Water supply under climate change

Dr Geoff Darch

November 2023

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Water scarcity is an urgent issue…

‘We just pray for rain’: Niger is in the eye of the climate crisis – and children are starving

Aguié’s clinic is full of malnourished children, with more dying in villages, as the global food crisis worsens years of drought

Fred Harter in Aguié
Mon 20 Jun 2022 07.45 (BST)

‘We worry about it disappearing’: alarm grows over Italy’s drought-hit Po River

Drought blighting country’s longest waterway continues as economic hub battles climate crisis

Angela Giuffrida *in Gualtieri*
Fri 17 Jun 2022 11.13 (BST)

California threatens ‘mandatory water restrictions’ if people don’t cut back

Governor’s warning comes amid drought after driest January-March period in at least a century

Guardian staff and agencies
Mon 23 May 2022 21.33 (BST)

Chile announces unprecedented plan to ration water as drought enters 13th year

Rivers that supply Santiago with water are running low, forcing rotating cuts to different parts of the city

Reuters in Santiago
Mon 11 Apr 2022 20.14 (BST)

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Source: *The Guardian*

The challenges we face

Especially acute in the East of England

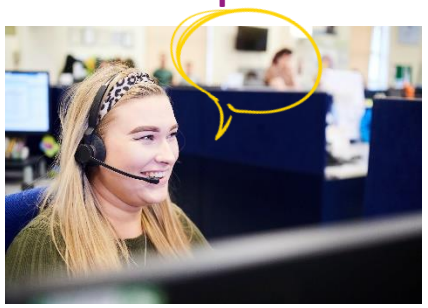
Climate change

Population and economic growth

Environmental protection

Common to the whole water industry

Affordability and customer expectations



Planning for the long term

Markets, structure and financing of the industry

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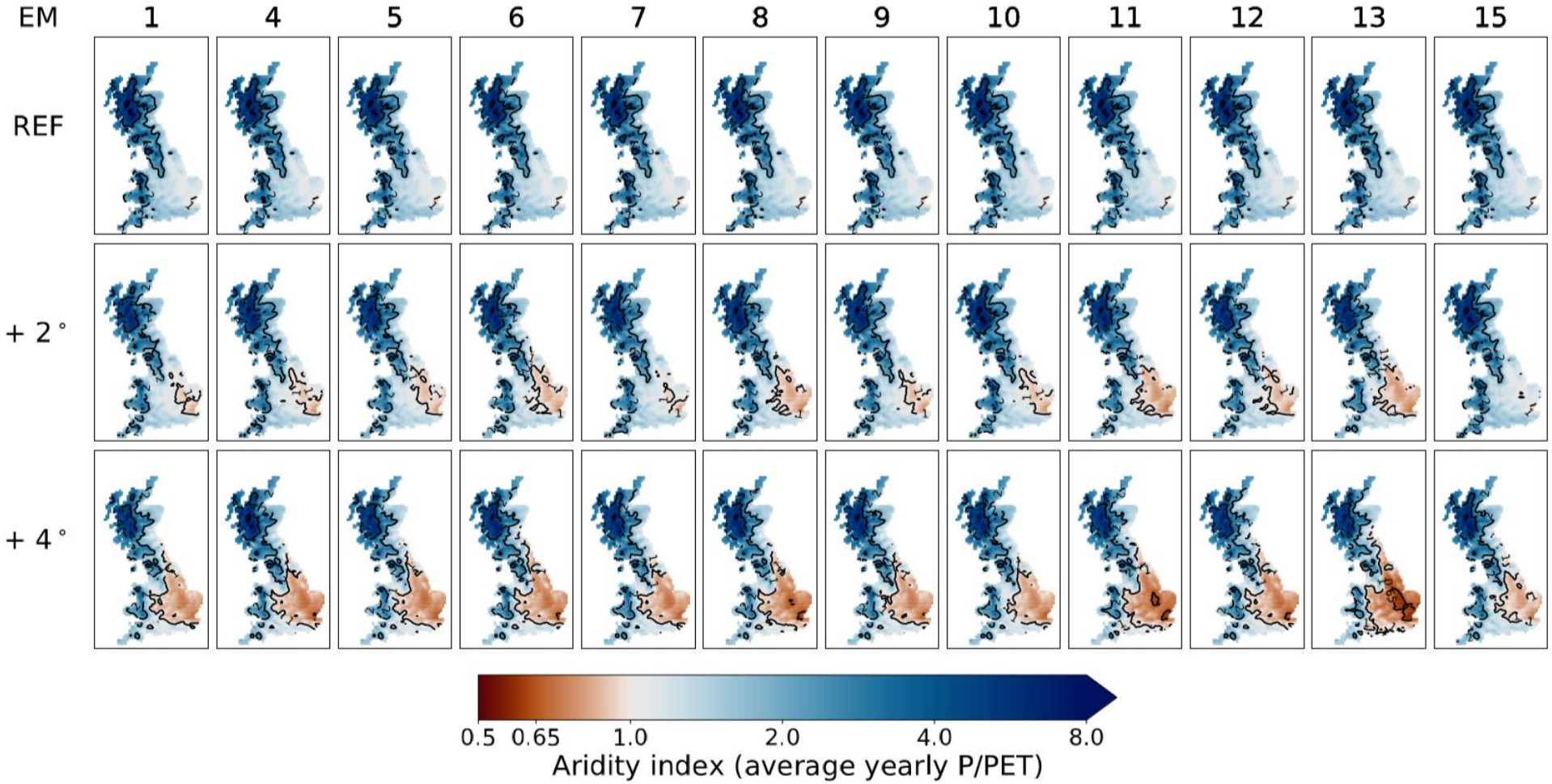
Climate change projections



Source: Reyniers, N., Osborn, T. J., Addor, N., and Darch, G. 2023. Projected changes in droughts and extreme droughts in Great Britain strongly influenced by the choice of drought index, *Hydrol. Earth Syst. Sci.*, https://doi.org/10.5194/hess-27-1151-2023.

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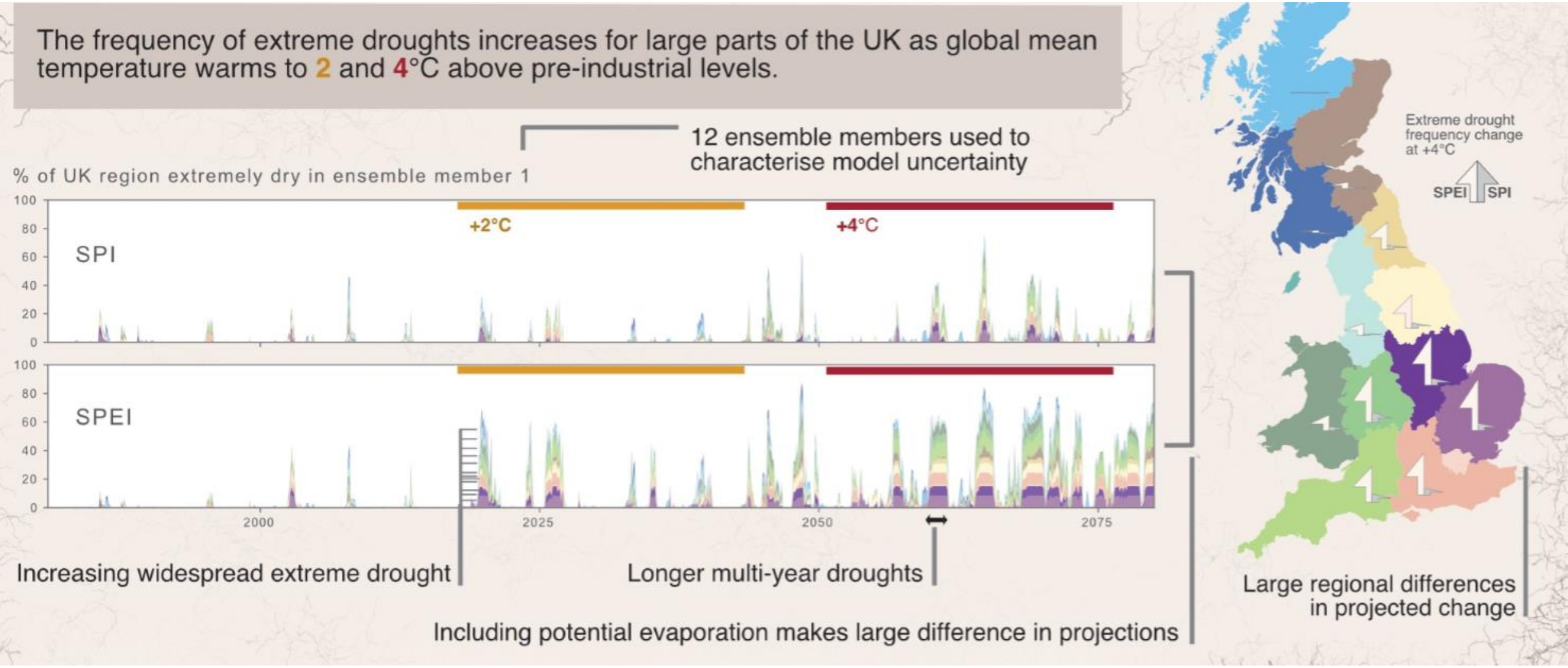

Source: Reyniers, N., Addor, N., Darch, G., He, Y., Zha, Q., and Osborn, T.: Understanding changes in meteorological drought in regional UK Climate Projections (UKCP18), EGU General Assembly 2021, online, 19–30 Apr 2021, EGU21-8713, https://doi.org/10.5194/egusphere-egu21-8713, 2021.

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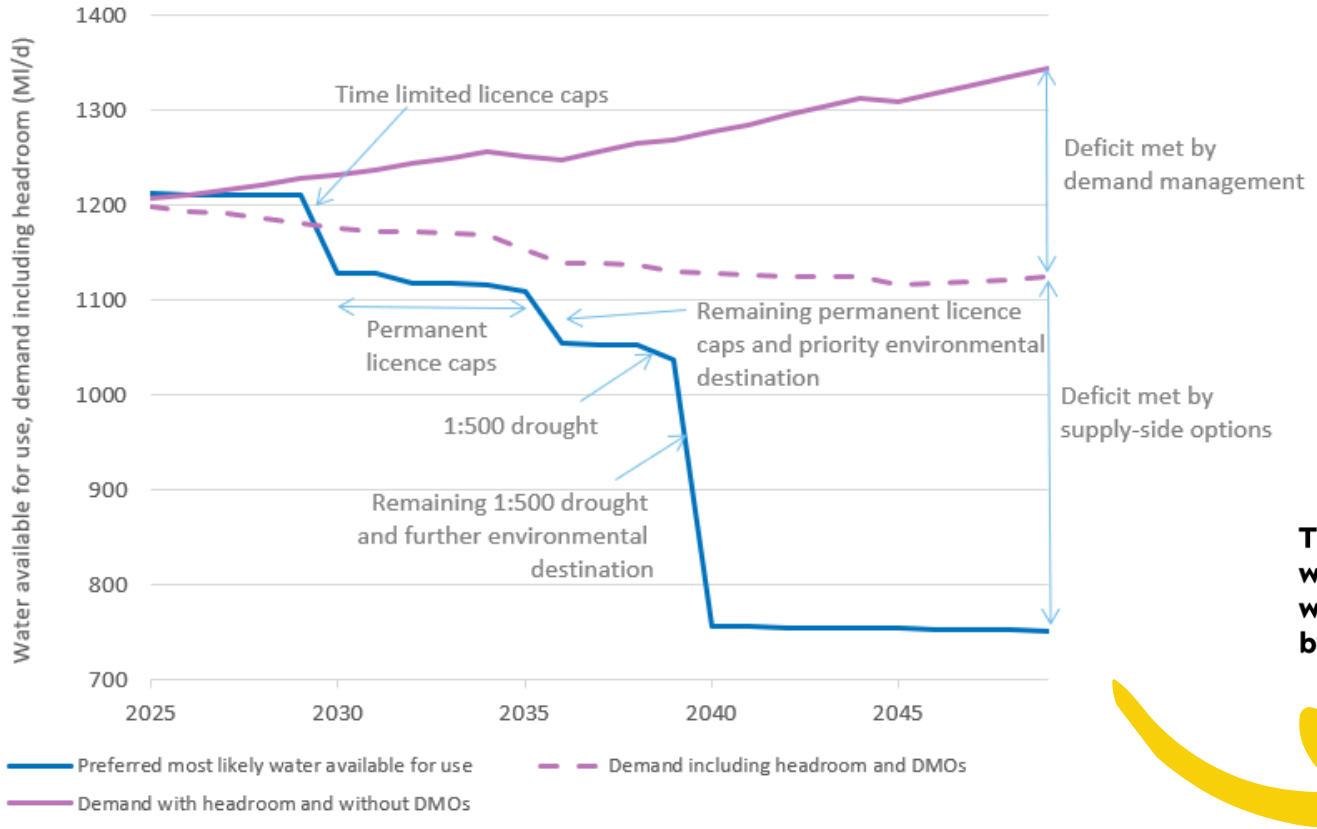
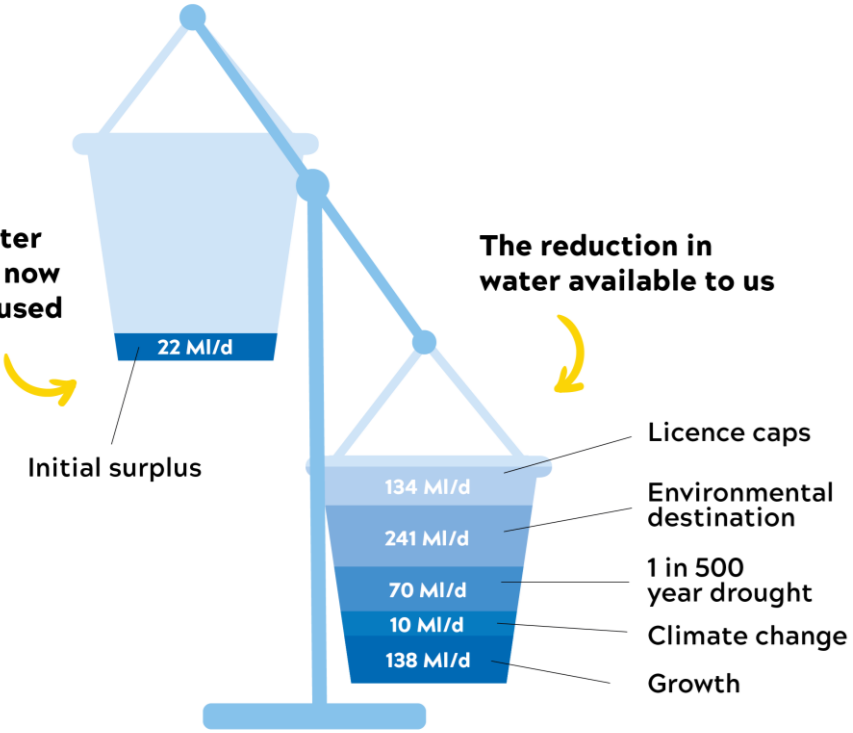
Scale of the challenges



By 2050

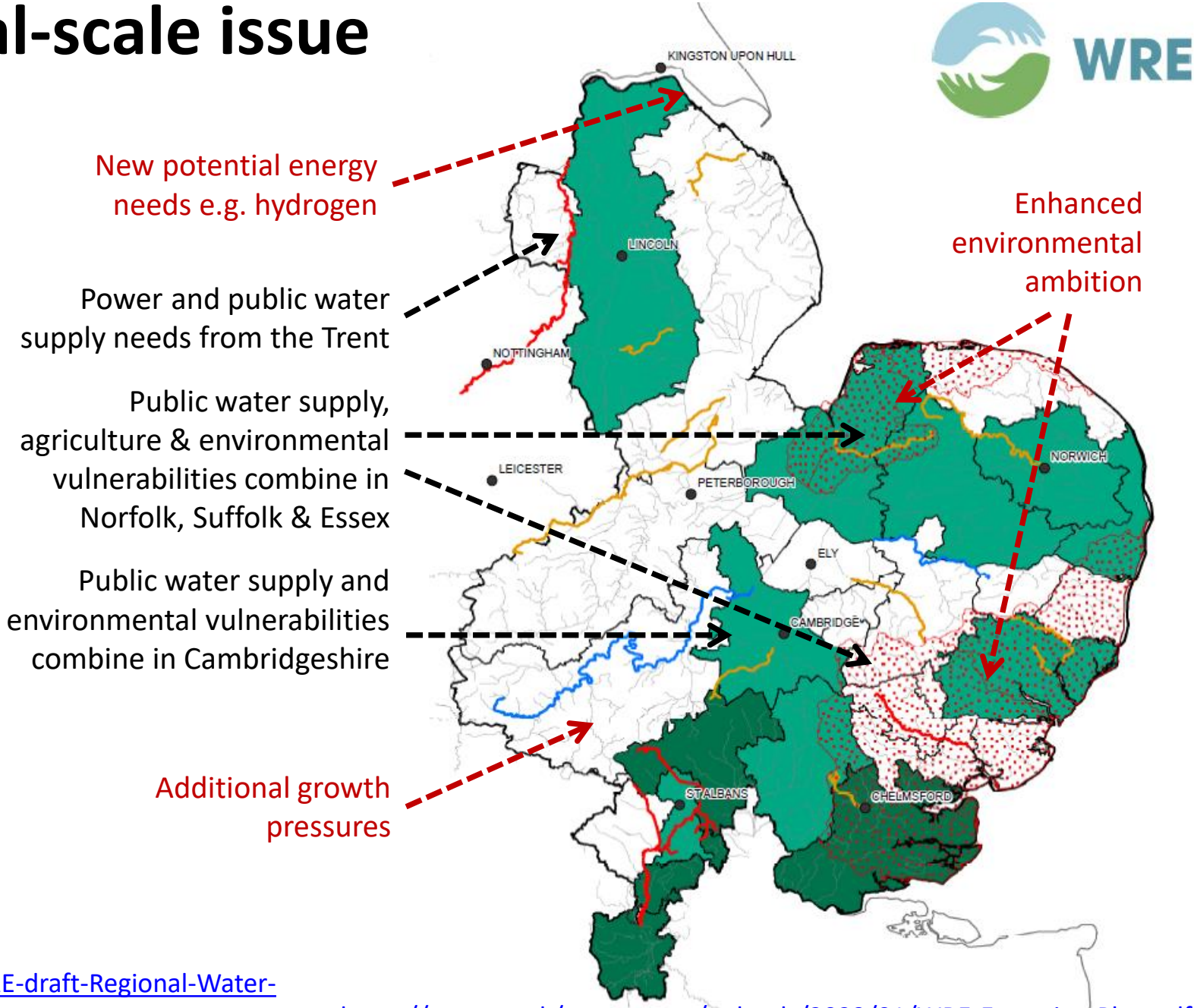
The amount of water we have available now which isn't being used by customers

The reduction in water available to us



Multi-sector, regional-scale issue

Sector	Change	Impact (Ml/d)
Public Water Supply	Licence caps	148
	Drought resilience	85
	Climate change	23
	Environmental destination	337
	Demand	72
Agriculture	Environmental destination	59
	Demand	83
Energy	Demand	142
Other	Environmental destination	22
	Demand	8



https://wre.org.uk/wp-content/uploads/2022/11/WRE-draft-Regional-Water-Resources-Plan-1.pdf

https://wre.org.uk/wp-content/uploads/2022/01/WRE-Emerging-Plan.pdf

Multi-objective, robust decision making

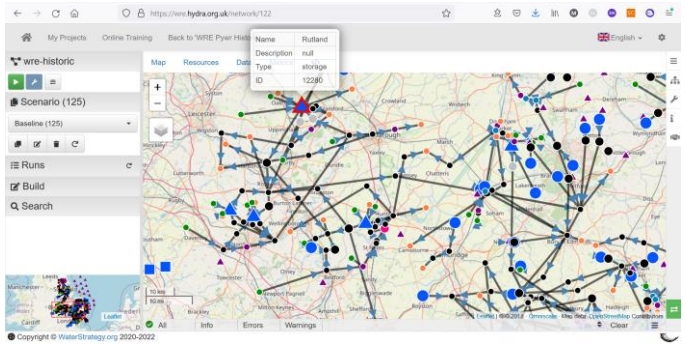
Problem Formulation (XLRM)

Identify:

1. Uncertainties affecting planning
2. Policy levers i.e. supply, institutional interventions, etc
3. Best value performance metrics
4. Build regional simulation model

Baseline Vulnerability Analysis (BVA)

1. Simulate current system under wide range of future scenarios
2. Identify system's vulnerabilities



Trade-off analysis

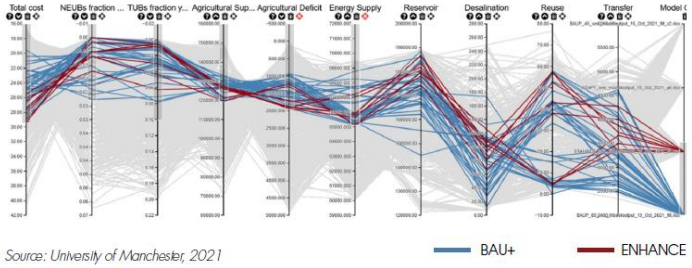
Interactive trade-off analysis. Stakeholders use parallel plots and simulator interface to explore trade-offs, filter and identify a candidate Portfolio

WRE portfolio scheduling

Develop scheduled plans from WRE portfolio for implementation across the planning horizon

Portfolio search

Robust many criteria search (MCS) using simulator under multiple future scenarios to identify promising portfolios and their trade-offs



Source: University of Manchester, 2021

WRE portfolio Stress-Test

1. Simulate WRE portfolio under wide range of scenarios
2. Vulnerability deep-dive

https://wre.org.uk/wp-content/uploads/2022/01/WRE-Emerging-Plan.pdf

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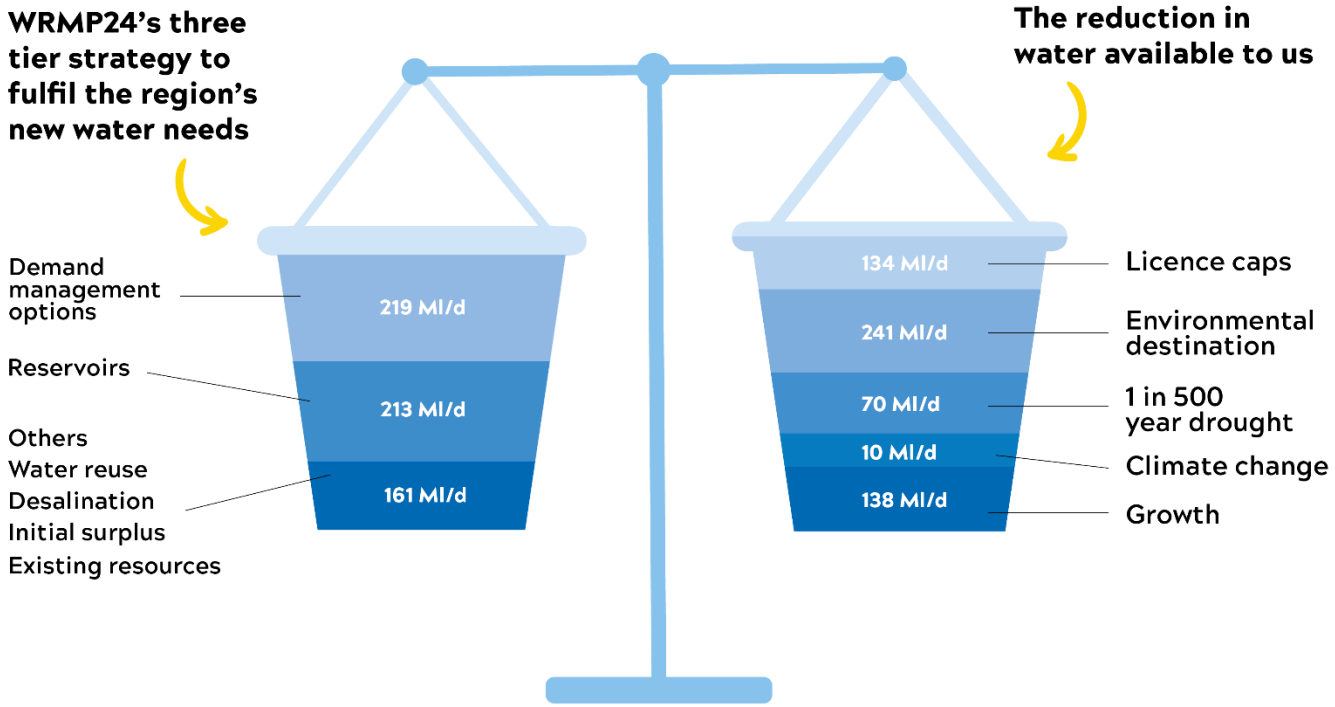
Meeting our long-term challenges

Our revised draft WRMP24 takes a **three-tiered approach** to tackling our long-term challenges.

1. Making best use of existing resources including demand management
2. Strategic water resource options - development of two new reservoirs
3. Adaptive future resources



We will also conduct scientific investigations between 2025 and 2030 to refine our environmental destination.

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Demand management

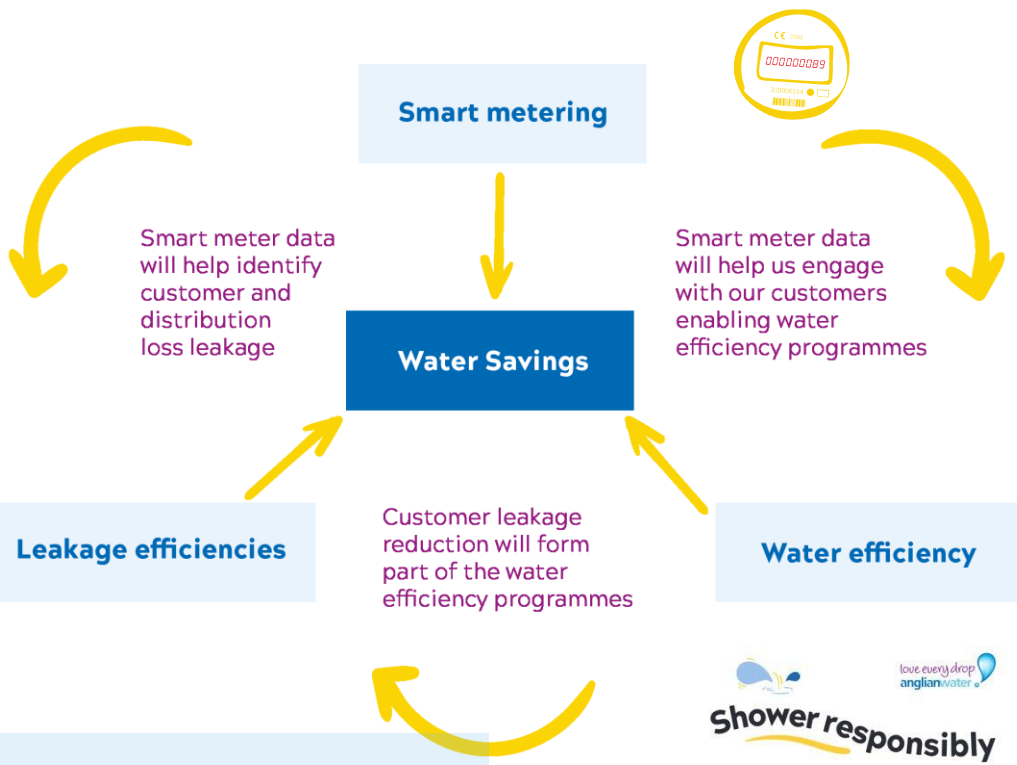
Smart metering

Complete roll out of smart meters by 2030, building on our current strategy. We expect smart meters to help us save 32Ml/d by 2050.

Our **leakage ambition** is to achieve a 38% reduction by 2050.

Compulsory metering

We believe that all customers should pay for what they use. Therefore, from AMP8 all customers who have a meter now or in the future will pay on this basis. **We will support eligible customers with our range of tariffs.**



Saving water

We will provide a high level of customer support based primarily on behaviour change and the identification of customer supply-side leakage. This will help us to achieve a Per Capita Consumption of **126 litres per head per day by 2030** and reach the National Framework target of **110 litres per head per day by 2050.**

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Non-household demand is a complex issue

Providing new water to facilitate non-domestic growth is becoming increasingly difficult due to lack of headroom (the 'buffer' between supply and demand) in our system due to:

- The Environment Agency's changed position on abstraction licence capping has reduced supplies.
- Non-household (NHH) demand has historically been stable in our region but in the last financial year, non-household demand increased by 28 Ml/d, and in the past six months, we have received a large increase in requests for NHH demand (totalling more than 30 Ml/d).
- These connection requests have typically been needed in a short timescale.
- There is no regulatory framework for developing the headroom for non-household demand that may or may not occur.

This has led us to **develop a new non-domestic policy position**; this recognises that the implementation of licence caps (and in some cases complete cessation of licences), means we are no longer able to supply all new NHH requests (either increased supply or new connections).

This policy also recognises that **we have a legal obligation to supply water for domestic purposes, i.e. for washing, cooking and sanitation.**
We need to prioritise this legal obligation with respect to existing and future domestic demand, over non-domestic purposes such as agri-food processing.

Due to the on-shoring of production (especially food and drink post-Brexit), supply chain issues following Covid, licence changes for businesses, and the start of requests relating to net zero.

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Non-domestic policy position

Our non-domestic policy recognises the importance of water resources for non-domestic purposes and for economic development in the East of England. The policy commits to:

- Review requests for new non-domestic demand in a timely manner and be transparent with retailers and end users regarding resource availability.
- Base decisions regarding new non-domestic demand on our WRMP forecasts (or the latest information we have) for the relevant Water Resource Zone (WRZ). This could result in the following decisions:
    - When there is a surplus in the WRZ and the request can be accommodated, no resource constraint will be applied.
    - If the new request exceeds the surplus available, a smaller amount may be requested with the difference being made up through water efficiency or water re-use.
    - Where there is no surplus in the WRZ, the request will only be granted if surplus water can be brought in from another WRZ.
    - Where there is insufficient water or where it would require unreasonable expenditure, we are legally entitled to decline to provide a supply of water. **We will do this when providing a supply would compromise the ability to meet our existing obligations together with our projected future obligations, as established through the WRMP process.**

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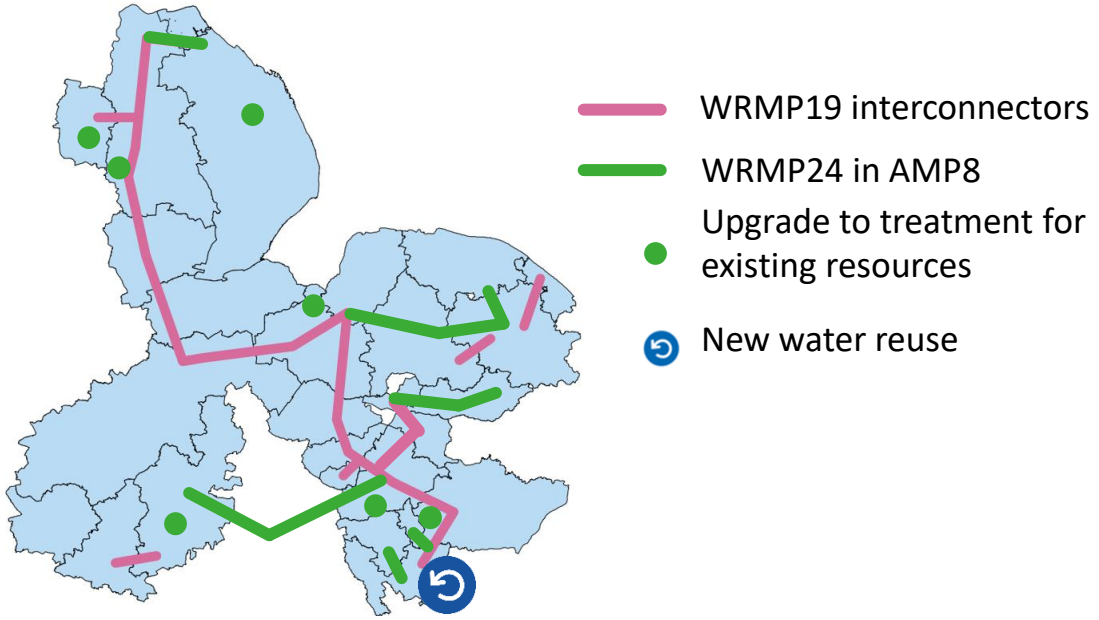
Optimise use of existing resources

Building on our WRMP19 strategy

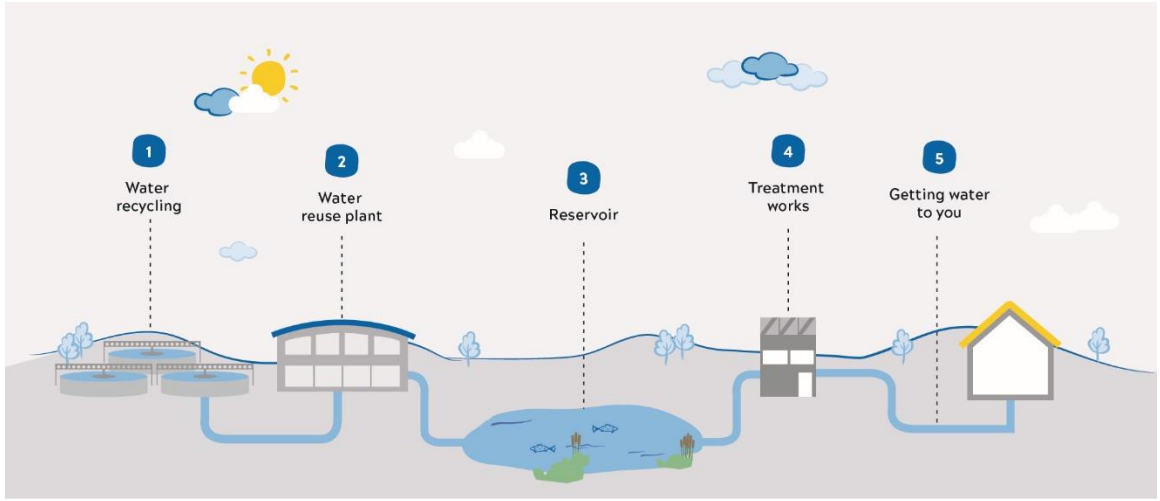
We are laying **380km of transfers between 2020 and 2025** to move water from areas of surplus to those in deficit.

We will build on this strategy in WRMP24, allowing us to move water around our region.



Maximises use of existing resources, through upgrades to existing water treatment works, a new water reuse facility and backwash recovery to return settled process water back to the works, reducing the amount abstracted.

Water reuse



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New reservoirs for our region

National and regional modelling has determined that these are low regret options for our region.

Company modelling has verified the need and reservoir selection. ✓

Lincolnshire reservoir

- South of Sleaford, Lincolnshire
- 50Mm^3 useable volume, similar in size to Grafham Water
- 169 Ml/d deployable output
- Water abstracted from River Witham when flows allow, with supporting transfer from River Trent; and
- Will supply **500,000 household**s in Lincolnshire and the South West of our region.

Fens reservoir

- North of Chatteris, Cambridgeshire
- 50Mm^3 useable volume, similar in size to Grafham Water
- 88 Ml/d deployable output shared between Anglian Water and Cambridge Water
- Water abstracted from the River Nene, River Great Ouse and the Middle Level when flows allow; and
- Will supply **125,000 households** for our customers in the Cambridgeshire and Norfolk areas.

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A holistic, multi-sector approach

FUTURE FENS: INTEGRATED ADAPTATION

New reservoir intake

New open water transfers

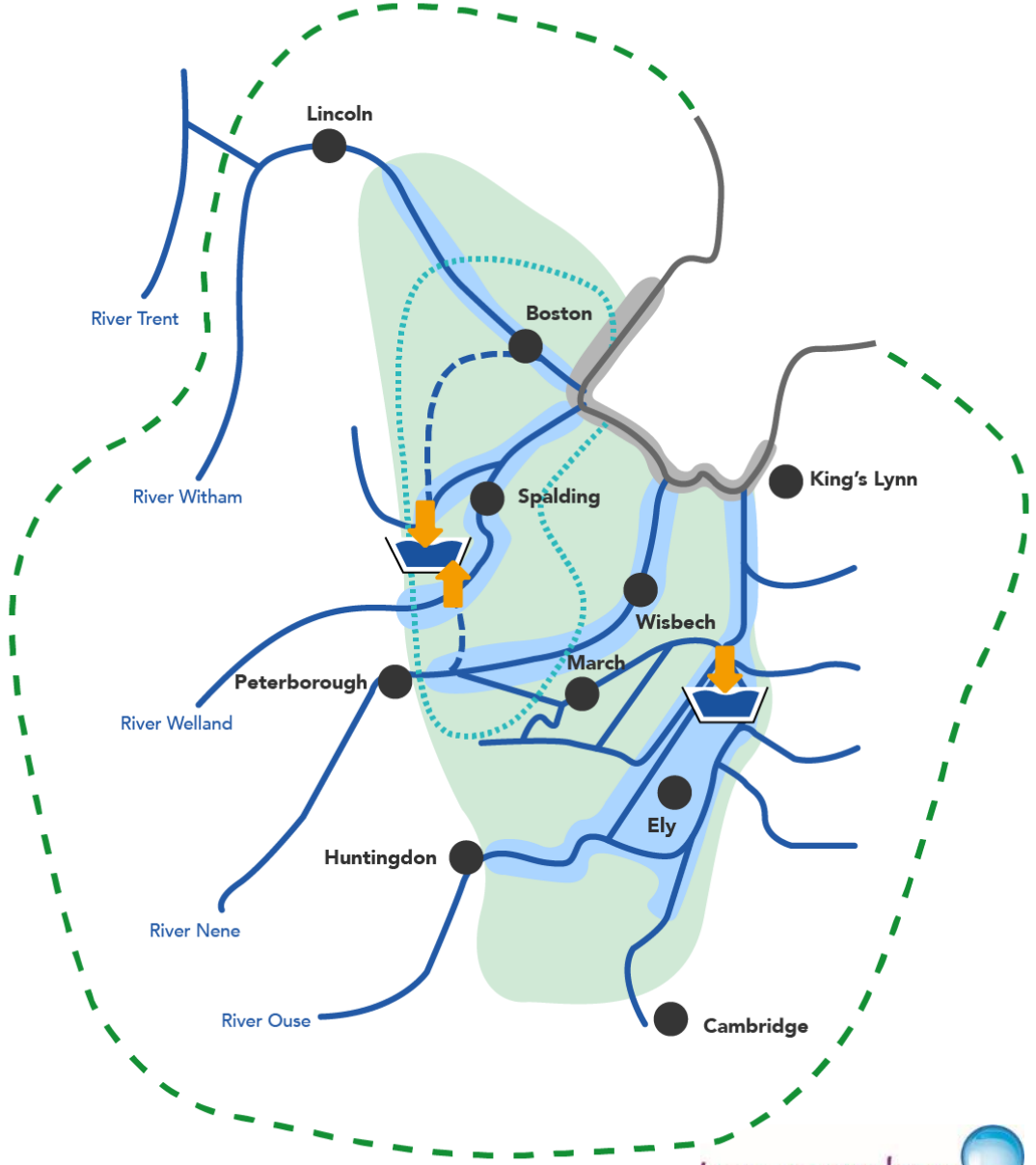
New flood risk management strategy

New reservoir (indicative location)

Adaptive plan for The Wash

Boston to Peterborough wetland corridor

Landscape boundary within which water strategy will be aligned with land use management (i.e. National Flood Risk Management and Environmental Land Management Strategy)



Norfolk Water Strategy Programme

Aim: To develop a long-term, coordinated, investable programme to attract large scale funding & financing into the use of at-scale nature-based solutions for improving water security

Nature based solutions (NbS) for water resource:


Regenerative farming techniques


River and floodplain restoration


Offline storage creation


Sustainable drainage systems


Wetland creation

Norfolk Water Hub

A platform to coordinate efforts and develop NbS to tackle water security challenges in Norfolk

- Facilitate experience sharing & dissemination of best practice
- Collect and provide data
- Influence government policy and funding design
- Support NBS project developers and achieve efficiency by aggregating applications and other processes
- Act as an incubator for new water initiatives, particularly new investment vehicles

Norfolk Water Fund

A fund to leverage & coordinate funding for the delivery of a specific NbS investment programme

- Targeted fund to invest in NBS implementation with clear KPIs
- Invests in a prioritised package of NbS based on ROI analysis – including co-benefits
- Enables mobilisation of pre-financing if revenue streams are clearly identified
- Contract out 'at-scale' delivery

Find our more at: https://wre.org.uk/projects/norfolk-water-strategy-programme/

NORFOLK WATER STRATEGY PROGRAMME

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The Nature Conservancy

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Norfolk County Council
on behalf of all Norfolk councils

These reports, non-technical summaries, and environmental assessments are at: anglianwater.co.uk/wrmp

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Any questions?