AtkinsRéalis

Phase 1

Water Resources East

24th May 2024

PLANNING FOR GREATER CAMBRIDGE GROWTH

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Executive Summary

Water Resources East (WRE) is the independent, not-for-profit membership organisation tasked by Government to create a regional water resources plan for Eastern England. WRE works collaboratively to understand the future needs and aspirations for water use for all water-using sectors and the environment through to the 2050s and beyond. They have developed a long-term multi-sector regional plan for Eastern England which identifies portfolios of shared solutions between companies and stakeholders that are low regrets, adaptive and relevant for a range of future scenarios. This is consistent with water company plans presented in their draft Water Resource Management Plans 2024 (WRMP24).

Eastern England is the driest region of the country and is designated as seriously water stressed by the Environment Agency. The impacts of climate change are already being felt and expected to increase into the future with more frequent dry periods, heatwaves and drought. At the same time, economic, population and housing growth are placing further pressure on water availability.

In March 2024, the UK Government released the Case for Cambridge[1] that sets out the ambition for the economic and housing growth of Cambridge and goes beyond those planned for by current water company, regional and local authority plan(s). However, water supplies are already constrained within the Cambridge area and there is concern over the environmental impact of new abstractions meaning that water availability could constrain future economic growth.

This report presents the results of an initial phase of work to develop growth scenarios for both household and non-household (business and industrial) water use in Cambridge Water Resource Zone to help members of the Cambridge Water Scarcity Group to understand the scale of the challenge, contextualise and explore the additional growth, the uncertainty in those growth forecasts, and its impact on WRE's current Regional Water Resources Plan for Eastern England[2]. The analysis has been commissioned by government to support their commitments for addressing water scarcity to accommodate growth in Cambridge. Other studies have been commissioned including work on a water credits market and supply options.

This project has demonstrated the scale of the challenge and helped to improve understanding of the range of future uncertainty, to enable more focus in subsequent phases. We found that to achieve the aspirations for further growth in the region, new solutions will be required to find approximately 50% more water by 2050. This is 50% more than is currently planned for by water companies in the region. If more water intensive industries are attracted to the area, then the additional need for water will be even higher. Current water company plans already include large strategic options and ambitious water efficiency targets, but to realise the Government's growth ambitions for Greater Cambridge area, significantly more water will need to be found and/or more schemes will need to be brought forward to avoid water supply planning deficits emerging.

Regional simulator modelling has shown that increased levels of water demand in Cambridge cannot be met solely by proposed WRE regional plan/Cambridge Water WRMP24 solutions due to constraints on abstraction licences and source capacities. To unlock and support growth in the region it is likely to need innovative local and regional options alongside changes to national legislation and regulation to support new ways of managing water (e.g. allowing water companies to supply non-potable water for certain purposes). Shared solutions with other sectors will also need to be explored, such as increasing agricultural winter storage.

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[1] Department for Levelling Up, Housing & Communities, 2024. The Case for Cambridge: https://www.gov.uk/government/publications/the-case-for-cambridge/the-case-for-cambridge

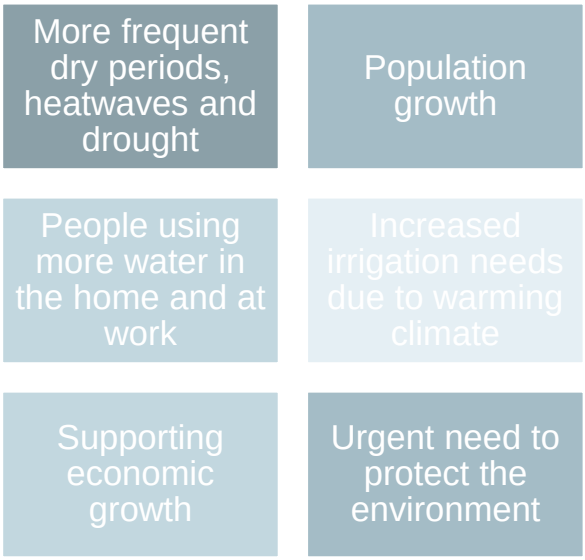
[2] Water Resources East, 2023. Regional Water Resources Plan for Eastern England: https://wre.org.uk/wp-content/uploads/2023/12/WRE-Regional-Water-Resources-Plan-for-Eastern-England.pdf

We acknowledge that there will be a need for further, and more detailed, work as data becomes available and more is known about build rates, development sites and the types of industry expected in the region. We recommend that future phases of this work integrate and align strategic wastewater and water management planning for the Greater Cambridge area to identify potential for shared solutions such as wastewater reuse.

1. Overview

Water Resources East (WRE) is the independent, not-for-profit membership organisation tasked by Government to create a regional water resources plan for Eastern England. The entire WRE region is designated as seriously water stressed by the Environment Agency. WRE works collaboratively to understand the future needs and aspirations for water use for all water-using sectors and the environment through to the 2050s and beyond.

WRE has developed a long-term multi-sector regional water resources plan for Eastern England[3]. The regional plan presents a low regrets approach and the ability to adapt in the future. It identified portfolios of shared solutions between companies and stakeholders that are relevant for a range of future scenarios including water efficiency and conservation measures alongside new supply options.



1.1 Greater Cambridge Growth

The current WRE regional plan was published in 2023 and was based on levels of housing and population growth projected within current local plans. It reflects work from the past 4 years and is consistent with current adopted local plan forecasts as presented in water company revised draft Water Resource Management Plans 2024 (WRMP24).

In March 2024, the Case for Cambridge[4] document was released that sets out the Government's ambition for the growth of Cambridge. The ambition goes beyond the growth forecast in the Greater Cambridgeshire Shared Planning (GSCP) Adopted Local Plan[5], which is supported by the water company and regional plan(s) through water supply and demand options. The Environment Agency has designated the Cambridge area as water-stressed and advised that some water bodies are at risk of deterioration, and that any new development must not increase abstraction in Greater Cambridge.

1.2 This project

AtkinsRéalis was commissioned by WRE to support a series of rapid tasks as part of an initial phase of work to help members of the Cambridge Water Scarcity Group contextualise and explore the additional growth forecast for Greater Cambridge region and its impact on the current WRE regional plan. This project sets the scene and provides a discussion of the types of water resource management solutions that may be needed to unlock growth in the region. We acknowledge that there will be a need for further, and more detailed, work to be done as data

[3] Water Resources East, 2023. Regional Water Resources Plan for Eastern England: https://wre.org.uk/wp-content/uploads/2023/12/WRE-Regional-Water-Resources-Plan-for-Eastern-England.pdf
[4] Department for Levelling Up, Housing & Communities, 2024. The Case for Cambridge: https://www.gov.uk/government/publications/the-case-for-cambridge/the-case-for-cambridge
[5] Greater Cambridge Shared Planning, 2018. Cambridge Local Plan: https://www.cambridge.gov.uk/media/6890/local-plan-2018.pdf

becomes available and more is known about build rates, development sites and the types of industry expected in the region as well as timescales and types of options.

For this initial phase of work we have focused on Cambridge Water's Water Resource Zone (WRZ) to simplify the analysis and to enable the water company data to be easily incorporated. The Cambridge WRZ encompasses all of the GSCP planning area. It is also worth noting that the regional water resource simulator provides a snapshot of the situation in 2050. Future work will be required to consider the phasing of options throughout the forecast period.

The aims of this project were to:

- Explore the impact of the proposed levels of growth and understand the challenge
- Better understand what level of growth is achievable in the region and how it can be achieved
- Provide context for the measures that could be implemented to unlock more growth in the region, for example:
  - More water efficient homes
  - More ambitious use of technology, e.g. water reuse
  - Government-led initiatives or changes to legislation, e.g. Building Regulations
  - Supplying more water into the region, e.g. transfer pipelines, reservoirs
- Recommend next steps for future phases of work

2. Understanding the challenge

The WRE regional plan is based on levels of housing and population growth projected within current adopted local plans. Without demand management measures and new future supply options, the growth in demand in Cambridge WRZ is projected to put the zone into a supply demand deficit. Therefore, options have been developed, and tested against a wide range of population, climate and environmental scenarios to ensure that the proposed schemes are 'low regret'. However, to realise the Government's growth ambitions for Greater Cambridge area (encompassing Cambridge City and South Cambridgeshire districts – shown in Figure 2-1), significantly more water will need to be found and/or more schemes will need to be brought forward to avoid water supply deficits emerging.

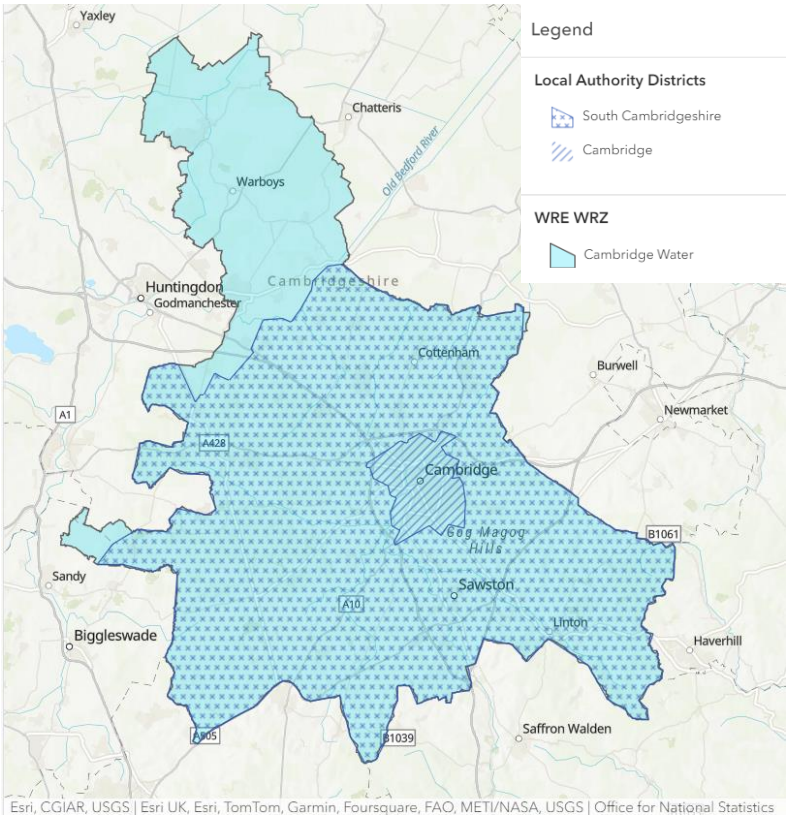


Figure 2-1: Greater Cambridge area (patterned overlay) and the Cambridge WRZ (in blue)

As part of this initial phase of work, growth scenarios have been developed for the Cambridge Water WRZ. There are many housing, economic growth and water-use forecasts for the region, each influenced by varying and uncertain drivers and resulting in a large range of possible scenarios. We have worked with our project stakeholders[6] to select scenarios that can be used to help demonstrate the scale of the challenge, understand the range of future uncertainty, and enable more focus in subsequent phases.

The scenarios developed and selected in this phase of work demonstrate the housing ambition and capture the range of uncertainty in:

- future rates of housing development and population growth;

[6] Water company representatives from Cambridge Water and Anglian Water and members of the Greater Cambridge Shared Planning team. The Environment Agency, Homes England, and DLUHC were also consulted at various stages of the project.

- economic growth (i.e. non-household growth), and
- associated water consumption.

These scenarios were informed by research into recent literature and housing plans for the region alongside stakeholder engagement.

2.1 New build occupants water use

To understand the potential scale of water needed by people living in new homes within the Cambridge Water WRZ by 2050, new build water use scenarios have been calculated as a function of:

- New housing build rates (Section 2.1.1), and
- New build per person water-use (Section 2.1.2).

2.1.1 New housing build rate

Figure 2-2 and Table 2-1 show the new housing build rate scenarios that have been developed and reviewed as part of this project. The scenarios selected for modelling are indicated by solid-coloured lines. Other published scenarios of housing growth rates for Cambridge, that were considered and used in WRMP24 and WRE regional modelling, are shown as grey to provide context.

It is important to remember that different sources of data have different purposes and that some have been developed based on trend-based analysis of housing need for the region, whereas others present ambitious rates to support national economic growth. Forecasts are continually reviewed and updated and will undoubtedly change. It is not our intention to match published scenarios but rather to provide a range of scenarios that sets the scale of the challenge, explores what is possible and captures future uncertainty rather than being used to provide deterministic predictions.

A scenario that captures a theoretical phased build-rate in which the annual rate increases over time has been developed, as this may better reflect the transition to a higher rate of growth over time that is required to enable increased build rates. It also could delay higher growth until after critical infrastructure are operational to ease water scarcity challenges in the region, such as the Grafham to Cambridge Water Transfer and the Fens Reservoir.

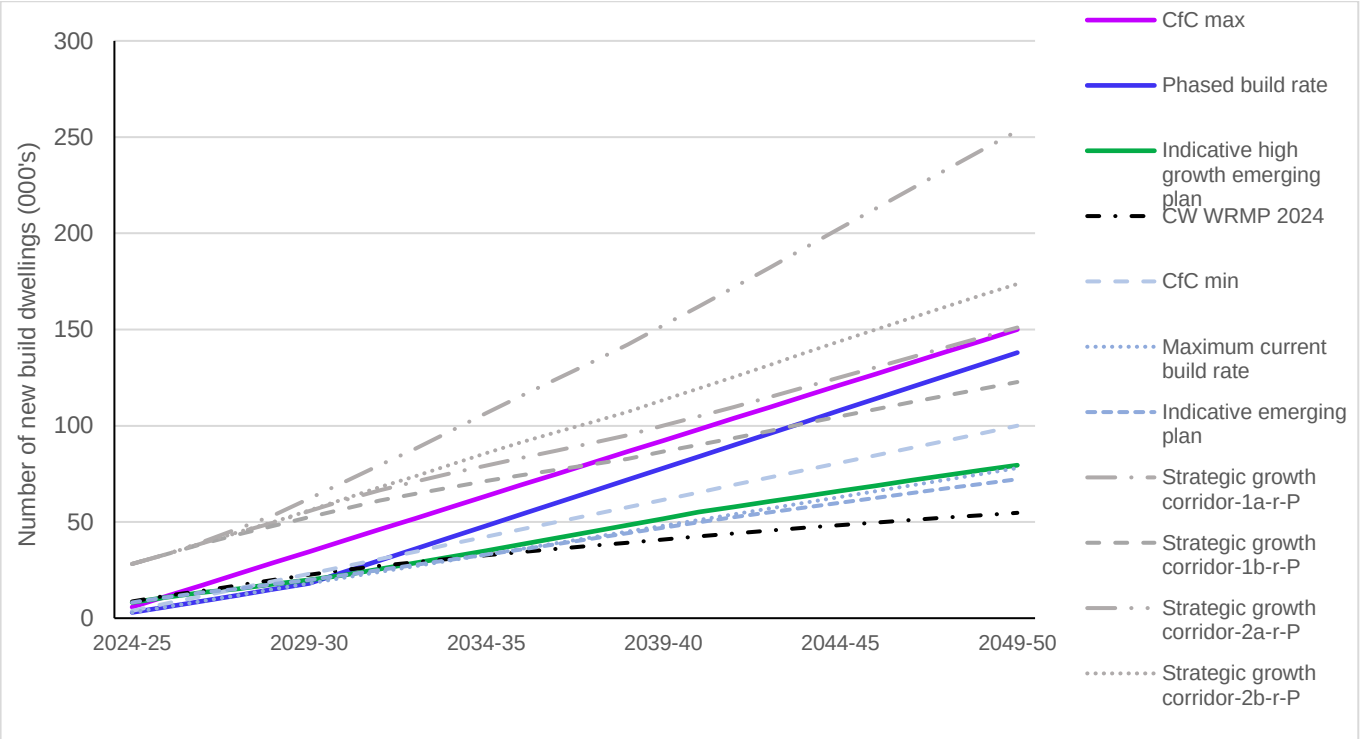


Figure 2-2: New house build scenarios (solid-coloured lines represent the agreed project scenarios)[7]

Table 2-1: Summary of selected new house build growth scenarios

Scenario name	General assumptions	Average annual build rate		Total change 2024/25 to 2050
		2024/25 to 2029/30	2030/31 to 2050	
Case for Cambridge maximum	Assumed linear trend to achieve the target of 150,000 new houses by 2050 stated within the Case for Cambridge released by the Secretary of State for Levelling Up in March 2024.	5,769	5,769	150,000
Phased build rate	Informed by project stakeholder engagement. Considers phasing of builds with an accelerated build rate following the completion of the Fens Reservoir when more water is available. Post-2030 build rate pushes the build rate beyond current rates and assumes that any current constraints on development levels will be overcome in the future such as, market demand, legislation and/or Research & Development (e.g. developments in offsite modern methods of construction).	3,000	6,000	138,000

[7] Rebasing scenarios to a consistent observed build rate in the base year was trialled but this was not appropriate for all scenarios and impacted total builds in 2050

Scenario name	General assumptions	Average annual build rate		Total change 2024/25 to 2050
		2024/25 to 2029/30	2030/31 to 2050	
Indicative high growth emerging plan	Based on Greater Cambridge Shared Planning group's emerging plan (Jan 2023). Incorporates their analysis of housing need and current maximum build rates achievable (3000 homes per year).	2,353	3,009	79,506
CW WRMP24	Cambridge Water's revised draft WRMP24. Based on local plans and used as the baseline scenario in Cambridge Water's WRMP.	2,764	1,564	54,737
Case for Cambridge minimum	Assumed linear trend to achieve the target of 100,000 new houses by 2050 stated within the Case for Cambridge released by the Secretary of State for Levelling Up in March 2024.	3,846	3,846	100,000
Maximum current build rate	Informed by stakeholder engagement. Maximum current build rate of approximately 3000 dwellings per year (GCSP Jan 2023 Local Plan)	3,000	3,000	78,000
Indicative emerging plan	Represents a 'central' most likely employment forecast for 2020-2041 and the housing required to support that.	2,353	2,625	72,214
Strategic growth corridor-1a-r-p	Average housing growth of 23,000 dwellings per year for the whole WRE and Water Resources South East (WRSE) region with approxiately 4,200 dwellings per year above Housing Plans. Household representative rates for young adults returning to (higher) 2001 levels by 2039, remaining fixed thereafter. An estimated 44% of the housing growth uplift is allocated to WRSE, 56% to WRE.	5,503	4,719	151,033
Strategic growth corridor-1b-r-p	As above but an estimated 75% of the housing growth uplift is allocated to WRE and 25% to WRSE.	4,856	3,470	122,716
Strategic growth corridor-2b-r-p	Average housing growth of 30,000 dwellings per year for the whole WRE and Water Resources South East (WRSE) region with approxiately 11,200 dwellings per year above Housing Plans. Household representative rates for young adults returning to (higher) 2001 levels by 2039, remaining fixed thereafter. An estimated 44% of the housing growth uplift is allocated to WRSE, 56% to WRE.	5,556	5,880	173,670
Strategic growth corridor-2a-r-p	As above but an estimated 75% of the housing growth uplift is allocated to WRE and 25% to WRSE.	6,784	9,596	253,188

2.1.2 New build per person water use

Current UK Building Regulations stipulate that new homes should be built to a 125 litres per person per day water efficiency standard or 110 litres per person per day where planning authorities adopt this tighter standard within local policies. Furthermore, WRE water companies' plans are striving to reduce overall household demand to 110 litres per person per day by 2050 in line with national water saving targets[8]. For new build homes in Greater Cambridge the building standards require homes to be built to a 110 litres per person per day standard, Also, Cambridge Water outlines a series of demand reduction measures within its revised draft Water Resources Management Plan (rdWRMP24) and most recent business plan that aim to achieve savings in all homes, through smart metering, household water audits and innovative tariffs. To reflect these measures in this phase of work we have taken the Cambridge Water WRMP24 forecast for new build households, including the forecast saving achieved from planned demand management reduction activities.

We have also developed a scenario that can be used to explore what could be achieved if household water use efficiency in new homes could be pushed even further, beyond current water company assumptions, to reduce per person water use in new homes to 80 litres per person per day. Figure 2-3 outlines the types of measures that would be required to push water efficiency below 110 litres per person per day. Changes to building regulations would be required to drive even more efficient fixtures and fittings installation, changes in the design of houses to favour vertical living and dry gardens/no gardens, alongside the widespread rollout of smart meters with in-house displays to influence behavioural change. It also would have to be supported by the adoption of relatively new concepts for the UK, such as development scale treatment and dual-supply pipe systems to utilise greywater, variable tariffs and water credits. It is important to note that ultimately the ability to achieve (and sustain) 80 litres per person per day in new build households is reliant upon what reductions can also be achieved in the existing housing stock to support a water credit market, public acceptance, uptake of efficiency measures, likely some water re-use and the willingness through behavioural change to adopt more efficient water use practices.

As an illustrative test of the extreme upper limits of water efficiency a scenario of 50 litres per person per day in new homes was developed. Other international countries have achieved this in emergency drought events such as South Africa, but for the UK, in addition to changes to building regulations, this would require an extreme shift and step-change in societal water-use behaviour, new technology and new legislation. To put this in perspective, based on the water supply technology currently available, the United Nations has stated that 50 litres per person per day is considered the minimum requirement for basic human needs and health.9 Therefore, this scenario has been included to show what would happen if it was feasible to reach these extreme water efficiency levels through changes to regulations, standards and new technology.

[8] Plan for Water: our integrated plan for delivering clean and plentiful water, 2023. Plan for Water: our integrated plan for delivering clean and plentiful water - GOV.UK (www.gov.uk)

[9] The Human Right to Water and Sanitation, media brief. https://www.un.org/waterforlifedecade/pdf/human_right_to_water_and_sanitation_media_brief.pdf

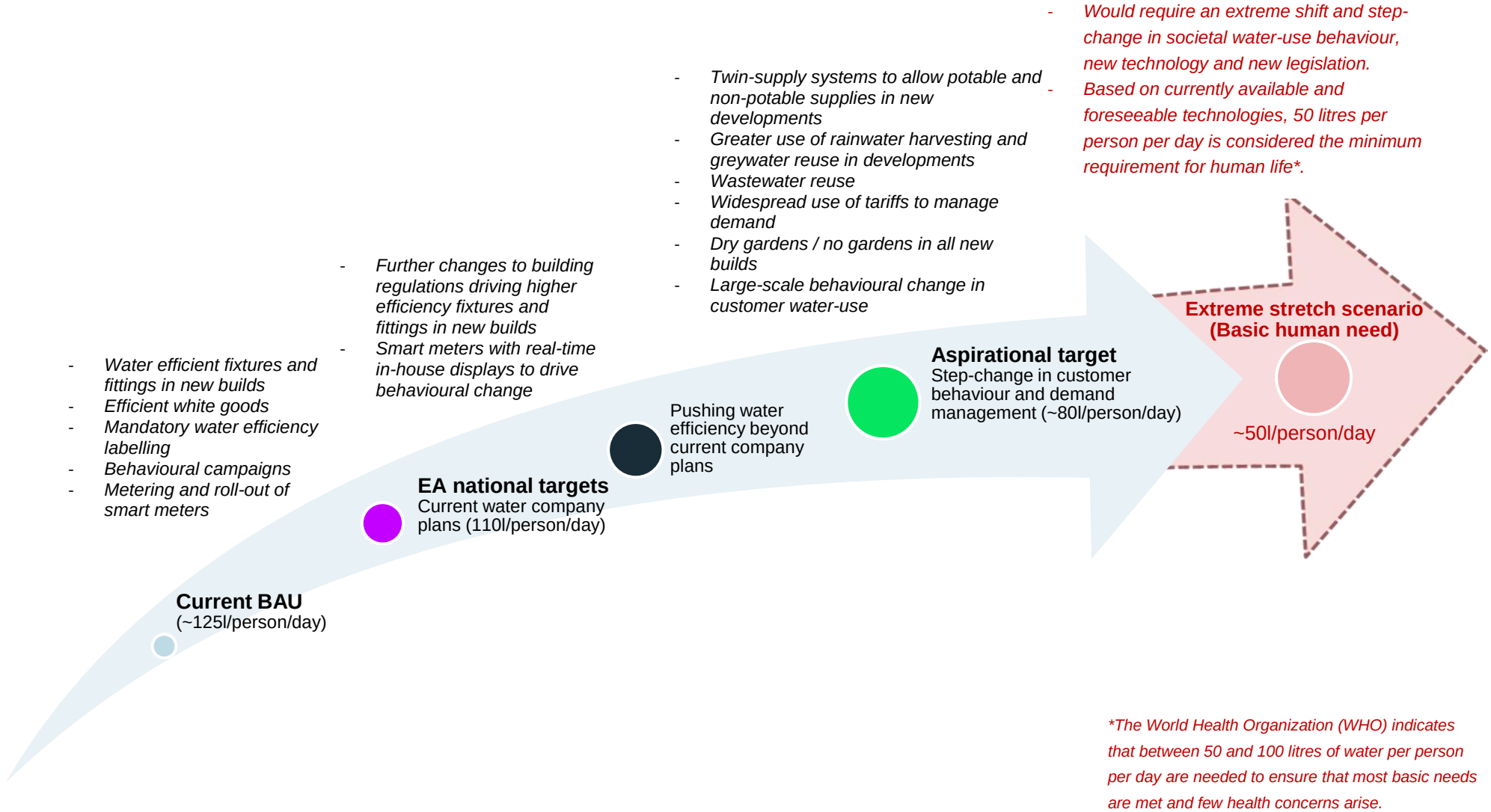


Figure 2-3: Water efficiency ambition – what's required?

Figure 2-4 summarises the scenarios that have been developed to represent the water-use of customers in new build households. These are described further in Table 2-2. The scenarios for modelling are indicated by solid-coloured lines. Other scenarios considered are shown as grey to provide context.

It was noted during stakeholder engagement that if new house building regulations are changed to stipulate either 80 litres per person per day or 50 litres per person day there would be a lagged uptake of those savings whilst the new homes that have been approved on current regulations are still being built and making their way through the planning system. This has been reflected in the selected scenarios. As outlined in Section 2.1.2 it is also important to note that these new build PCC scenarios will be highly reliant on changes to regulations, standards and new technology as well as a water credits market where new build PCC can be offset by developers funding retrofit and efficiency activities in the wider existing housing stock that deliver savings beyond Cambridge Water's rdWRMP.

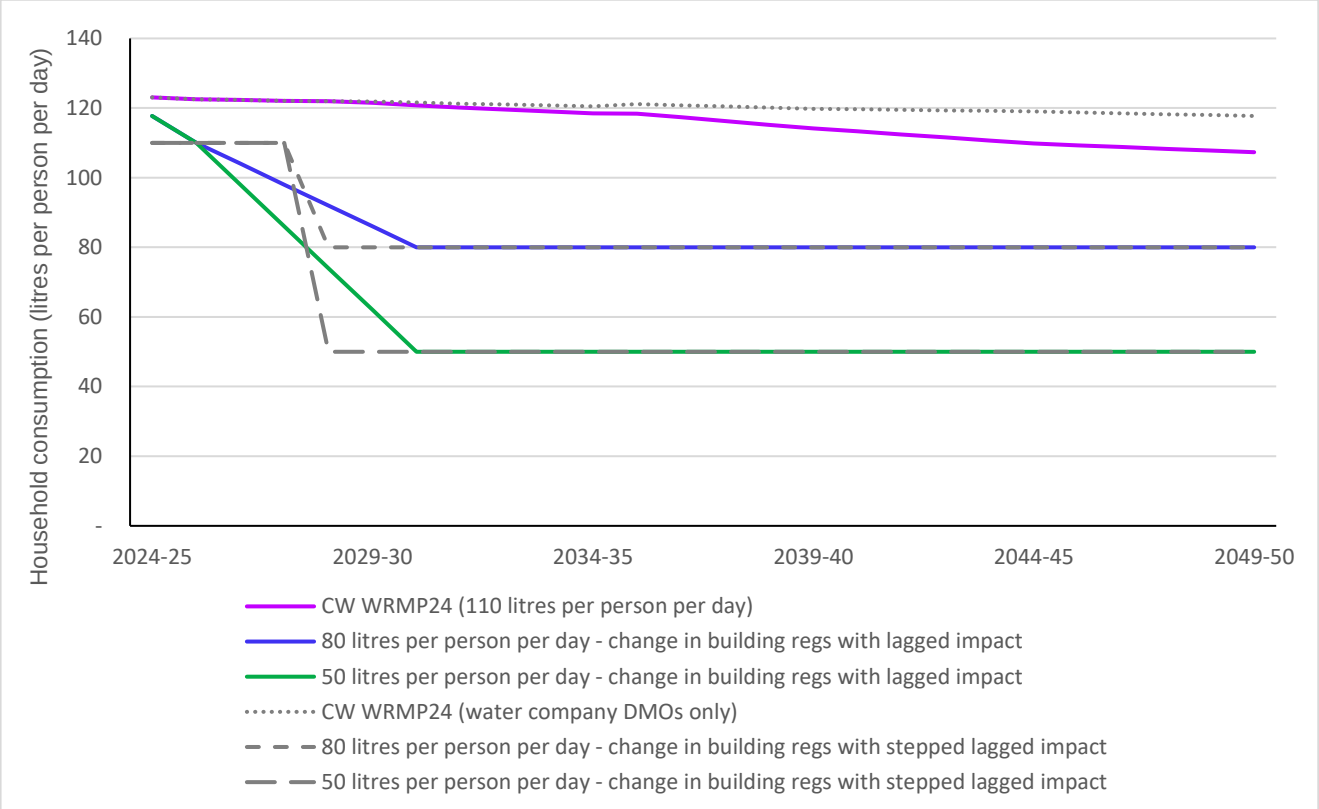


Figure 2-4: New build occupants' water use scenarios (solid-coloured lines represent the agreed project scenarios)

Table 2-2: Summary of selected new build water use scenarios

Scenario name	General assumptions	Average annual PCC (litres per person per day)		Percentage saving 2024/25 to 2050 (%)
		2024/25 to 2029/30	2030/31 to 2050	
CW WRMP24 (110 litres per person per day)	Per Capita Consumption forecast from Cambridge Water's revised draft WRMP24 including both water company and government-led initiatives to reduce household demand (final plan dry year annual average forecast).	122	117	7
80 litres per person per day	Assumes 80 litres per person per day will be included in building regs within the next couple of years. Includes a lag in the system as housing approved pre-80 litres per person per day moves through the system. Assumption that by 2025 all approved applications are at 110 litres per person per day with gradual transition to all new builds built to 80 litres per person per day regulation by 2030.	101	80	32
50 litres per person per day	Extreme 'what if' stretch scenario. Assumes shift change in societal water-use behaviour, new technology and new legislation to allow changes in how water is managed for example, allowing the supply of non-potable water by water companies. Also assumes that 50 litres per person per day will be included in building regs within the next couple of years and/or achieved through developers funding additional retrofit projects within the existing building stock that deliver savings beyond Cambridge Water's rdWRMP. Includes a lag in the system as housing approved pre-50 litres per person per day moves through the system. Assumption that by 2025 all approved applications are at 110 litres per person per day with gradual transition to all new builds achieving net 50 litres per person per day potable water use by 2030.	91	50	58

2.1.3 Total new build household water use scenarios

Figure 2-5 uses water company forecast occupancy rates[10] of ~2.4 people per household to calculate the total new build household net potable water use projected under each scenario[11]. This shows that just for the new build households alone the scenarios suggest that between 20Ml/d and 40Ml/d is required to satisfy the household water demand by 2050 under the optional, tighter water efficiency standard currently in Building Regulations (110 litres per person per day).

However, it is important to highlight the uncertainty in the assumptions applied within these indicative scenarios. It is widely accepted that homes built to a 110 litres per person per day standard often use much more water in practice. For example, Thames Water cites an average of around 140 litres per person per day usage in new homes built to a 110 litres per person per day standard, utilising data from smart meters. There is also uncertainty in the longevity of the savings once houses are occupied due to the influence of customer water use behaviour and occupier replacement of fixtures and fittings. For these reasons, Anglian Water Services use the average per person usage recorded from their metered households for new builds instead of 110 litres per person per day and Cambridge Water will review their new builds water use once smart meter data is available in AMP9.

As such, these estimates of additional water demand may significantly understate the challenge. This places an emphasis on water companies, local authority planners, housing developers and government to work together to reduce average per capita consumption amongst households.

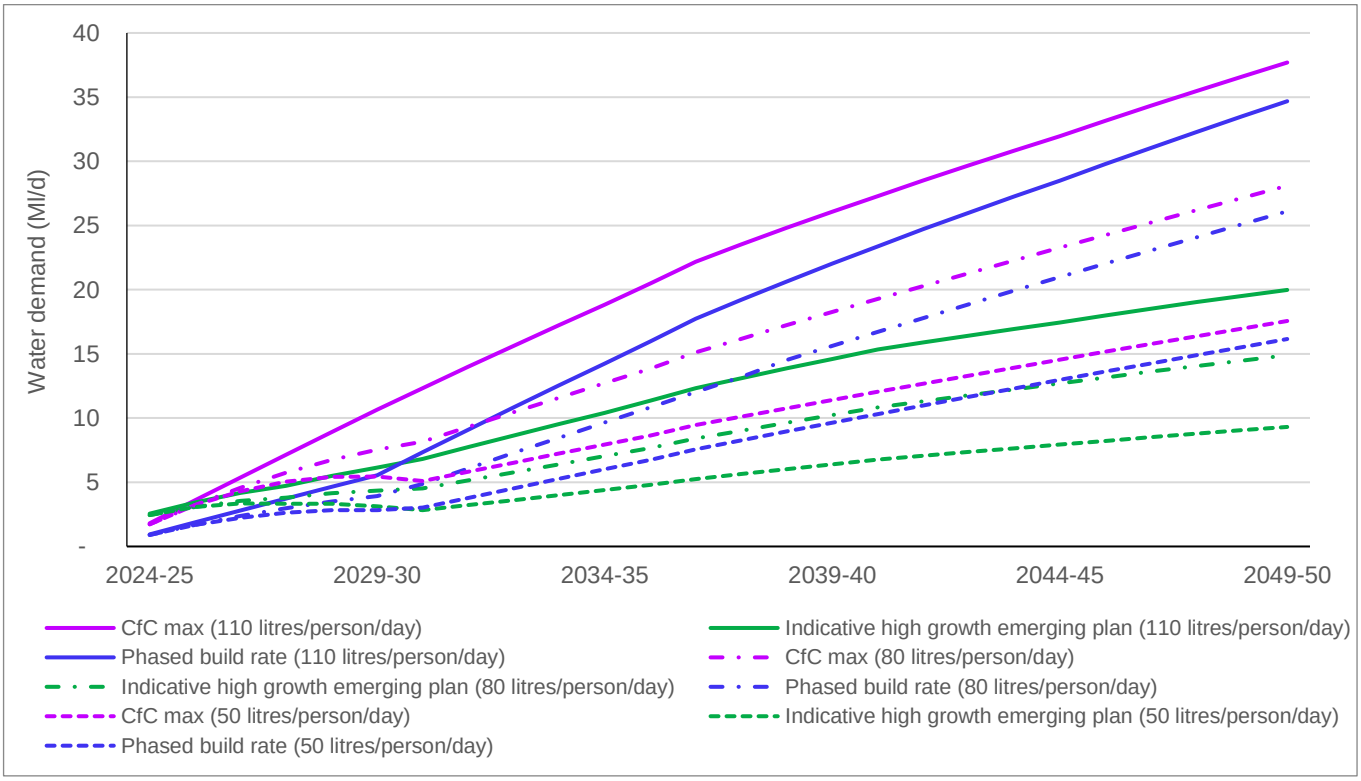


Figure 2-5: New build household water use scenarios

[10] taken from Cambridge Water's revised draft Water Resources Management Plan 2024

[11] Scenarios of new build households represent total new builds within the Cambridge WRZ, they are not in addition to current forecasts of new households.

2.2 Non - household water use

Non-household water use refers to usage associated with users in sectors such as commercial properties, health services and industry. Cambridge Water has seen a significant increase in non-household development plans over the last few years, as the supply area becomes a growing hub for science and innovation. The Case for Cambridge was published by Government in March 2024 which outlines the aspirations for sustainable economic growth in Cambridge and its importance for contributing to a successful national economy. This will create further demand for water amongst non-household customers.

However, the Environment Agency is concerned about risks of deterioration in local water bodies and the Government is seeking a national target of a 9% reduction in business and industrial (non-household) water consumption by 2038. In Cambridge, where water supplies are constrained and there is concern over the environmental impact of new abstractions, water availability whilst protecting the environment is becoming a blocker to economic growth. Currently some water companies in the region are assessing each request on a case-by-case basis, but some large requests for water from businesses have had to be refused until new supply options in the region become available.

2.2.1 Challenges of forecasting and managing non-household water use

It is difficult for planners to assess the future growth of businesses and for water companies to forecast the potential water needs for a number of reasons including:

- There are known data quality issues with measured water-use which the market operator is working to improve. In 2019 it was reported that the proportion of water meters that have gone unread for more than a year has doubled from 7% to 15% since the market opened in 2017. 5% of meters have not been read for over two years[12].
- Local authorities have difficulty in forecasting future water demand for inclusion in development plans. For example, it is difficult to predict whether warehousing with low water usage or businesses with very large water needs will occupy specific sites.
- The water requirements of individual developments and sites can change toward more water-intensive types between the local plan stage and when proposals come forward.
- Businesses could seek to increase their use of public water supplies in response to their own abstraction licences being capped or reduced.
- There are potentially very significant new water requirements from emergent technologies and sectors, for example for data centres, green hydrogen production and carbon capture, usage and storage. There is high uncertainty over how much water each of these industries typically use, indicating a need for better data sharing.
- Developers may seek access to the public water supply given the difficulty in securing new abstraction licences of their own.
- In Cambridge, developers are looking to build on the Government ambition for the city to be the European Science Capital and are proposing science park and laboratory developments that do not have proposed tenants, and therefore water requirements are not clear at point of development.

[12] Ofwat, 2019. State of the market 2018-2019: reviewing the second year of the business retail water market. State-of-Market-Report-2018-19-Final.pdf (ofwat.gov.uk)

2.2.2 Non-household water use scenarios

Given the large uncertainty in future growth forecasts for both the type and the numbers of businesses and industries and other non-household sites being developed in the WRZ over the next 25 years, our forecasts are driven by the household population forecasts. In this way, the non-household forecasts are coherent with the household growth scenarios.

The following assumptions were adopted:

- Non-household growth is directly related to population growth within the Cambridge Water WRZ, i.e. the new population within the region will be employed by new industry within the region.
- The current proportion of industry sectors and other non-household users remains unchanged in the future.
- The water reduction measures planned within Cambridge Water's WRMP24 will be applied to all new businesses.

In future studies, other scenarios could be explored with different mixes of industries, such as biotech, large technology firms and healthcare. However, our work provides coherent scenarios that can be used as a starting point to explore the scale of potential water needs to support further economic growth in Cambridge WRZ. The scenarios generated are comparable with employment growth rates forecast by Greater Cambridge Shared Planning[13] shown in Table 2-3.

Table 2-3: Sector employment growth to 2041 for Greater Cambridge ('000s)[14]

Sector	2020 employment count	Central scenario (change)	High scenario (change)
Health and care	20.4	+10.8	+13.4
IT services	13.4	+5.1	+6.6
Head offices and management con.	6.4	+5.1	+5.7
Architectural and engineering	10.2	+6.7	+7.3
Other professional services (inc. R&D)	20.5	+15.6	+20.3
Other manufacturing and repair	1.6	+0.8	+0.9
All sectors	213.6	+66.6	+76.7

The scenarios generated are shown in Figure 2-6 and suggest that anywhere between 15Ml/d and 25Ml/d of extra water, beyond that currently planned for, could be needed to support economic growth in the region. This could be anywhere between a 40% and 70% increase in the non-household demand for water within Cambridge WRZ. This does not account for potential increases in the proportion of water intensive sectors which would add to this challenge. This incorporates planned water reduction activities for non-household users, as outlined in Cambridge

[13] Greater Cambridge Employment and Housing Evidence Update (greatercambridgeplanning.org)

[14] Sourced from analysis presented in Greater Cambridge Employment and Housing Evidence Update (greatercambridgeplanning.org)

Water's rdWRMP24, which **for planned non-household demand only**, is proposed to reduce the forecast growth in NHH consumption in 2038 by 11% (from 35 Ml/d to 31 Ml/d). Regardless of these planned water reduction activities for non-household users Cambridge Water's rdWRMP24 still forecasts a growth in non-household demand of 55% by 2038 from the 2019/20 position. Therefore, with such a focus on economic growth for the region, it will be difficult to meet the Government's target of 9% reduction in non-household water use by 2038 without a radical change in demand management options to reduce NHH water use.

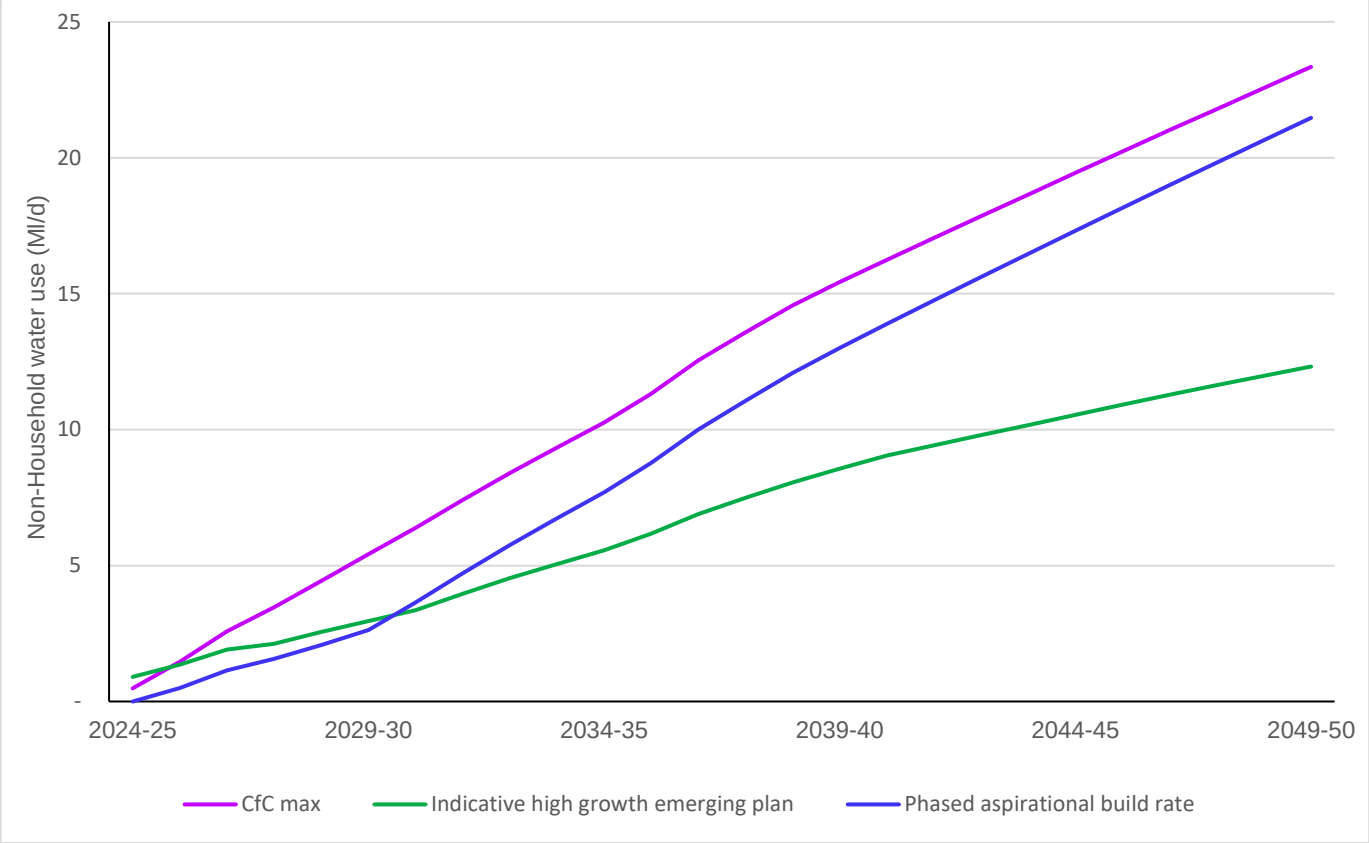


Figure 2-6: Non-household water use scenarios

3. The scale of the challenge

Figure 3-1 shows the impact when the new growth water needs are combined with the existing housing stock and the industry and businesses that are already operating in the area to show the total need for public water supply (Distribution Input, DI) over the planning period. Cambridge Water's rdWRMP projection is also shown (black line), which already includes large strategic options and an ambitious demand management and leakage reduction programme[15]. To achieve the aspirations for further growth in the region, new solutions will be required to find approximately an extra 15 to 55 Ml/d, depending on the actual pace of growth and its water demand, compared to Cambridge Water rdWRMP24 projected future DI. If more water intensive industries arrive, the additional need for water will be even higher.

At the upper end of the scenarios presented, approximately an extra 55Ml/d could be needed to support the Case for Cambridge's maximum growth ambitions. Even if new build household customers' net potable water use is reduced to 80 litres per person per day, approximately an additional 45Ml/d may be required.

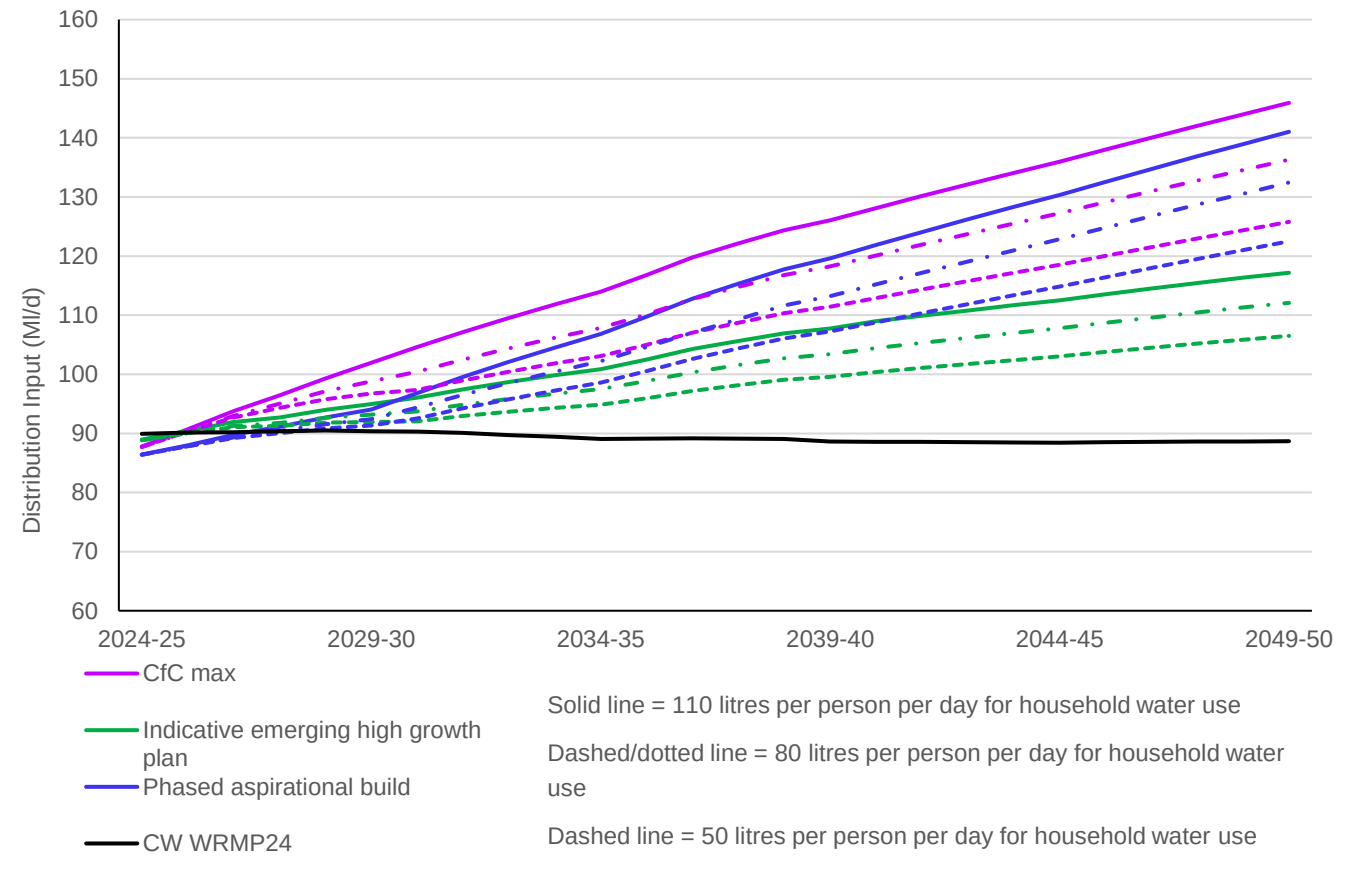


Figure 3-1: Impact on Cambridge Water's WRZ distribution input (demand for water)

[15] Regional Water Resources Plan for Eastern England, December 2023. WRE-Regional-Water-Resources-Plan-for-Eastern-England.pdf

4. Finding a solution

The growth scenarios presented in this report were modelled using the WRE regional water resource simulator to identify the impact on future supply options across the region. Nexsys Analytics then applied an optimisation algorithm to test several portfolios of future supply options that maximise multi-sector performance, minimise costs and are low regret[16]. These portfolios included the full range of feasible supply options that were considered for the WRE regional plan. We also included a 'dummy option' node within the simulator modelling to isolate how much additional water is needed to meet the scenarios of housing and economic growth for Cambridge.

The search identified that both combinations of feasible supply options and the 'dummy option' are required to meet the higher demand associated with the growth scenarios. The existing supply options to the Cambridge Water WRZ from the WRE system include the Grafham to Cambridge Water Transfer and the Fens Reservoir. The search indicated that between approximately 10Ml/d to 30Ml/d additional capacity is required across the simulated scenarios and good performing portfolios. In this way, the search has indicated that increased levels of water demand driven by housing and economic growth cannot be met by proposed WRE regional plan/Cambridge Water WRMP24 solutions alone due to constraints on abstraction licences and source capacities. The Case for Cambridge growth scenario requires the greatest additional capacity.

To support growth in the WRZ, a mix of new solutions from local to national scale will be required. As summarised in Figure 4.1. WRE's current Regional Plan will likely need to be enhanced with a mix of additional demand management, local and regional options alongside changes to national legislation and regulation to support new ways of managing water (e.g. allowing water companies to supply non-potable water for certain purposes). Shared solutions with other sectors will also be needed. The Regional Plan is an adaptive plan and relies on reuse and desalination options that are scalable to accommodate uncertainty and allow for the emergence of new challenges. However, the modelling undertaken in this study suggests that because Cambridge is such as constrained water resource system, the scale of the growth challenge in Cambridge erodes all adaptive flexibility and capacity within the current Regional Plan and that new options need to be sought.

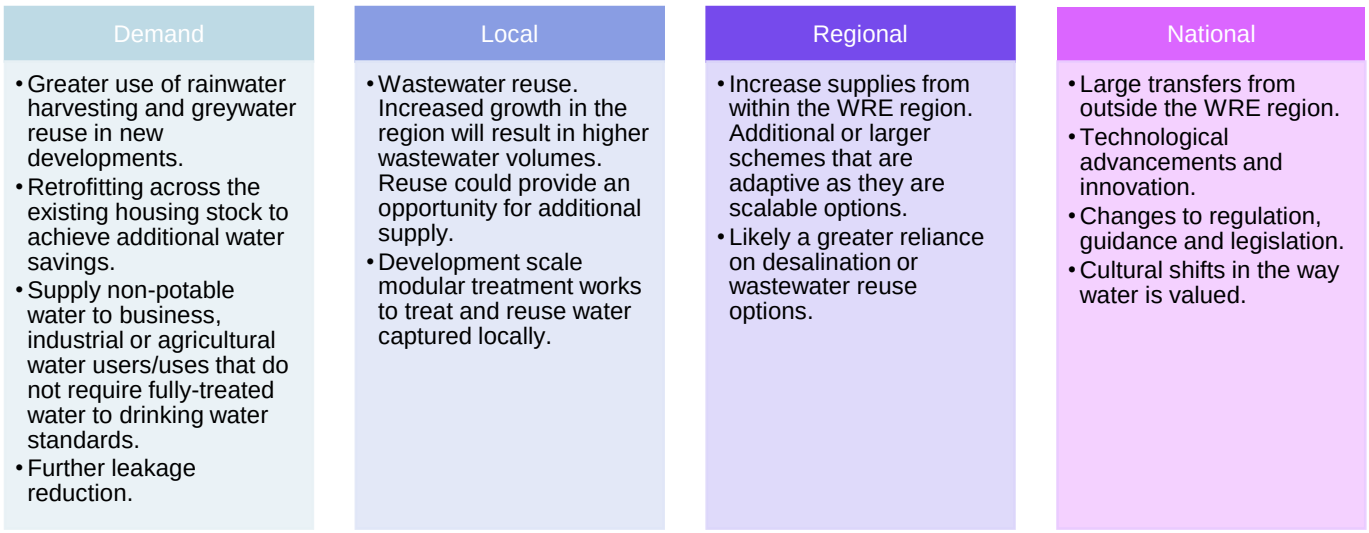


Figure 4-1 - Summary of potential options to support growth in Cambridge WRZ

[16] Nexsys analytics search results are presented in an accompanying report.

4.1 Simple mass balance tool

To support understanding of how water is sourced, used and recycled in the WRZ, we have created a simple mass balance tool (see Figure 4-2).

The flexibility is provided to increase the boundaries of the tool to a catchment rather than water company resource zone geographies. When developing potential water resources solutions that will support growth scenarios for Cambridge, it is important they are set in the wider context. Long-term water company planning includes potential reductions in abstraction from existing sources where they are deemed to be adversely affecting the aquatic environment. This process is intended to reduce the harm of existing operations and is termed Environmental Destination. For the Greater Cambridge area, Environmental Destination will potentially drive significant investment in new, alternative sources of water that will meet future needs. All new sources will need to demonstrate that they do not cause environmental harm. This means we will need to look for new innovative local solutions that go beyond the current suite of 'traditional' options and may need to look at the wider catchment or regionally and potentially nationally to find shared solutions. The combination of Environmental Destination and ambitions for the growth and prosperity of Cambridge present significant challenges but may drive efficiency if solutions for Cambridge can be developed alongside wider solutions for the WRE region. The mass balance tool provides flexibility to consider both the impact of varying Environmental Destination and it could be expanded to explore the possibility for options in the wider catchment.

The functionality has also been provided to explore more innovative options such as:

- Using wastewater reuse as a potential option for supply.
- Identifying industrial or business uses that could be supplied with non-potable water, to relieve pressure on the public water supply.
- Working with the agriculture sector to increase raw water winter storage.

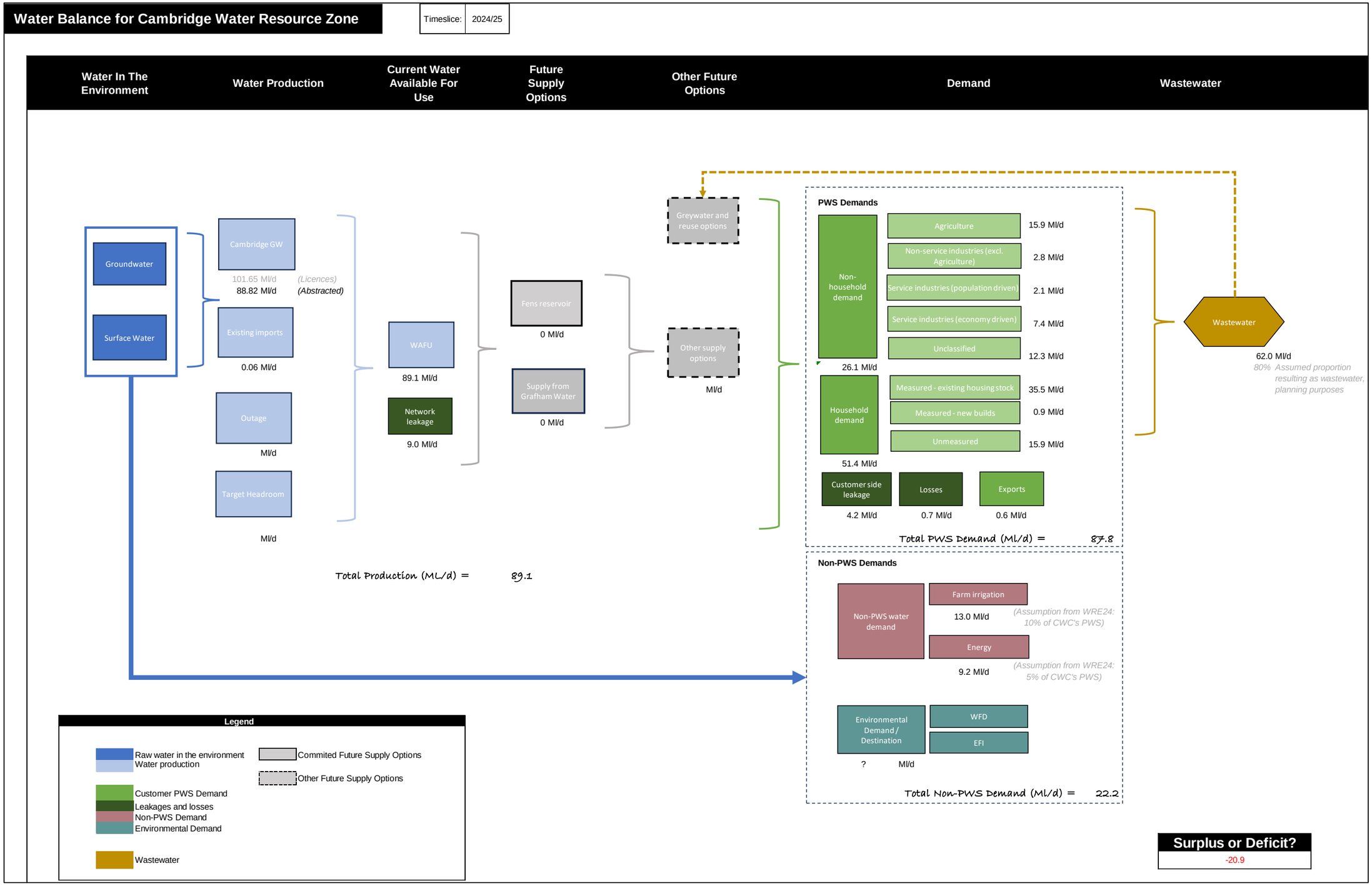


Figure 4-2: Screenshot of the mass balance model for Cambridge WRZ

5. Recommendations

This initial phase of work has provided growth scenarios that help members of the Cambridge Water Scarcity Group understand the challenge, contextualise and explore the implications of additional growth in the Greater Cambridge region, the uncertainty in those growth forecasts, and its impact on the current WRE Regional Water Resources Plan. This has set the scene and provided a discussion of the types of water resource management solutions that may be needed to unlock growth in the region.

However, we acknowledge that there will need to be further, and more detailed, work to be done to identify the exact 'low regret' options that will be required to meet the projected deficits in the public water supply, and when decisions would be needed so they can be brought into supply in a timely and cost-effective way. Further studies are also needed to improve the evidence base about potential build rates, development sites and the types of industry expected in the region.

In particular, our work has identified the following recommendations that would support future phases of this work:

- This phase has provided an overview of the scale of the challenge but importantly, this work should be developed further to understand the specific 'best value' options that will be required, phasing of solutions and to understand tiggers for investment/when decisions will need to be made. Consideration should be given to what level of growth is sustainable. Depending on updates to building standards for the region PCC scenarios of 105 litres per person per day and/or 100 litres per person per day may need to be explored.
- Integrate and improve alignment between the Drainage & Wastewater Management Plan and Water Resources Management Plan for the Greater Cambridge area:
  - Work to date has been delivered separately.
  - There are likely to be common solutions to the pressures of growth on both water and wastewater services (such as wastewater reuse).
- Look for shared solutions with business and industry:
  - Identifying sources and uses for non-potable water and water re-use that could relieve pressure on the public water supply and 'free up' water within the constrained Cambridge water system.
  - Certain industries and sectors (e.g. biotech) within Greater Cambridge may play a role in developing new technologies that can be part of the solution.
- Instigate research to support the development of the next round of water company and regional plans:
  - Continued sharing of data on economic and population forecasts for the region to reduce uncertainties (e.g. numbers and phasing of new housing build rates).
  - Commence research into non-household demand for businesses and industries based on typical and emerging water use, particularly for the lesser understood 'water hungry' industries that the Government is hoping to attract to the Greater Cambridge area.
  - Investigate how legislation or regulation change may allow water companies to support a move towards water neutral developments (e.g. upscaling greywater reuse to a development scale and retrofitting across existing housing stock).
  - Further exploration of adaptive planning including the identification of metrics and triggers for actions/decisions. Consider how this can be integrated into company monitoring programmes and risk management registers or systems. This would help ensure that key factors that influence plans are monitored and, when necessary, trigger a change in adaptive pathway if, for example, companies experience slower demand reductions than forecast or there are supply scheme delays.
- Continue to engage with other regional groups to explore opportunities for inter-region transfers.

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