from the workplace, schools and holiday centres to customers' homes. We are unlikely to recover the position by year end.

Supply schemes: Our three AMP7 supply schemes in Nottinghamshire and North Staffordshire water resource zones are on course to be deliver our 'Increasing water supply capacity performance commitment' (PR19SVE_G12) of 68.5Ml/day by March 2025.

Our Green Recovery proposals are completely separate to our AMP7 schemes being located in a different water resource zone – the strategic grid – and will therefore not contribute to our AMP7 performance commitment.

Metering Our proposed programme will increase meter penetration from 49% to 63%. We are not formally classified by the Environment Agency as a water stressed area and we therefore need to persuade customers to switch to metered billing. A full description of current performance is in Chapter 12 Smart Metering.