GARD response to

Affinity Water's Consultation on

Draft

Water Resource Management Plan 2024

20th February 2023

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GARD response to consultation on Affinity Water's draft WRMP24

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Scope of this response

This response focuses on the need for new resources and their timing in Affinity Water's Central Region – the supply zones to the North and West of London. These are the zones that are potentially supplied by water from Thames Water's proposed Abingdon Reservoir or from the Severn to Thames Transfer. However, GARD's commentary on Thames Water's need for either Abingdon Reservoir or the Severn to Thames transfer, and the choice between them, has been left until 20th March because of the delay in the consultation on Thames Water's WRMP and in Thames Water's delayed responses to information requests.

Affinity Water's deficit forecast

Affinity Water's ultimate forecast deficit between supply and demand has been over-estimated by about 200 Ml/d by 2075 because of:

- over-estimation of population growth by use of unrealistic local authority housing plan figures instead of the much lower Office of National Statistics population growth forecasts;
- assumptions for reducing per capita consumption (PCC) which are too slow and fail to meet the Government's 110 l/h/d target – the combination of excessive planned population growth and inadequate PCC reduction inflates the deficit by about 120 Ml/d by 2075;
- the inclusion of 86 Ml/d of unnecessary abstraction reductions in the lower Colne – GARD agrees the need for about 150 Ml/d of abstraction reductions in the upper Colne and Lea chalk stream tributaries and 35 Ml/d of reductions in upper Ouse chalk stream tributaries. However, the lower Colne is a heavily modified river, which will benefit from the upstream reductions, so there is no need for the further 86 Ml/d of reductions.

GARD's proposal for dealing with the Central Region deficit

GARD fully supports proposals by the Chalk Streams First (CSF) group of NGOs to bring forward abstraction reductions in the 'classic' upper catchment chalk streams by the early 2030s. Our re-assessment of the Central Region supply demand balance shows that this can be achieved by the early 2030s through:

- at least the first 50 Ml/d phase of the GUC transfer, possibly the full 100 Ml/d transfer as insurance against higher than expected demand growth
- bringing forward the first 50 Ml/d phase of the Thames to Affinity transfer
- preferably, a transfer of 30 Ml/d from Anglian Water (or an increase in the Thames to Affinity transfer)

These measures, combined with realistic population growth and PCC reduction, would maintain the Central Region supply demand balance to 2040, with PCC and leakage reductions that are still well short of Government targets. If these targets are ultimately met, the Central Region would have a surplus of up to about 100 Ml/d after 2040 – in other words, there would be a substantial safety factor against non-achievement of the Government targets.

Affinity Water's need for Abingdon reservoir or Severn to Thames transfer

GARD supports the analysis by the recent Chalk Streams First report that shows flow recovery from chalkstream abstraction reductions would lead to over 50% recovery of deployable output from downstream reservoirs. We consider the 17% deployable output recovery assumed in Affinity Water's plan to be far too low, for the reasons explained in the CSF report. If deployable output recovery in the downstream reservoirs is at the much higher level shown by the CSF report, the future Affinity supplies, after allowing for all the upper chalk stream reductions, can be maintained without the need for either Abingdon reservoir or the Severn to Thames transfer.

In our response to Thames Water's consultation on their draft WRMP, due on 20th March 2023, GARD will provide further evidence for the ability of Affinity Water's future supplies to be maintained without the need for Abingdon reservoir or the Severn to Thames transfer.

Potential for WBGWS-type schemes in the Chilterns

GARD recognises that there is uncertainty over the amount of flow and deployable output recovery from the chalk stream abstraction reductions. However, this uncertainty can be managed by use of the upper catchment chalk aquifers for drought support schemes similar to the existing West Berkshire Groundwater Scheme (WBGWS).

If flow recovery from the chalk stream abstraction reductions is less than expected, Affinity Water's supplies could still be maintained without the need for Abingdon reservoir. If flow recovery is over 50%, as forecast in the CSF report, the WBGWS concept would allow a net <u>gain</u> of about 50-60 Ml/d in London deployable output.

Outline proposals for this type of scheme have been put forward in the recent Chalk Streams First report and a report on relieving Affinity Water's over-abstraction in the River Ivel (an upper Ouse chalk tributary). A pre-feasibility study of the Ivel proposal is currently being undertaken jointly by Affinity Water and Anglian Water, with a report due in summer 2023.

In principle, the conjunctive use of the chalk aquifer and the reservoirs downstream, as for the WBGWS scheme, appears a much better way of using the chalk water resource, with far less impact on chalk streams than continuous pumping of water supplies directly from the chalk. The concept should now be investigated as a matter of urgency, with the aim of implementing one or more pilot schemes in AMP8 and full implementation in AMP9.

1. Introduction

1.1 GARD’s role

Group Against Reservoir Development (GARD) is a community-based organisation representing local residents and businesses, mainly in the South Oxfordshire villages of Steventon, Drayton, East and West Hanney and Marcham, who would be affected by Thames Water’s plans to build a major new reservoir near Abingdon.

GARD campaigns against this inappropriate reservoir solution and in favour of sustainable water resource options such as effluent reuse and raw water transfer from Severn to Thames. We also strongly support demand-side measures to reduce leakage of water and efficient use strategies, including metering. GARD's membership includes many technically-qualified people, and we are advised by Water Industry professionals. GARD's website is at http://www.abingdonreservoir.org.uk/.

1.2 The scope of this response

This response focuses on the need for new resources and their timing in Affinity Water’s Central Region – the supply zones to the North and West of London, numbered WRZ1 to 6 (see Figure 1 below). These are the zones that are potentially supplied by water from Thames Water’s proposed Abingdon Reservoir or from the Severn to Thames Transfer.

However, GARD’s commentary on Thames Water’s need for either Abingdon Reservoir or the Severn to Thames transfer, and the choice between them, has been left until 20th March because of the delay in the consultation on TW’s WRMP and in TW delayed responses to information requests.

Figure 1 - Affinity Water's supply zones

2. Affinity Water’s need for new resources

2.1 Supply demand balance for Affinity Water’s Central Region

The dry year annual average (DYAA) baseline supply demand balance for the Central Region has been derived by summing the WRMP tables for zones WRZ 1 to 6, as shown in Figure 2.

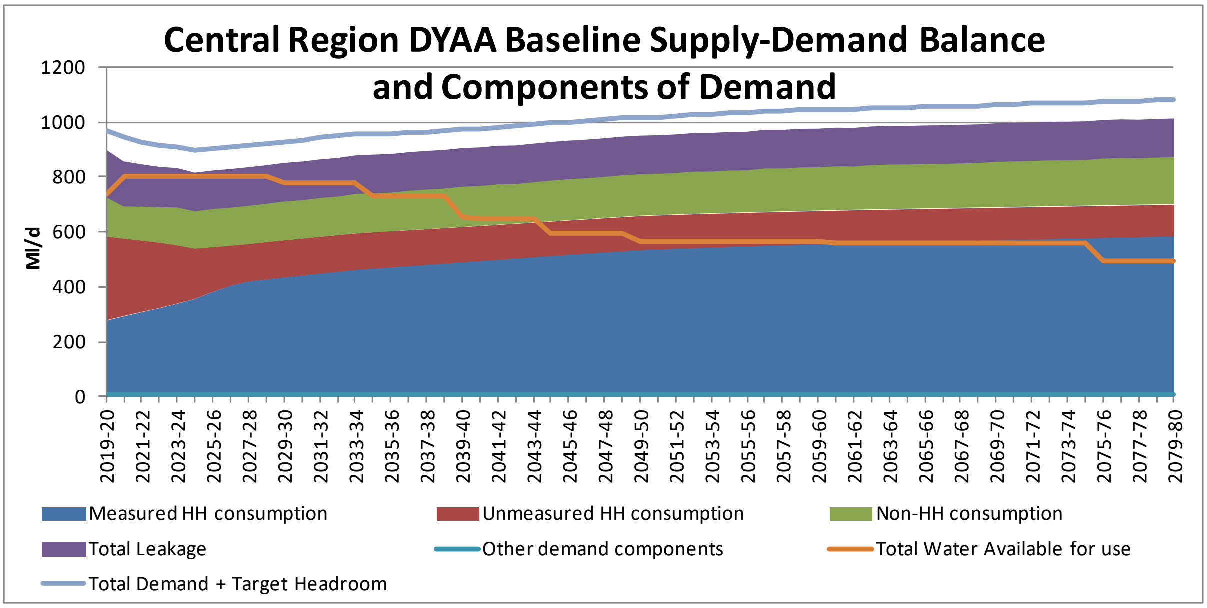


Figure 2 - Central region DYAA baseline supply demand balance

The “baseline” supply demand balance includes measures in the current, 2019-24, business plan for leakage reduction, demand reduction and new sources; it does not include any such measures beyond 2024. The declining ‘Water Available for use’ allows for planned future abstraction reductions and loss in deployable output due to climate change throughout the planning period.

The baseline supply demand balance shows a deficit between supply and demand throughout the plan period. The main components of the deficit are shown in Table 1 and illustrated in Figure 3:

All in Ml/d	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075	2080
Abstraction reduction	0	0	21	66	137	190	278	278	278	278	278	278	278
Climate change	10	12	14	16	24	27	29	32	34	36	39	41	44
Leakage reduction	0	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33
Increased consumption	0	-84	-49	-19	5	27	50	64	75	85	97	102	112
Target headroom	56	68	67	62	58	58	56	56	58	57	57	57	57
Total deficit	**232**	**92**	**150**	**221**	**323**	**400**	**454**	**469**	**482**	**492**	**504**	**509**	**589**

Table 1 - Components of Affinity Water’s Central Region baseline deficit

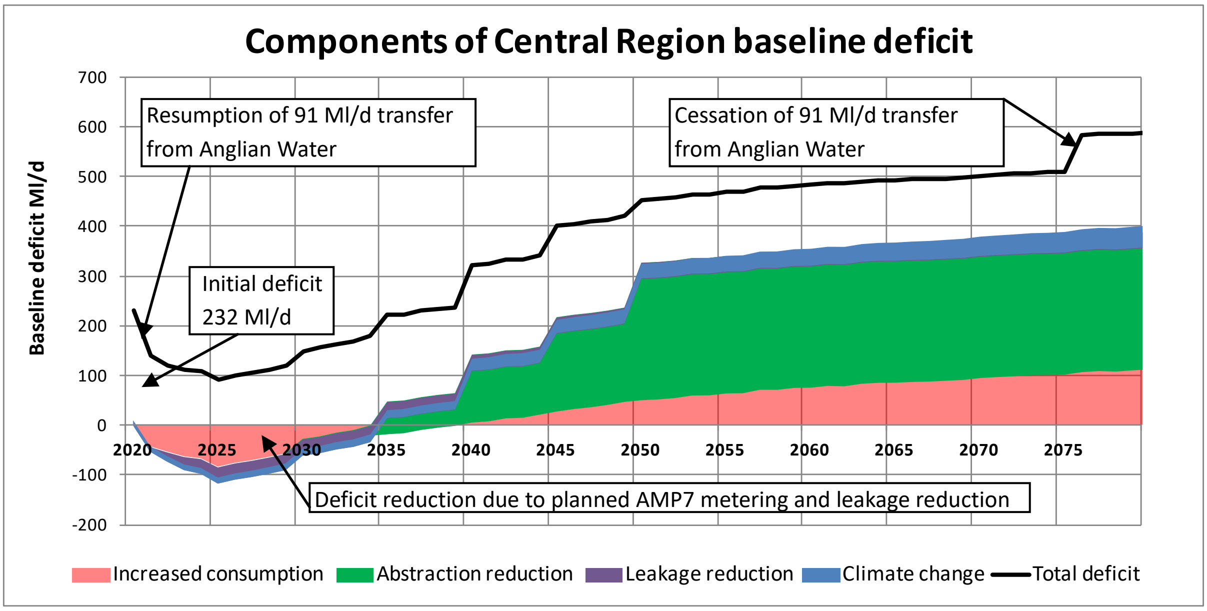


Figure 3 - Affinity Water growth in Central Region baseline deficit 2020 to 2075

Affinity Water's plan starts with a deficit of 232 Ml/d in 2019. This is because a) the baseline deficit excludes allowances for demand reduction by Temporary Use Bans (TUBs)and Non-essential Use Bans (NEUBs), b) the baseline deficit excludes current allowances for drought permits/orders, and c) the initial baseline deficit excludes the 91 Ml/d transfer from Anglian Water which was temporarily suspended in 2019. The deficit shown in Figure 3 reduces by 91 Ml/d in 2021 due to resumption of the temporarily suspended Grafham transfer. The TUBs and NEUBs are included as measures in the Final Plan, but not most of the drought permits/orders.

Figure 3 shows the large initial baseline deficit reducing up to 2025 due to demand management and leakage reduction in the current AMP7 business plan. After 2025, the baseline deficit rises rapidly due to abstraction reductions, rising consumption due to population growth and allowance for loss of deployable output due to climate change.

Affinity Water's existing supplies are almost all from groundwater sources, which are not significantly affected by the increase in the drought resilience standard from 1 in 200 years to 1 in 500 years. Table 5.1 of the main WRMP document shows a loss in DO of only around 1% due to the switch to 1:500 resilience in 2040 – this is a minimal part of the forecast deficit.

2.2 Population growth and the increase in consumption

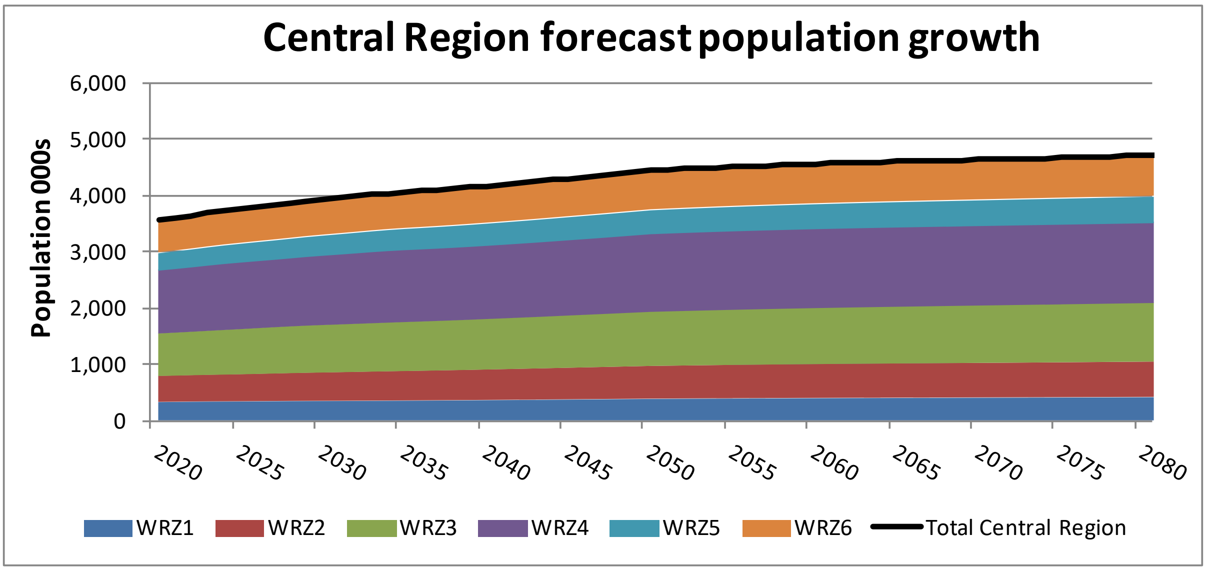
Headlines:

- GARD believes the population methodology used in the WRMP is not fit for purpose

- GARD has proposed a simple methodology that complies with the need in the WRPG to use local planning data modified by other projection data that would be simpler, easier and more widely acceptable to stakeholders

- Our calculations show that the Affinity Water population estimates may be over-stated by 632,000 by 2050 and 742,000 by 2080. At the baseline PCC of about 150 l/head/day, that is equivalent to an over-forecast of the baseline deficit by 95 Ml/d in 2040 and 111 Ml/d by 2080.

Affinity Water's forecast population growth up to 2080 in the six Central Region zones is shown at Figure 4:



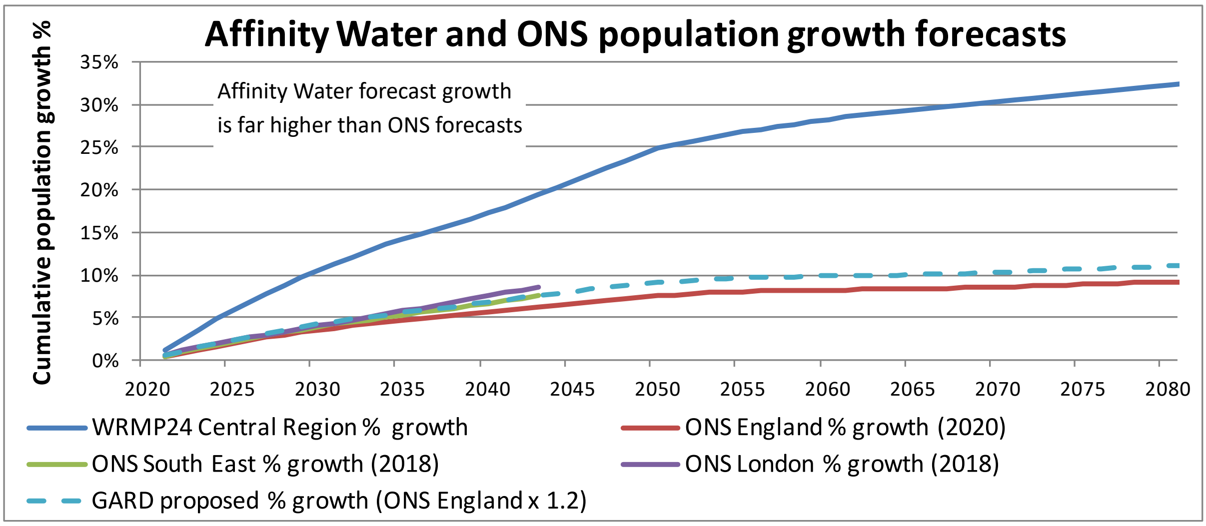
Data from Affinity Water WRMP tables

Figure 4 - Affinity Water forecast population growth in Central Region

Affinity Water's forecast rate of population growth is far higher than Office of National Statistics population growth forecasts for England[1] and for the South East and London regions[2], as shown in Figure 5:

[1] ONS population forecast for England in 2020 https://www.ons.gov.uk/file?uri=/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/z3zippedpopulationprojectionsdatafilesengland/2020basedinterim/enpppopendata2020.xls

[2] ONS regional population forecasts in 2018 https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/regionsinenglandtable1



Note: ONS regional forecasts are only available to 2043

Figure 5 - Comparison of Affinity Water and ONS population growth forecasts

The WRMP 24 Central Region % growth line is obviously and demonstrably unrealistic. The marked reduction in growth rate that occurs at around 2050 shows the perennial problem with water company population projections. The period up until 2050 represents a forecast based mostly on local area plans and CPRE and others have shown that, often, only 40% or less of any proposed development is delivered. Hence there is an alarming disparity between the WRMP Central projection and the ONS projections.

Worse, even though the projection reverts to ONS rates of growth after the end of local area plans, these rates of growth are applied to the already greatly inflated figures assumed from the local plans. Presumably this is the reason for the Central projection continuing to diverge from the ONS projection, even though, logically, it should mirror it.

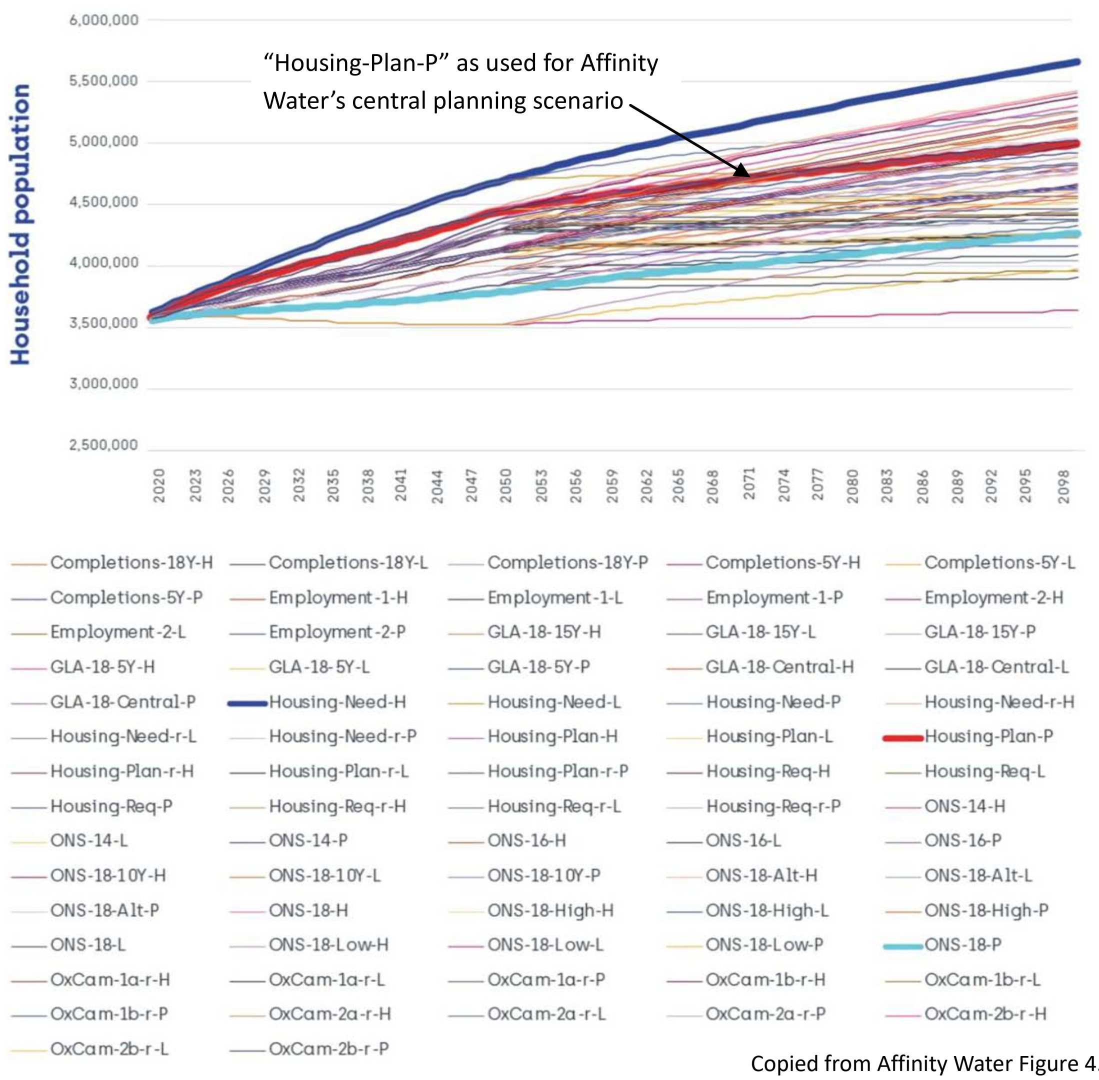
Previously, South East water companies and WRSE have argued that the South East is a special case and that growth in the region is greater than in the rest of England. This argument is not supported by the ONS sub-national population projections for England.[3] These show a growth projection across the regions of England between 2018 and 2028 of between 2.3% and 7%, with an average of 5%. The projection for the South East is 4.4% and for London 4.9%; both are below the average.

Using the projected England growth rate, a Central Region 2020 starting point of 3.6 million from Figure 4 above would, at ONS growth rates, become 3.87 million in 2050 and 4.06 million in 2080. This would mean that the respective Affinity figures were too high by 632,000 and 742,000 respectively. Our calculation uses ONS calculated rates to 2045, by which time annual growth has fallen to 0.16%, which is applied through to 2080.

[3] Table 1: Projected population change for English regions, mid-2018 and mid-2028, ONS Subnational population projections for England: 2018 based, Published 24th March 2020

In fact, growth rates are expected to be even lower than used here. In the 2020-based Principal Projection - England,[4] which covers out to 2120, the growth rate falls to 0.1% by 2051 and continues to fall to around 0.04% by 2057, before finally becoming negative by the end of the century. The BBC has reported that latest studies now expect the UK population to peak in 2063 and fall thereafter.[5] Worldwide estimates of when different countries will move from positive to negative population growth are being constantly revised forward. The implications of a steady or falling UK population, as raised by leading statisticians and analysts, are profound, but are not even mentioned yet alone addressed in this plan.

In fact, the general analysis carried out by Affinity on its population projection can only be described as naïve and simplistic. The Affinity Water makes much at paragraphs 4.49 - 4.51 and Figure 4.8 of the development of 72 different projections for each WRZ, as below:



Copied from Affinity Water Figure 4.8

Figure 6 - Affinity Water's 72 population growth scenarios

[4] 2020-based Interim National Population Projections, England, Principal, published 12th January 2022
[5] https://www.bbc.co.uk/news/health-53409521, accessed 12 Feb 2023

Affinity Water note in paragraph 4.51 that it would not be plausible to model these scenarios through the regional models, so what is the purpose of showing all these scenarios? It is impossible from the Figure to tell which is which. Would it have been too difficult to provide the list below plot in the order in which they appear? Simply layering 72 scenarios onto an unreadable graph before dismissing 71 of them does not constitute analysis. No attempt is made to discuss the implications of choosing this particular projection in terms of how it relates to the other projections listed, or why they differ by so much. In which case, why was this work carried out? Is it simply to make it look as if some attempt has been made at analysis?

A much more credible approach would have been to develop a principal, high and low projection for each WRZ. These could then have been modelled within the resources available, providing useful data that could be compared with local housing and ONS projections. Regardless, this is immaterial as at para 4.52 it is made clear that the decision was made to use local plan data simply because that is the guidance contained in the WRPG. This implies that, in the extreme, if the local plan derived projection had been a complete outlier (either above or below all the others) it would still have been chosen without question. It would have been far more honest, and saved time and resource, to simply state this at the start of the population section.

Para 4.52 is particularly disingenuous in implying that the adaptive plan will be responsive to actual outcomes that reflect the lower projections. By choosing to develop its largest infrastructure project, the Abingdon Reservoir, at the start of the plan, future low growth outcomes can no longer be accommodated.

Whilst both Affinity Water and WRSE make much of the need to follow the WRPG and use local housing data, the rest of the guidance seems to have been ignored.

The WRPG[6] states that:

'You should consider an adaptive plan where there is a significant difference in projections, particularly where this might affect your investment decisions in the first half of your plan. You should ensure your plan does not lead to over-investment or constrain planned growth. You should set out how you have developed and used alternative scenarios in your plan and the impact they have had on your plan.'

(GARD highlighting)

The guidance has a clear requirement for the Affinity Water plan to consider alternative projections where this might affect early investment decisions. By adopting a single projection, at the higher end of forecasts, Affinity has not followed this guidance.

By pursuing an inflated population projection and failing to develop a 'most likely'

[6] Water Resources Planning Guideline Version 10, Environment Agency, Ofwat, Natural Resources Wales.

population projection, or even a 'mean of different projections', both of which would be considerably below the chosen projection, Affinity Water has failed in its duty to ensure that their plan does not lead to over investment.

The WRPG further states that water companies should:

- *demonstrate how you have included other information sources and amended your forecast accordingly*
- *demonstrate that you understand the uncertainty associated with your forecasts and how you will manage it*
- *If you are using a planning period beyond 25 years and are basing decisions on this forecast, you should explain the range of uncertainties this long-range forecast will have. You should explain in your plan how you will manage this uncertainty.*

To deal with each requirement in turn:

There is no evidence that other information sources have been used to amend Affinity Water's chosen projection. Para 4.52 couldn't be clearer in stating that the adoption of the Housing-Plan-P as the central planning scenario is based on a certain understanding of the WRPG, rather than any analysis of the projections listed. Further, there is no analysis presented to show that Affinity Water have understood the uncertainty in their choice of projection. Many organisations besides GARD have raised this issue in previous consultations, so the company cannot claim to be unaware of the issue.

To discharge the wider duties imposed by the WRPG, it is incumbent on Affinity to demonstrate understanding of the uncertainty around its chosen projection and how this will be managed. It is hard to differentiate the different projections in Figure 4.8, but the central planning scenario, Housing Plan-P, appears to be the 17th highest out of 72 scenarios, with all projections above it being 'High' projections. Why is this not ringing alarm bells in the Affinity team and, indeed, at Ofwat/RAPID?

The third point is not addressed at all in the plan as presented. The imminent fall in population growth expected in the UK (2052)[7] and already experienced by many countries, including Germany (2022) and Italy (since 2017) is not even mentioned.

As such, GARD believes that the population calculations and assumptions as presented are unfit for purpose. Instead, we believe the following process would be simpler, more realistic and meet the needs of a wide range of stakeholders (including regulators).

1. The latest ONS Principal Projection should be used to determine expected overall population growth and used as the basis for strategic level planning of water provision.

[7] https://worldpopulationreview.com/countries/united-kingdom-population

2. Local housing plan data should be used to determine the location and timing of future 'hotspots', allowing the timing and development of infrastructure to be finessed at the operational level.

3. These first 2 steps comply with the requirement to use both local planning data AND other data and would resolve historical complaints about companies planning being based on over-inflated population projections. It would be easy to demonstrate compliance with the sometimes-conflicting guidance in the WRPG.

4. Agree a methodology for the development of single high and low variant projections, so that required investment and risk can be managed.

5. The data produced should be used in discussion with the regulators to agree what risk is acceptable and how it will be managed

    - This should result in an agreed headroom calculation to be applied to the output of Step 1. A 20% addition to the ONS 2020 growth forecast for England up to 2080 would seem reasonable. This growth is plotted on our Figure 6 and can be seen to align closely with the ONS regional forecasts for London and the South East.

    - The calculation would need an openly agreed debate and compromise between cost, customer value, shareholder value, environmental issues and risk. It is not acceptable for the regulator to make the water company responsible for this. The company has conflicting responsibilities to customers and shareholders. The regulator must take a more active part in this process.

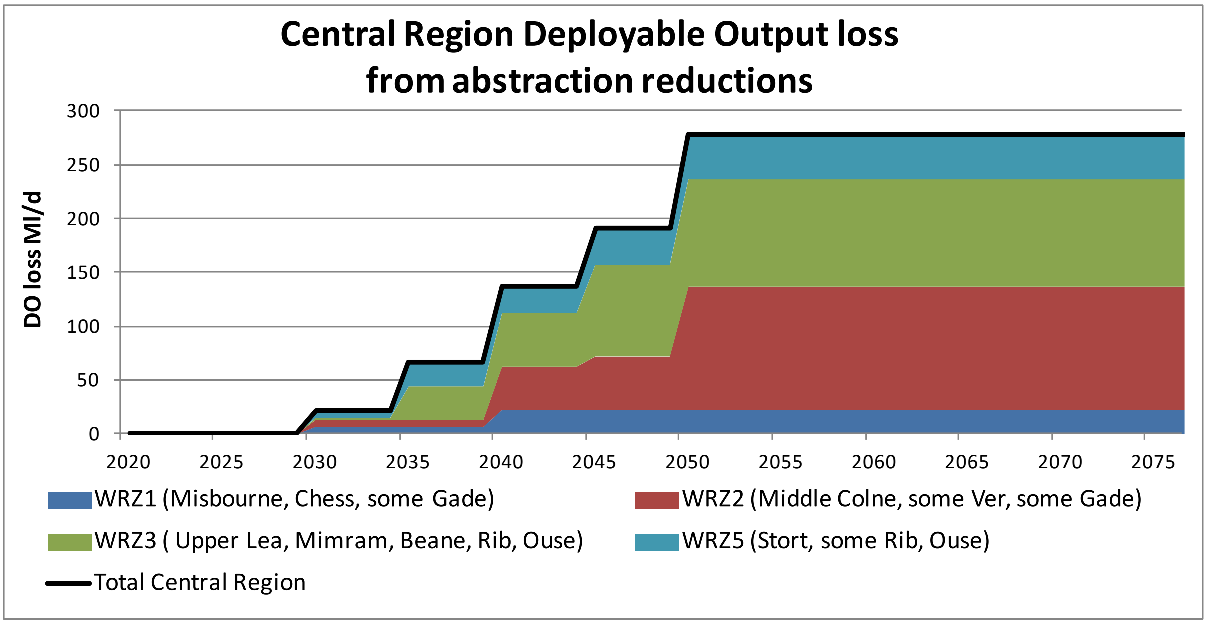
    - This corrects the current system that forces companies to over provide while encouraging financial gaming of the 'system'.

At the baseline PCC of about 150 l/head/day, GARD's suggestion of using the ONS forecast growth for England plus 20% is equivalent to an Affinity over-forecast of the baseline deficit by 56 Ml/d in 2040 and 113 Ml/d by 2080.

2.3 Environmental reductions

Overall environmental reductions in Affinity Water's draft WRMP

As can be seen on Figure 3, loss of deployable output due to environmental abstraction reductions is the largest component of Affinity Water's forecast deficit in the Central Region. The deployable output loss from environmental abstraction reductions in each zone are shown in Figure 7:



Notes: 1. Data taken from Row 34 in WRMP supply demand balance tables
2. There are no planned environmental reductions in WRZ4 (Pinn) or WRZ6 (Wey)

Figure 7 - Deployable output loss due to environmental reductions in WRZs

The water resource zone boundaries do not align with river catchments, so some of the catchment reductions for individual rivers are split between two zones. Some of the reductions in WRZ3 and WRZ5 are in chalk catchments draining northwards into the River Ouse.

Data on deployable output loss in individual sources have been obtained via an information request to WRSE[8]. These data also allocated the reductions to WRZs. Comparison of the WRSE data and the data in the WRMP tables shows that Affinity Water's planned environmental reductions align exactly with WRSE's 'High' scenario for abstraction reductions.

Reductions in the upper Colne and Lea chalk tributaries

The proposed abstraction reductions have been reviewed separately in a report for the Chalk Streams First (CSF) group of NGOs, which is available on the internet[9]. This showed a comparison of the abstraction reductions proposed by Chalks Stream First with the deployable output losses in Affinity Water's plan, as shown in Table 2:

[8] Data supplied by WRSE in file *"GARD-03 Source Level Environmental Ambition Data.xlsx"*

[9] Dealing with the impacts of groundwater abstraction on the chalk streams of the Colne and Lea valleys, Chalk Streams First, January 2023 https://chalkstreams.org/flow-recovery-following-abstraction-reduction/

		CSF Proposal		Affinity Water DO loss		
Colne catchment:	**Recent abstraction 2019-21**	**CSF proposed abstraction**	**Abstraction reduction**	**Reduction by 2034-35**	**Reduction by 2039-40**	**Reduction by 2049-50**
Misbourne	15.8 Ml/d	6.2 Ml/d	9.6 Ml/d	2.0 Ml/d	4.0 Ml/d	4.0 Ml/d
Chess	15.1 Ml/d	4.1 Ml/d	11.0 Ml/d	0.0 Ml/d	0.0 Ml/d	0.0 Ml/d
Gade	36.2 Ml/d	11.9 Ml/d	24.3 Ml/d	4.7 Ml/d	18.4 Ml/d	36.4 Ml/d
Ver	25.8 Ml/d	7.7 Ml/d	18.1 Ml/d	6.4 Ml/d	11.8 Ml/d	11.8 Ml/d
		Colne total	**63.0 Ml/d**	**13.1 Ml/d**	**34.2 Ml/d**	**52.2 Ml/d**
Lea Catchment:						
Upper Lea to Water Hall	48.4 Ml/d	7.2 Ml/d	41.2 Ml/d	4.1 Ml/d	8.9 Ml/d	38.7 Ml/d
Mimram	10.4 Ml/d	6.1 Ml/d	4.3 Ml/d	1.7 Ml/d	3.2 Ml/d	3.2 Ml/d
Beane	24.9 Ml/d	9.8 Ml/d	15.2 Ml/d	14.0 Ml/d	14.0 Ml/d	21.6 Ml/d
Rib	22.8 Ml/d	7.3 Ml/d	15.5 Ml/d	7.1 Ml/d	7.1 Ml/d	15.5 Ml/d
Ash	1.2 Ml/d	0.0 Ml/d	0.0 Ml/d	0.7 Ml/d	0.7 Ml/d	0.7 Ml/d
Stort	25.0 Ml/d	13.5 Ml/d	11.5 Ml/d	8.4 Ml/d	8.4 Ml/d	15.8 Ml/d
		Lea total	**87.6 Ml/d**	**36.0 Ml/d**	**42.3 Ml/d**	**95.6 Ml/d**
		Total	**150.6 Ml/d**	**49.1 Ml/d**	**76.5 Ml/d**	**147.8 Ml/d**

Table 2 - CSF and Affinity abstraction reduction proposals in upper Colne/Lea tributaries

The figures in Table 2 show that the CSF proposed reductions align quite well with the losses of deployable output losses assumed in Affinity Water's WRMP. The CSF and Affinity Water figures are not directly comparable because the CSF figures are reductions from recent abstraction and Affinity Water figures are losses in deployable output. This will explain some of the differences in figures for the individual chalk streams.

The comparison in Table 2 shows that Affinity Water's proposed reductions in the upper chalk streams of the Colne and Lea valleys are similar in overall amount to the Chalk Streams First proposals – a total of about 150 Ml/d. Therefore, GARD supports these proposed reductions in the upper chalk streams. However, we note that the timing of the reductions in Affinity's plan delays most of these urgently needed improvements until after 2040, presumably because of a perceived need to wait for a major new source like Abingdon reservoir or the STT – a major weakness in Affinity Water's plan.

Reductions in the Lower Colne

In addition to the abstraction reductions in the upper chalk tributaries shown Table 2, Affinity Water's plan allows for 86 Ml/d of reductions in the main River Colne valley downstream of the upper chalk tributaries, at the approximate locations shown in Figure 8:

Figure 8 - Approximate locations of abstractions in the main Colne valley

Affinity Water's planned 86 Ml/d of abstraction reductions in the main Colne valley are 34 Ml/d more than the reductions from the upper catchment chalk streams shown in Table 2. Overall, it appears that Affinity plan to give up all their sources in the Colne valley, as shown by the plot of the baseline supply demand balance for WRZ2, which is reproduced below:

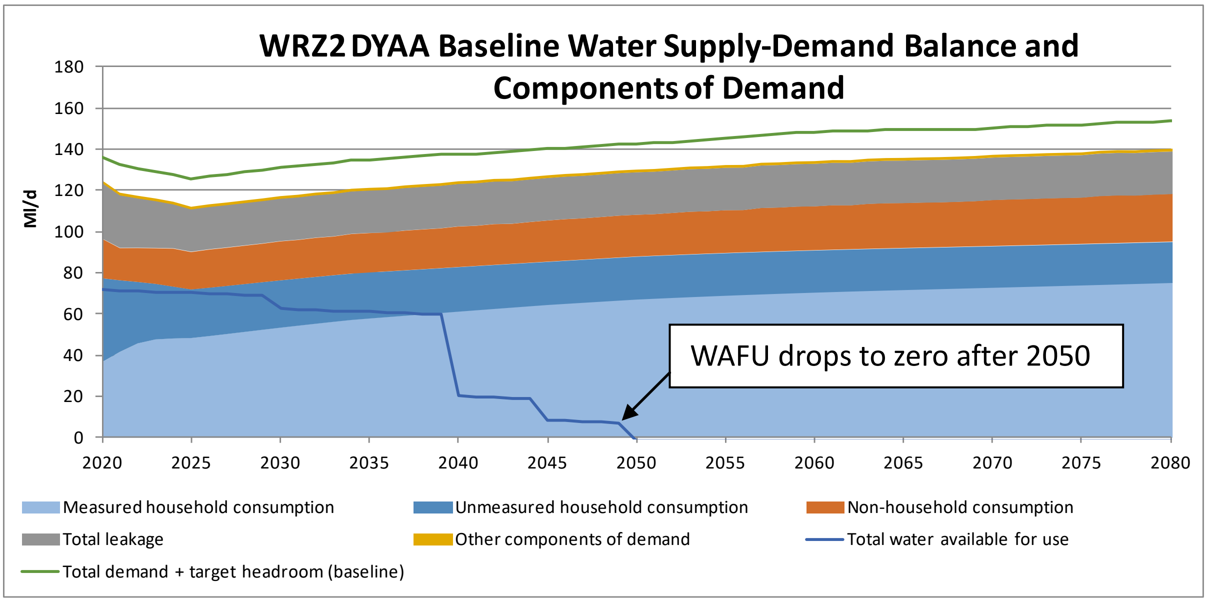


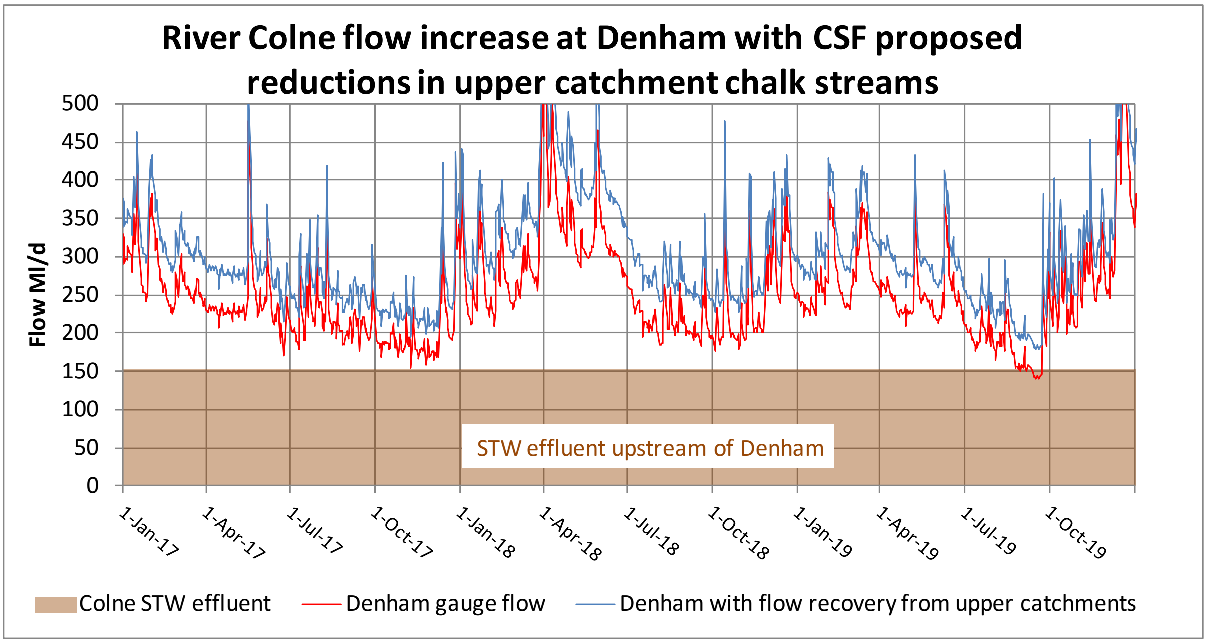
Figure 9 - Affinity WRMP baseline supply demand balance for WRZ2 (Colne)

This shows water available for use (WAFU) in the Colne zone falling to zero after 2050 as a consequence of the 86 Ml/d of abstraction reductions (which appear actually to exceed the WAFU – presumably an error).

However, whereas the abstraction reductions in the upper Colne catchment are easily justified in terms of restoring near-natural flows in iconic chalk streams, the benefits of the larger reductions in the lower Colne are highly questionable. The river weaves between gravel pits and forms part of the Grand Union Canal for a lot of this reach. It is classified as Heavily Modified from downstream of the Gade confluence. Flows from Denham down are largely effluent from Maple Lodge STW which returns much of the water abstracted further up the Colne catchment. The main River Colne is not and never will be a "classic" chalk stream.

Furthermore, the main River Colne will benefit substantially from the abstraction reductions in the upper catchment chalk streams. The flow enhancement in the main Colne from the upper chalk stream reductions during the 2017 to 2019 drought is shown in Figure 10, as modelled by Chalk Streams First[10]:

[10] Adapted from Figure 27 in Chalk Streams First report, January 2023



Note: the STW effluent amount is from EA 'recent actual' data in 2015[11]

Figure 10 - Main River Colne flow recovery from upper catchment reductions

During dry summers, flow in the main River Colne is dominated by effluent from Maple Lodge STW and a number of small STWs upstream, with little dilution by natural flows. The additional flow from the upper catchment abstraction reductions will more than double the natural summer flow contribution in the main River Colne and greatly increase the dilution of STW effluents.

The cost of replacement sources for Affinity Water's planned 87 Ml/d of abstraction reductions in the main River Colne valley would be of the order of £1 billion (roughly half the cost of Abingdon reservoir, plus additional pipelines to the demand areas). It is difficult to see how such a huge cost can be justified by the environmental benefits in the lower Colne valley, especially bearing in mind the flow benefits that will arise from the upper catchment abstraction reductions. Noting Ofwat's concerns over increases in customer bills and nationwide concerns over sewage pollution, it is suggested that the £1 billion needed for the lower Colne reductions would be much better spent on sewerage improvements.

Therefore, GARD proposes that Affinity Water's planned 87 Ml/d of abstraction reductions in the main Colne valley should be abandoned.

Reductions in the Ouse catchment

About 35 Ml/d of Affinity Water's planned abstraction reductions are in chalk stream tributaries of the upper Ouse catchment, as shown in Table 3:

[11] From EA File *'HERTS Artificial Influences overview.xlsx'*

Company	WRZ	Source	Catchment	2034-35	2039-40	2049-50
Affinity	AZ3	BALD	Ivel	2.2	2.2	3.2
Affinity	AZ3	BOWR	Ivel	0.0	3.6	3.6
Affinity	AZ3	EAGL	Cam	0.0	0.9	0.9
Affinity	AZ3	FULL	Ivel	2.7	2.7	3.7
Affinity	AZ3	LOND	Cam	0.0	0.9	0.9
Affinity	AZ3	OFFL	Hiz	0.0	0.0	0.0
Affinity	AZ3	OUGH	Hiz	0.0	0.0	3.8
Affinity	AZ3	TEMP	Hiz	3.1	3.1	4.1
Affinity	AZ3	WELL	Hiz	0.0	0.0	0.9
Affinity	AZ3	WYMO	Hiz	0.0	0.0	1.1
Affinity	AZ5	DEBD	Cam	3.1	3.1	3.1
Affinity	AZ5	NEWP	Cam	0.0	0.9	0.9
Affinity	AZ5	UTTL	Cam	6.0	6.0	6.0
Affinity	AZ5	WEND	Cam	0.0	2.3	2.3
			Sub-total	**17.1**	**25.7**	**34.5**

Table 3 - Planned Affinity Water abstraction reductions in the upper Ouse catchments

These reductions are broadly in line with reducing abstraction in these chalk catchments to 10% of average catchment recharge, as set out in the Defra funded report on Abstraction as a percentage of Recharge (A%R)[12]. The planned 10.5 Ml/d abstraction reductions for the Ivel catchment are slightly less than the reductions proposed in a recent report, based on A10%R[13].

Therefore, GARD supports the need for Affinity Water's planned reductions in the Upper Ouse chalk catchments.

2.4 Flow benefits for lower rivers and downstream supplies

Flow recovery from abstraction reductions

The amount and timing of chalk stream flow recovery from abstraction reductions is crucial to avoid excessive cost and long delays in flow re-naturalisation. If the amount of recovery is high and a good proportion of extra water from the chalk catchments is available to refill the existing downstream reservoirs in droughts, there will be comparatively little additional water resource development needed. This would allow flows in the Chilterns chalk streams to be re-naturalised within a few years and at relatively low cost.

Affinity Water's plan assumes that only 17% of the flow recovery from abstraction reductions

[12] A%R, Abstraction as a % of recharge in chalk streams, December 2021 https://chalkstreams.org/ar-abstraction-as-a-of-recharge-in-chalk-streams/

[13] Alleviation of over-abstraction of chalk groundwater in the Upper River Ivel, John Lawson for RevIvel, June 2022 https://www.revivel.org/app/uploads/2022/07/Ivel-report-21.6.21-BHs-redacted.pdf

converts to increased deployable output from the London reservoirs[14].Consequently, the plan delays most of the environmental abstraction reductions until after 2040, because of the supposed need to wait for replacement supplies from Abingdon reservoir, which cannot deliver water to Affinity Water's supply zones until after2040.

The Chalk Streams First report "Dealing with impacts of groundwater abstraction on the chalk streams of the Colne and Lea valleys"[15] examined in detail the evidence of measured flow recovery from abstraction reductions and the results of groundwater modelling. From reviews of measured flow recoveries, the conclusions were (with reference to the relevant pages in the CSF report):

1. Given sufficient time for flows to recover after genuine and maintained total abstraction reductions in a catchment, the measured flow gains will average about 80% of the abstraction reduction. The recovery will vary substantially across the range of flows, perhaps from less than 30% recovery in droughts to well over 100% recovery at times of high groundwater levels and flows (page 45).

2. This pattern of measured flow recovery is seen consistently in examples in several rivers:

    - The Friars Wash reduction in the River Ver in 1993 (pages 33 to 36)
    - Comparative flow and abstraction changes in the Rivers Chess and Ver (pages 37 to 39)
    - Comparative flow and abstraction changes in the Rivers Beane and Rib (pages 39 to 41)

3. There are no instances of flow recoveries failing to materialise when they might reasonably be expected after genuine and maintained abstraction reductions – several examples of supposed "disappointing" flow recoveries can be explained by the reductions being too small or insufficiently maintained:

    - The Bow Bridge reduction on the River Ver (pages 36 to 37)
    - The Fulling Mill reduction on the River Mimram (pages 42 to 43)

4. Short term signal tests are not a reliable way of assessing flow gains from abstraction reductions in these rivers:

    - Signal tests at Kensworth Lynch on the River Ver (pages 108 to 109)
    - Signal tests at Chesham on the River Chess (pages 197 to 201)

The CSF report reviewed modelled flow recoveries shown by the Environment Agency's Herts Regional Groundwater Model and its own lumped parameter models. These models all validate reasonably well when comparing modelled and measured historic groundwater levels and river flows (details in Appendices A to D in CSF report). As described in Chapter 4

[14] Affinity WRMP24, Annex 5.6, page 13
[15] Dealing with the impacts of groundwater abstraction on the chalk streams of the Colne and Lea valleys, Chalk Streams First, January 2023 https://chalkstreams.org/flow-recovery-following-abstraction-reduction/

of the CSF report, pages 46 to 52), both models show very similar patterns and amounts of flow recovery from abstraction reductions:

1. The patterns and amounts of modelled flow recoveries are similar to the measured flow recoveries described above.
2. At average river flows, modelled river flow recoveries are in the region of 80% of the abstraction reductions. At extreme low flows, modelled flow recoveries are typically around 30-40% of abstraction reductions.
3. These conclusions are equally true in all four case study rivers (Chess, Ver, Mimram and Beane).

The modelled and measured flow recoveries are similar. They are far more than the 17% flow recovery assumed in Affinity Water's WRMP and in the draft regional plan of Water Resources in the South East.

Similar conclusions were reached in the RevIvel report on over-abstraction in the River Ivel[16]. If present abstraction of about 13 Ml/d abstraction was to stop, the modelling showed that flows in the River Ouse would rise by about 11 Ml/d on average (85% recovery) and about 6 Ml/d (45% recovery) in droughts. The increased flows in the River Ouse would boost inflows to Grafham reservoir, which could then provide replacement supplies to the areas currently fed from the River Ivel.

Benefits to downstream supplies from proposed reductions

The Chalk Streams First Report, page 60, shows modelled flow recoveries from the total 151 Ml/d of CSF proposed abstraction reductions shown in Table 2. The modelled daily Colne and Lea flow recoveries since 1920 have been added to the Teddington and Feildes Weir flow records to assess the increase in London deployable output, using the GARD model of the London supply system. Details of GARD's London supply model are given in Appendix F to the CSF report. In the 100-year period 1920-2019, with the enhanced reservoir inflows, the critical drought which governs London deployable output is July 1933 to November 1934 as shown in Figure 11:

[16] Alleviation of over-abstraction of chalk groundwater in the Upper River Ivel, page 41
https://www.revivel.org/app/uploads/2022/07/Ivel-report-21.6.21-BHs-redacted.pdf

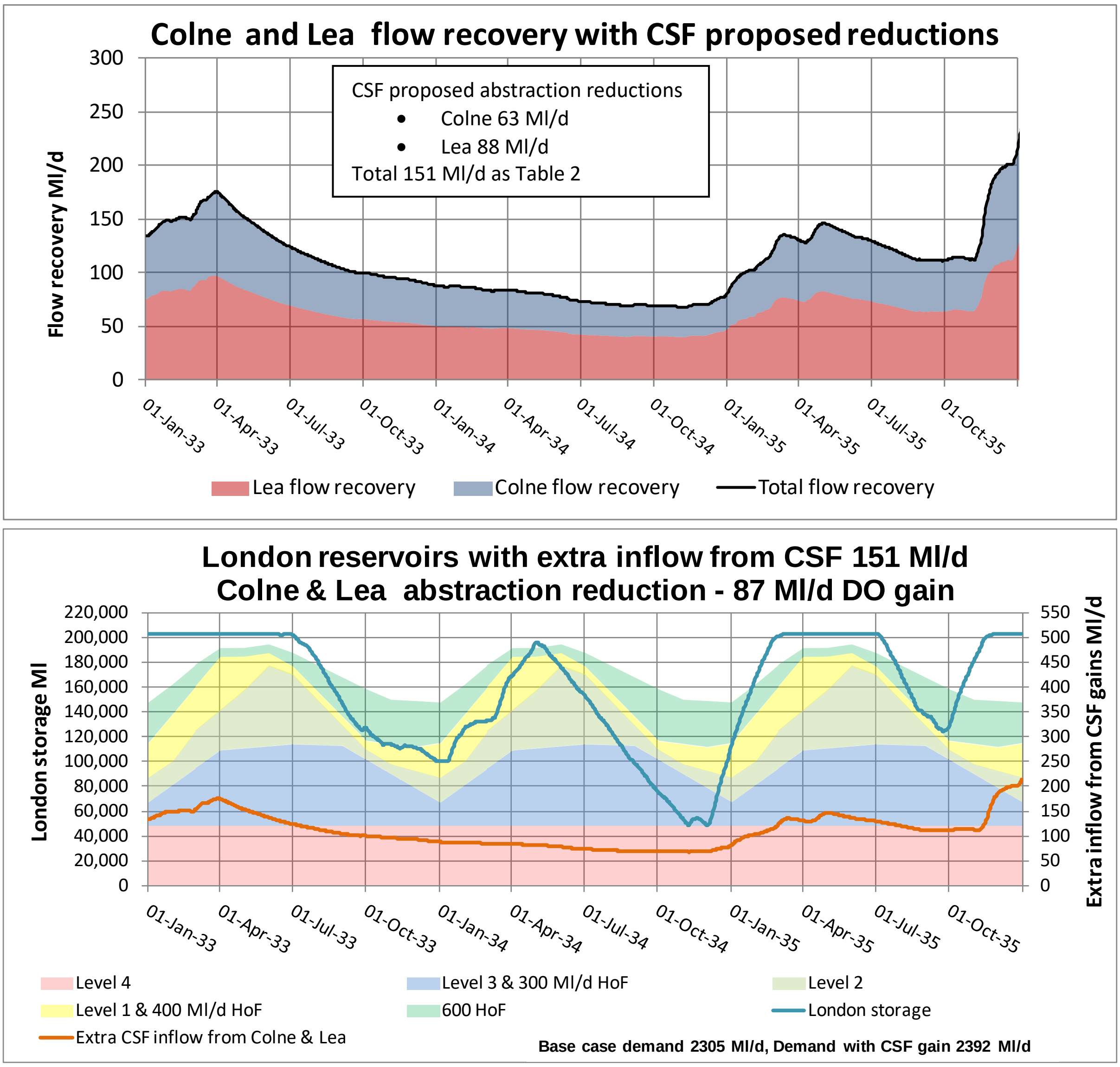


Figure 11 - Modelling of London DO gain from CSF proposed reductions in 1933-34

The modelled flow recovery in the 18-month drought starts at over 80% of the 151 Ml/d abstraction reduction at the start of the drawdown of the London reservoirs in July 1933. The modelled flow recovery percentage drops to around 40% when London storage starts to recover in November 1933. The modelled 87 Ml/d gain in deployable output is 58% of the 151 Ml/d abstraction reduction – a far higher gain than the 17% assumed in current draft water company WRMPs.

A similar analysis was carried out for the RevIvel report on alleviating over-abstraction in the River Ivel, concluding that for Grafham reservoir there would be average 64% recovery of the abstraction reduction over the duration of the critical drought, which is also 1933/34[17].

It is concluded that when considering the amount of replacement sources needed for the planned abstraction reductions in the upper Colne, Lea and Ouse chalk streams, the

[17] RevIvel report on Ivel over-abstraction, pages 55-57

assumed deployable output recovery in the London reservoirs and in Grafham reservoir should be around 60% and not the 17% assumed in Affinity Water's plan. We recognise that the Grafham recovery would only apply to the planned abstraction reductions in the Rivers Ivel, Oughton and Hiz (see Table 3); the reductions in the Rivers Cam and Rhee do not affect flows at the intake to Grafham reservoir.

2.5 Climate change

Affinity Water's allowances for loss of deployable output due to climate change in their six Central Region zones are shown in Figure 12:

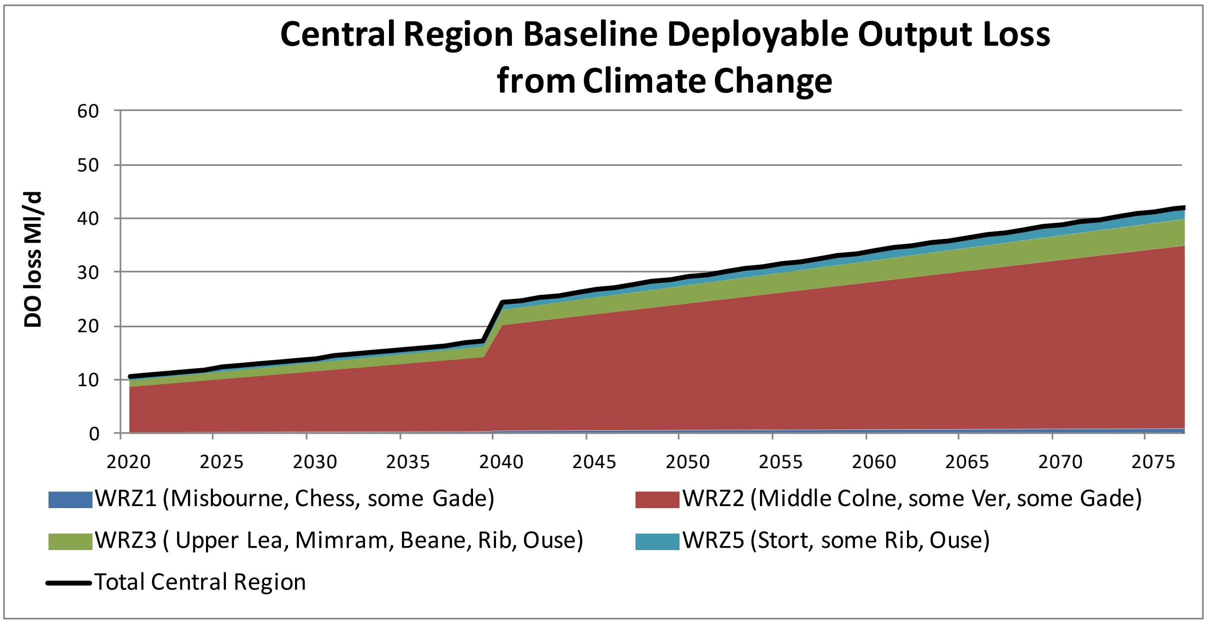


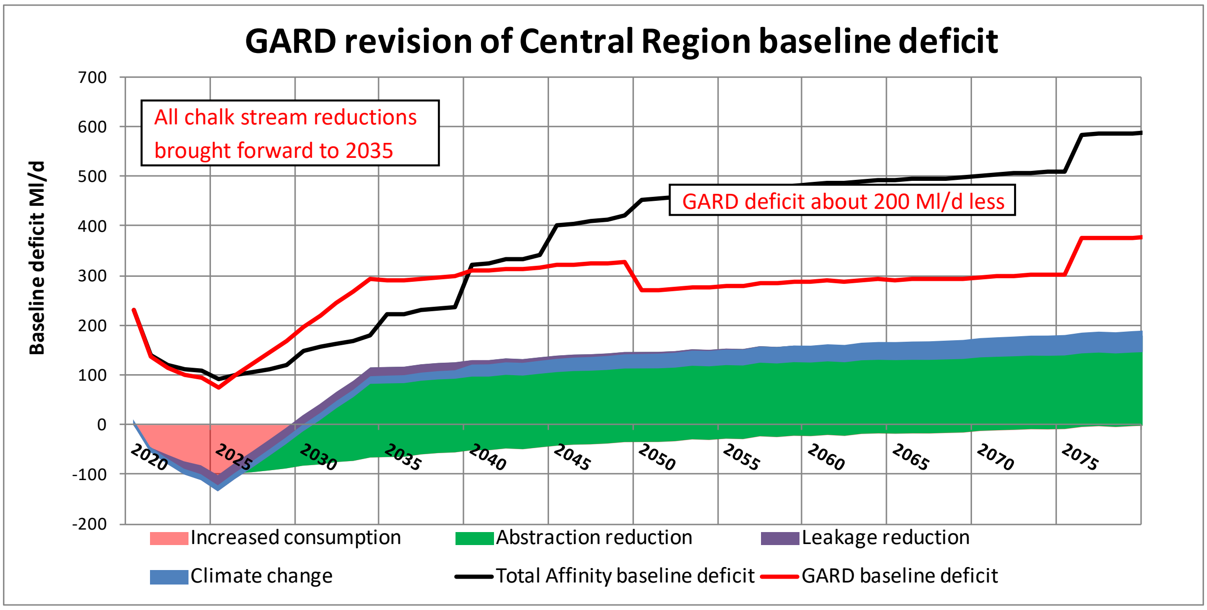
Figure 12 - WRMP allowances for climate change DO loss in Central Region zones

The plan makes no allowance loss of deployable output due to climate change in zones WRZ4 and WRZ6 (Pinn and Wey) and minimal allowances in zones WRZ1 and WRZ5. Presumably, this is because supplies in these zones are entirely from groundwater, which is considered to be only minimally affected by climate change.

By far the largest allowance for climate change is in WRZ2 (Colne) with a loss of deployable output of 35 Ml/d by 2080 and 43 Ml/d by 2100. Presumably, these DO losses are considered to apply to groundwater sources in the lower Colne valley which are hydraulically connected to the river and therefore susceptible to climate change. However, these DO losses should not have been included in the baseline supply demand balance because the plan assumes that all the Colne zone sources are abandoned for environmental reasons – see earlier Figure 8 in Section 2.3 and its following text. Inclusion of the loss of 43 Ml/d for climate change in WRZ2 has doubled counted the loss.

2.6 Summary of the need for new resources

Taking account of GARD's comments on population growth and environmental reductions, the make-up of the Central Region baseline deficit would be as shown in Figure 13:



Notes: 1. Population growth revised as in Section 2.3 and Figure 5.
2. Abstraction reductions reduced and brought forward as in Section 2.3
3. No change in Affinity proposed climate change allowances or leakage reduction

Figure 13 - GARD proposed revision to Central Region baseline deficit

The changes relative to Affinity Water's baseline deficit are:

- Population growth is as per ONS forecast growth plus 50%
- Environmental reductions exclude 79 Ml/d of lower Colne reductions and bring all others forward for completion by 2035

The climate change reduction is unchanged because the 79 Ml/d lower Colne abstractions are retained.

Overall, the ultimate need for new resources is reduced by about 200 Ml/d.

3. Proposals for new resources

3.1 Affinity Water's proposed new resources

Affinity Water's Central Region final plan supply demand balance is shown in Figure 14:

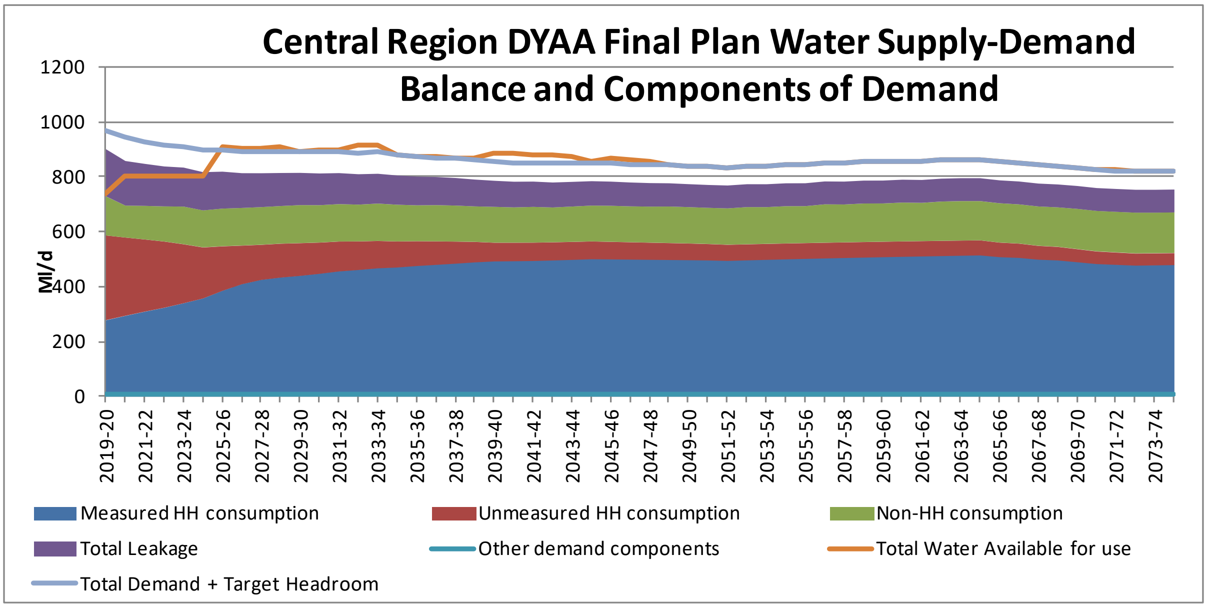


Figure 14 - Affinity Water WRMP Central Region final plan supply demand balance

Figure 15 shows the measures that Affinity Water plan to deal with the baseline deficit:

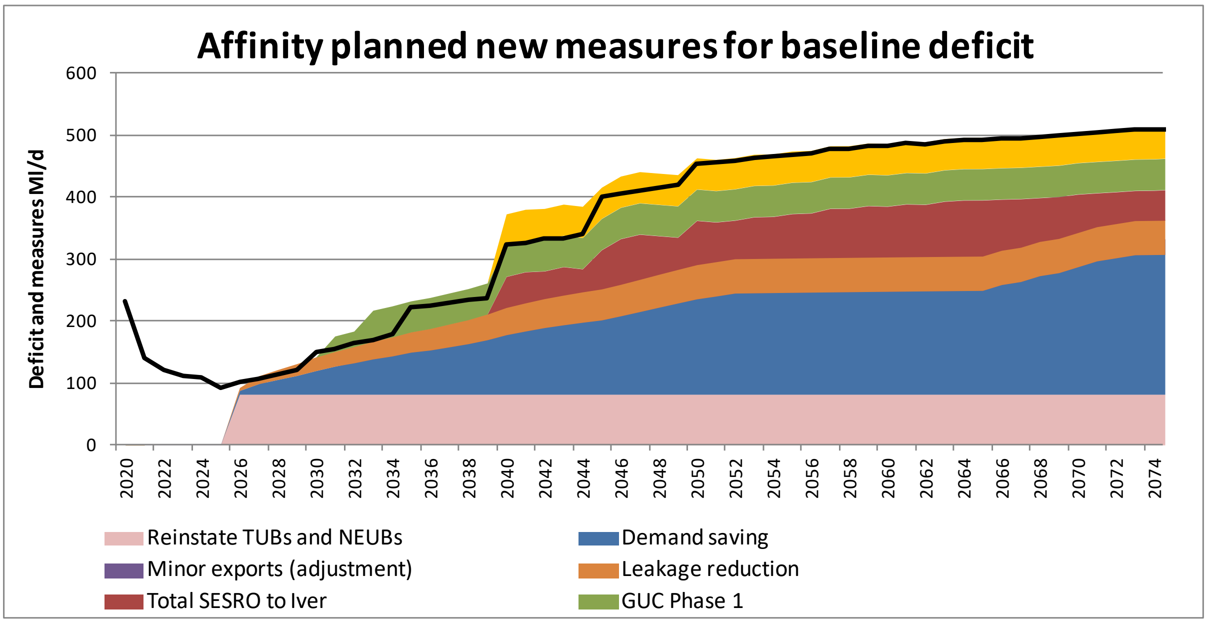


Figure 15 - Affinity Water planned measures to deal with Central Region baseline deficit

This shows that the largest measure for addressing Affinity Water's baseline deficit is their planned leakage and demand reduction through metering and reduced PCC. However, there is also a need from 100 Ml/d of GUC transfer and up to 90 Ml/d from Abingdon reservoir.

3.2 Affinity Water proposed PCC reductions

The Affinity Water's planned reduction in per capita consumption (PCC) and household meter penetration in the Central Region is shown in Figure 16:

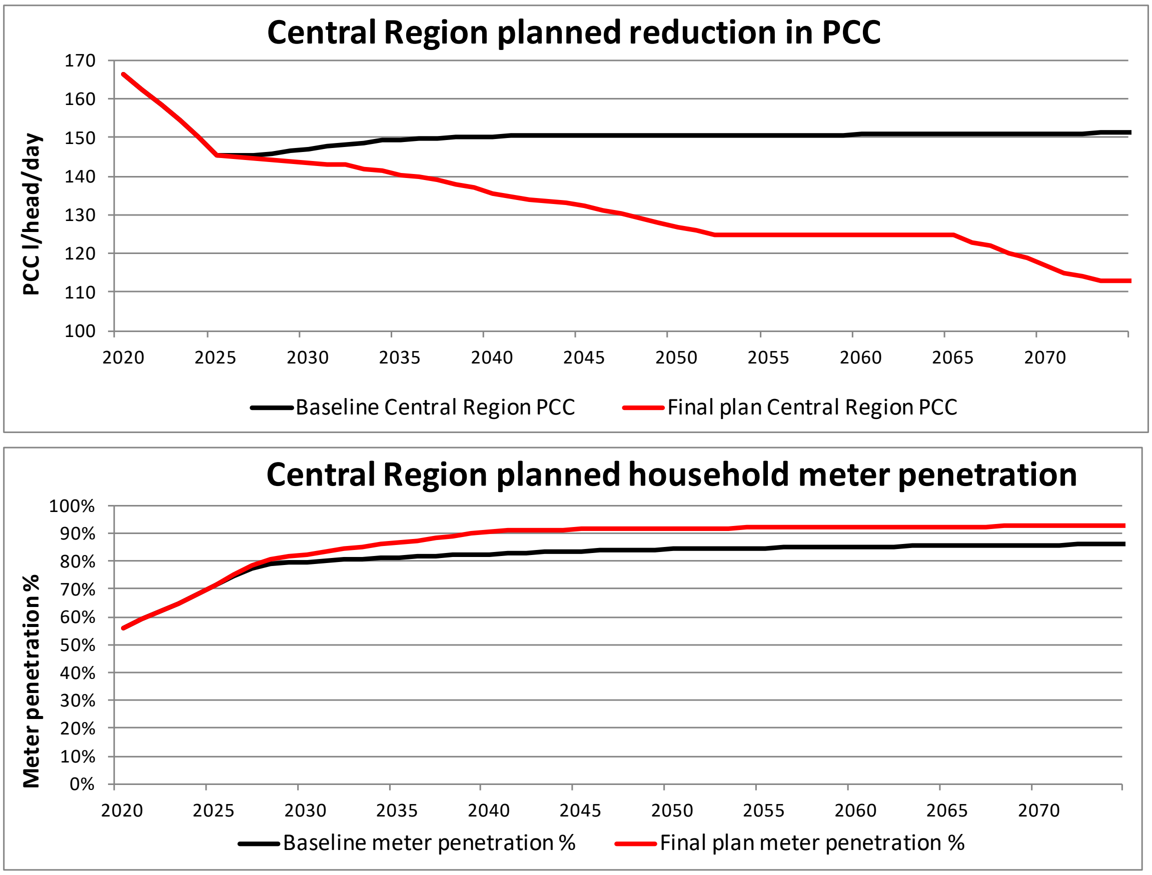


Figure 16 - Central Region planned PCC reduction and household meter penetration

Figure 16 shows that Affinity Water plan eventually to get close to the Government's 110 l/h/d target, reaching 113 l/h/day by 2075. However, by 2040, the planned PCC of 135 l/h/d is well above the Government target.

Planned meter penetration rise quickly to 80% by 2028, but then slows markedly, with 90% penetration not achieved until 2040. GARD proposes that meter installation should continue at the pre-2028 rate until 90% smart meter penetration is achieved by about 2032. This would help to achieve rapid chalk stream abstraction reductions. If Central Region PCC is reduced to 124 l/h/d by 2040 and 110 l/h/d by 2050, the Central Region demand savings would be 48 Ml/d by 2040 and 74 Ml/d by 2050 (assuming Affinity Water's population forecasts). This would provide a substantial part of the planned abstraction reductions without any need for new sources.

3.3 Affinity Water proposed leakage reduction

Affinity Water's planned leakage reduction in the Central region since 2017 is shown in Figure 17:

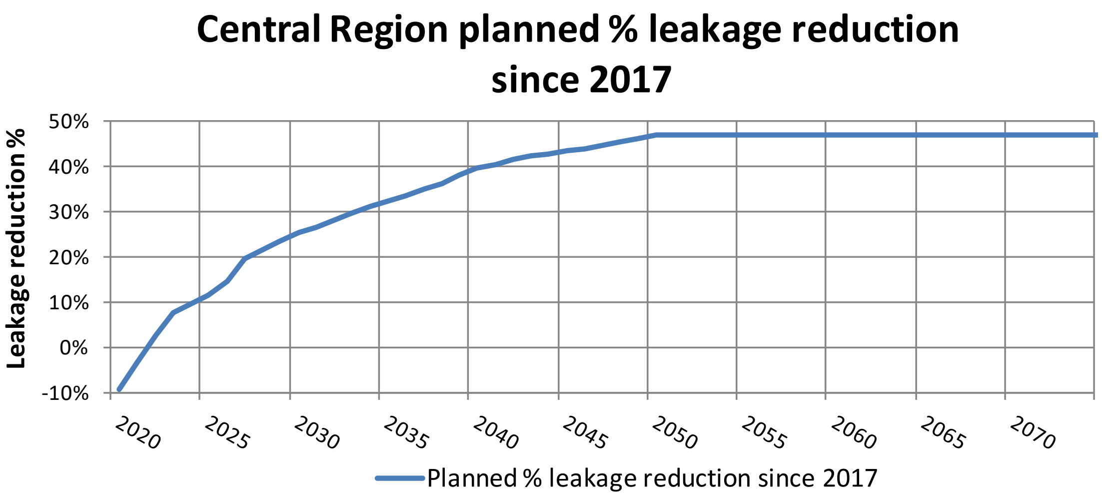
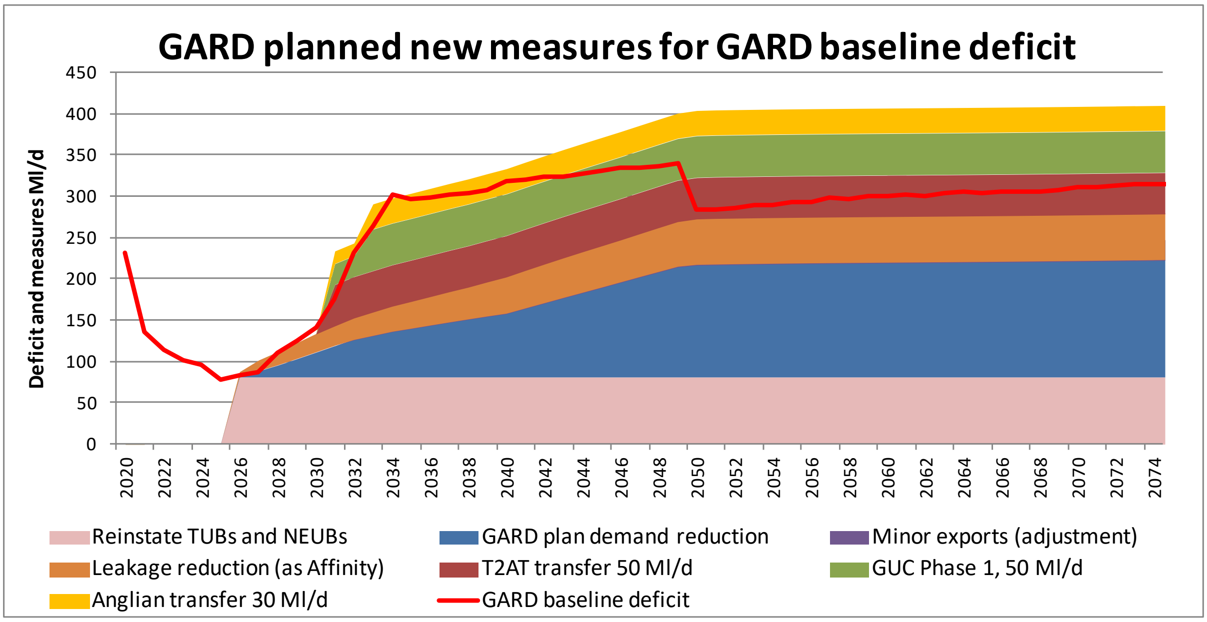


Figure 17 – Affinity Water planned Central Region leakage reduction since 2017

From Figure 17, it appears that Affinity Water's planned leakage reduction falls 3% short of the Government target of 50% reduction by 2050, relative to a 2017 base leakage, equivalent to a 5 Ml/d shortfall. This is relatively insignificant.

3.4 GARD assessment of need for strategic options

GARD's proposals for dealing with the baseline deficit are shown in Figure 18:



Notes: 1. GARD baseline deficit revised as in Section 2.6 and Figure 12

Figure 18 - GARD proposal for dealing with GARD revised baseline deficit

The GARD baseline deficit excludes 79 Ml/d of lower Cone abstraction reductions and GARD's proposed population growth (as Section 2.2 and Figure 5). All other parts of the deficit are as forecast by Affinity Water.

The GARD planned demand reduction assumes GARD's proposed population growth and reduction of PCC to 124 l/h/d by 2040 and 110 l/h/d by 2050. Leakage reduction and reinstatement of TUBs and NEUBs are as in Affinity Water's plan.

Figure 18 shows that GARD's revised baseline deficit, including all the upper Colne, lea and Ouse chalk stream reductions by 2034, can be met by the 50 Ml/d first phase of the GUC transfer, 50 Ml/d of Thames to Affinity transfer and a 30 Ml/d transfer from Anglian Water, all in place by 2034, combined with bringing forward the 'Connect 2050' distribution network.

By 2034, with 180 Ml/d of abstraction reduction in place in the upper Colne, Lea and Ouse chalkstreams, the GARD planned PCC would only be reduced to 141 l/h/day and the planned leakage reduction would be only 31% below the 2017 leakage, both well short of the ultimate Government targets. If the ultimate Government PCC and leakage targets are reached, there would be a surplus of well over 100 Ml/d, as shown in Figure 18.

Or, looked at another way, the GARD proposal has in excessive of 100 Ml/d additional headroom as a guard against the PCC and leakage targets not being achieved.

It is appreciated that the GARD proposal includes a 30 Ml/d transfer from Anglian Water, which is not currently in Affinity Water or Anglian Water's plans. GARD proposes that this would be a better way of enabling the planned 30 Ml/d of abstraction reductions in the upper Ouse chalk streams, instead of second phases of either the Thames to Affinity transfer or the GUC transfer. It would be better to keep the solution to the Ouse over-abstractions within the Ouse catchment, rather than exporting water from the Thames valley where it is most needed.

GARD's proposed transfer from Anglian region is further discussed in Section 3.6.

3.5 The Thames to Affinity transfer

GARD proposes that 50 Ml/d of the Thames to Affinity transfer should be brought forward to the early 2030s, connecting Affinity Water to Thames Water's London supply system. Combined with early implementation of 'Connect 2050' (re-naming it 'Connect 2030'), the Thames to Affinity transfer would allow all the planned upper Colne and Lea chalk stream reductions to be in place by the early 2030s.

The Concept Design Report for the Thames valley component of the T2AT describes the source of water for the transfer as follows[18]:

> *"The source of water for the LTR option is the River Thames. The natural flow in the river will need to be supported, especially during drought years, by the South East Strategic Reservoir (SESRO) SRO and possibly the Severn Thames Transfer (STT) SRO. SESRO is a*

[18] T2AT Concept Design Report, Lower Thames Reservoir Version, paragraph 1.11

pre-requisite for the LTR option because without SESRO the LTR option would leave Thames Water with a reduced volume of strategic storage."

In GARD's opinion, the source of water for the Thames to Affinity transfer should be a direct connection to Thames Water's London supply system, via an existing reservoir, probably the Queen Mary reservoir. The 50 Ml/d transfer to Affinity would become an additional 50 Ml/d demand on London's supply system. The existing reservoir system can provide support to the natural River Thames flows when needed in a drought, as it does for all other demands on the London supply system. By the time the T2AT transfer comes into operation in the early 2030s, the demand on London's supplies will have been reduced by about 120 Ml/d due to planned leakage and PCC reductions[19], and there will be additional 67 Ml/d of deployable output from the planned Teddington DRA scheme. There will be no need for any water from Abingdon reservoir or the Severn to Thames transfer.

GARD does not accept the argument "*SESRO is a pre-requisite for the LTR option because without SESRO the LTR option would leave Thames Water with a reduced volume of strategic storage."* The 50 Ml/d demand from Affinity Water on the London supply system is no different to any other London demand. If the London supply system deployable output can cover the demand, as it can with planned demand savings, leakage reduction and Teddington DRA scheme, there is no need for additional London storage.

If flow recovery is realistically allowed for as per Section 2.4 and Figure 11, the Thames to Affinity transfer doesn't need to wait for either Abingdon reservoir or the Severn to Thames transfer. We will be providing more evidence for this in our response to Thames Water's draft WRMP, due on 20th March.

3.6 The Grand Union Canal transfer

Although GARD's analysis of WRSE's draft regional plan[20] has shown that there is no theoretical need for <u>any</u> new water supplies in areas that might be supplied from Abingdon reservoir, we recognise that this depends on achievement of planned leakage and PCC reductions, and that some climate change scenarios move the analysed surplus (in normal, non-extreme drought years) to a lower value. We also acknowledge that early re-naturalisation of flows in the Colne and Lea chalk streams could require additional water sources if leakage and PCC reductions come into effect later than planned, and that some (much more modest than WRSE's draft Plan) new resources should be implemented as risk mitigation.

Therefore, GARD welcomes the plan to complete at least Phase 1 of the GUC transfer by 2031. This would bring "new water" into the catchments feeding Thames Water's London's reservoirs. Much of the water coming in via the GUC transfer would end up in Thames

[19] Data from Thames Water's draft WRMP tables
[20] GARD response to consultation on WRSE's draft regional plan, Section 3.3

Water's London reservoirs, either via enhanced chalk stream flows or through STW effluent returns.

Although our analysis shows that a 50 Ml/d GUC transfer would be more than enough for Affinity Water's needs and re-naturalising chalk stream flows, there would be additional security if the GUC carrying capacity can be increased to 100 Ml/d at relatively little additional capital cost, via the 'Phase 2' of the scheme, as implemented in WRSE's plan by 2040. Our view is that this phase should be brought forward for completion by 2035. Operating costs would only be on an as needed basis.

3.7 Transfer from Anglian Water to re-naturalise upper Ouse chalk streams

GARD proposes that the proposed upper Ouse chalk stream reductions, as shown in our Table 3, should be enabled by a transfer from Anglian Water, instead of the Affinity Water's proposed transfers via the Thames to Affinity transfer and Abingdon reservoir. In the case of the upper Ivel reduction of about 12 Ml/d, this type of solution has been described in a report for the local river restoration group, RevIvel[21], and includes a proposal for a drought support scheme similar to the existing West Berkshire Groundwater Scheme (WBGWS), connecting the Ivel supply area to Grafham reservoir. This would provide insurance against the flow recovery being less than forecast, or possibly a net increase in Grafham deployable output.

The solution to over-abstraction for the River Ivel could also be applied to the 5 Ml/d of abstraction reductions planned in the upper Hiz catchment, also with linkage to Grafham reservoir and a WBGWS type of drought support scheme.

The 14 Ml/d of abstraction reductions from the upper Cam and Rhee catchments cannot be linked to Grafham reservoir in the same way as the Ivel and Hiz reductions, because the Ouse flow benefits only occur downstream of the Grafham intake at Offord. However, it is suggested that replacement supplies from within Anglian Water's supply system would be feasible, if abstraction reductions in the Anglian region kept within the limits proposed in the report on Abstraction as a % of Recharge instead of the much larger reductions proposed in Anglian Water's plan. GARD will be making this point in a response to Anglian Water's plan.

3.8 WBGWS-type scheme for the upper Colne, Lea and Ouse chalk streams

GARD recognises that there is uncertainty in the amount of flow recovery from chalk stream abstraction reductions that can be converted into additional deployable output from downstream reservoirs. However, this uncertainty can be managed, with a possible net

[21] Alleviation of over-abstraction of chalk groundwater in the Upper River Ivel, pages 55 to 59 https://www.revivel.org/app/uploads/2022/07/Ivel-report-21.6.21-BHs-redacted.pdf

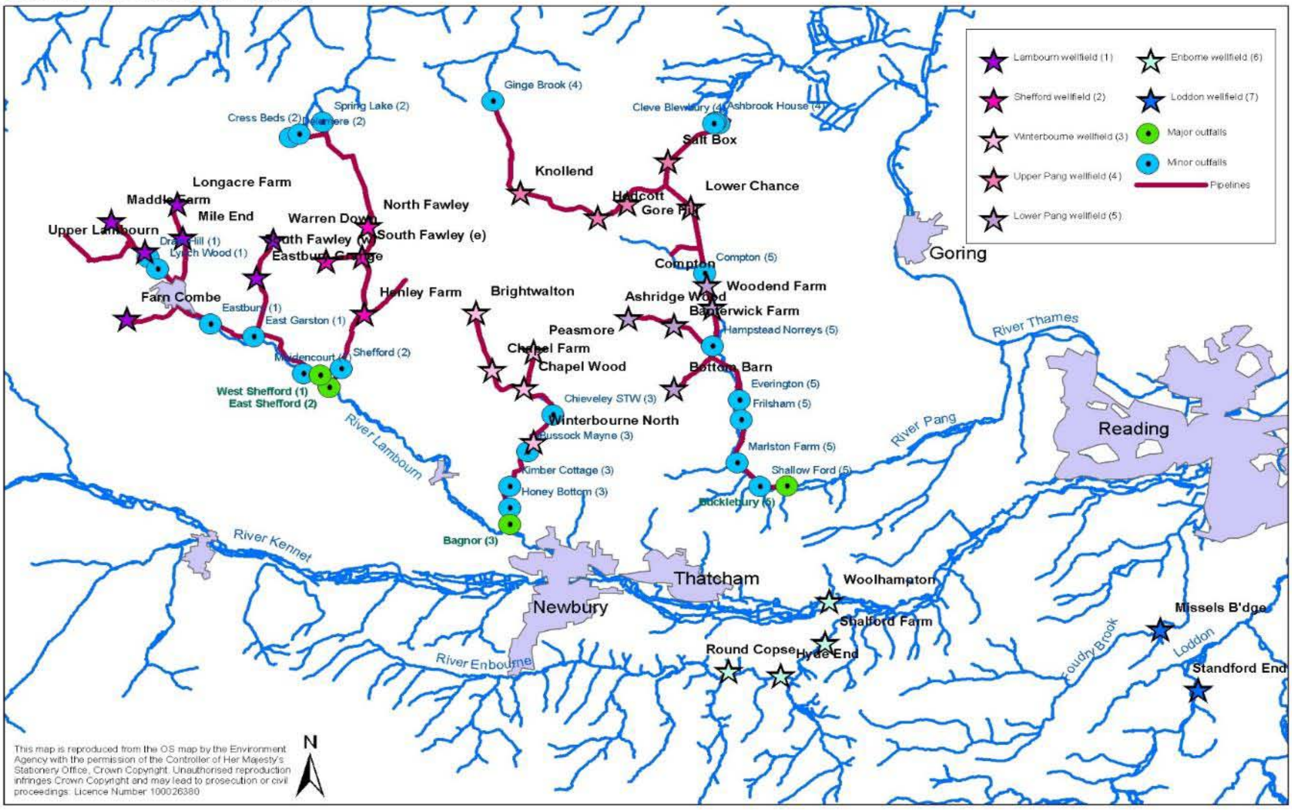
increase in deployable output from downstream reservoirs, if the chalk aquifer is used for drought support schemes similar to the existing West Berkshire Groundwater Scheme.

The West Berkshire Groundwater Scheme (WBGWS) was constructed in the 1970s to augment London's water supplies during severe droughts – its planned use is about once in 25 years. The scheme abstracts water from boreholes in the chalk aquifer in the upper Lambourn, Pang, Enbourne and Loddon valleys, discharging water into those rivers from where it flows down into the River Thames for later abstraction to fill London's reservoirs. It contributes about 90 Ml/d to London's deployable output.

The WBGWS concept could be used in the chalk streams of the upper Colne, Lea and Ouse valleys, operating in conjunction with the proposed abstraction reductions. When triggered in droughts, boreholes in the chalk tributaries would augment flows in the River Thames or Ouse for abstraction into the lower Thames reservoirs or Grafham Water. Boreholes in the Lea tributaries would supplement filling of the Lea valley reservoirs.

The layout and components of the existing WBGWS are shown in Figure 18:

West Berkshire Groundwater Scheme



Map copied from Environment Agency presentation to Action for the River Kennet in January 2020

Figure 19 - Layout of the West Berkshire Groundwater Scheme

In general, the scheme abstracts groundwater in the upper parts of the chalk valleys, where there is little if any perennial river flow, and transfers water via pipelines to discharge into the lower parts of the valleys where there is perennial river flow even in severe droughts. This avoids discharging the water into a dry river bed where it would quickly sink back to the water table. There are some intermediate discharge points to augment drought flows further up the valleys, simulating a natural flow accretion profile.

In a drought, the scheme is allowed to be used for a maximum of 8 months. The maximum daily release in each donor catchment corresponds to roughly 20-30% of average catchment recharge. The total release from the donor catchments gradually reduces from 126 Ml/d to 67 Ml/d, as the drought progresses. The scheme is triggered in periods of extremely low flows in the River Thames, when the London reservoir storage falls below a control line.

Thames Water's WARMS2 modelling of the London supply system for their 2019 Water Resource Management Plan showed that, in the past 100 years, the WBGWS would only have been used significantly in the droughts of 1921/22, 1933/34, 1943/44 and 1975/76. The scheme would also have been triggered briefly in 1949.

The recent Chalk Streams First report shows how the chalk tributaries of the Colne and Lea could be used in a WBGWS-type scheme, providing an insurance against flow recovery being less than expected[22]. Drought support releases from the Colne tributaries could be used for filling the existing lower Thames reservoirs and support from the Lea tributaries would feed into the Lea valley reservoirs. An indication of the potential scale of adopting the WBGWS concept across all the Lea and Colne tributaries is shown in Table 4. The suggested maximum releases for each of the tributaries are in the region of 20-30% of average recharge, as is the case for the Lambourn, Enbourne, Pang and Loddon:

[22] Dealing with the impacts of groundwater abstraction on the chalk streams of the Colne and Lea valleys, Chalk Streams First, January 2023 https://chalkstreams.org/flow-recovery-following-abstraction-reduction/

	Colne chalk streams				
	Misbourne	Chess	Gade/ Bulbourne	Ver	Totals for Colne
Catchment area km^2	95 km2	105 km2	184 km2	132 km2	516 km2
Av. annual recharge	74 Ml/d	82 Ml/d	144 Ml/d	103 Ml/d	403 Ml/d
Continuous PWS abstraction					
Abstraction in 2019-21	15.8 Ml/d	15.1 Ml/d	36.2 Ml/d	25.8 Ml/d	92.9 Ml/d
Abstraction as % recharge	21.2%	18.4%	25.2%	25.0%	23.0%
CSF proposed abstraction	6.2 Ml/d	4.1 Ml/d	11.9 Ml/d	7.7 Ml/d	29.9 Ml/d
Reduction to achieve A10%R	9.6 Ml/d	11.0 Ml/d	24.3 Ml/d	18.1 Ml/d	**63.0 Ml/d**
WBGWS-type support					
Suggested maximum release	20 Ml/d	20 Ml/d	40 Ml/d	25 Ml/d	**105 Ml/d**

	Lea Chalk streams					
	Upper Lea (to Water Hall GS)	Mimram	Beane	Rib & Quin	Stort	Totals for Lea
Catchment area km2	150 km2	136 km2	175 km2	152 km2	280 km2	893 km2
Av. annual recharge	87 Ml/d	79 Ml/d	102 Ml/d	88 Ml/d	163 Ml/d	518 Ml/d
Continuous PWS abstraction						
Abstraction in 2019-21	48.4 Ml/d	10.4 Ml/d	24.9 Ml/d	22.8 Ml/d	25.0 Ml/d	131.5 Ml/d
Abstraction as % recharge	55.6%	13.1%	24.5%	25.9%	15.4%	25.4%
CSF proposed abstraction	7.2 Ml/d	6.1 Ml/d	9.8 Ml/d	7.3 Ml/d	11.5 Ml/d	43.2 Ml/d
Reduction to achieve A10%R	41.2 Ml/d	4.3 Ml/d	15.2 Ml/d	15.5 Ml/d	13.5 Ml/d	**89.6 Ml/d**
WBGWS-type support						
Suggested maximum release	25 Ml/d	20 Ml/d	25 Ml/d	20 Ml/d	40 Ml/d	**130 Ml/d**

Table 4 - Potential for WBGWS concept in the Colne and Lea catchments

Reduction of abstraction to achieve acceptable flows across all of the Colne and Lea tributaries would require about 63 Ml/d of replacement supply, potentially from Thames Water's lower Thames reservoirs. The impact on London's supplies could be offset by up to 105 Ml/d of drought support releases from the upper Colne chalk. The equivalent figures for the Lea catchment could be 90 Ml/d of replacement sources and up to 130 Ml/d of drought support releases from the upper Lea chalk.

GARD model simulation of the abstraction reductions and WBGWS-type support releases shown in Table 4 suggests that they could give a net gain to London deployable output of in the region of 55-60 Ml/d after allowing for 87 Ml/d of flow recovery from the total 153 Ml/d of abstraction reductions, as shown on Figure 10.

The CSF report's conclusions from this assessment of the potential for use of the WBGWS concept in the Chilterns chalk streams were:

1. If the concept was adopted in all the upper Colne and Lea chalk streams, abstraction could be reduced by 150 Ml/d as proposed by EA, with replacement supplies as from London reservoirs and a net gain to London's supplies of possibly 55-60 Ml/d.

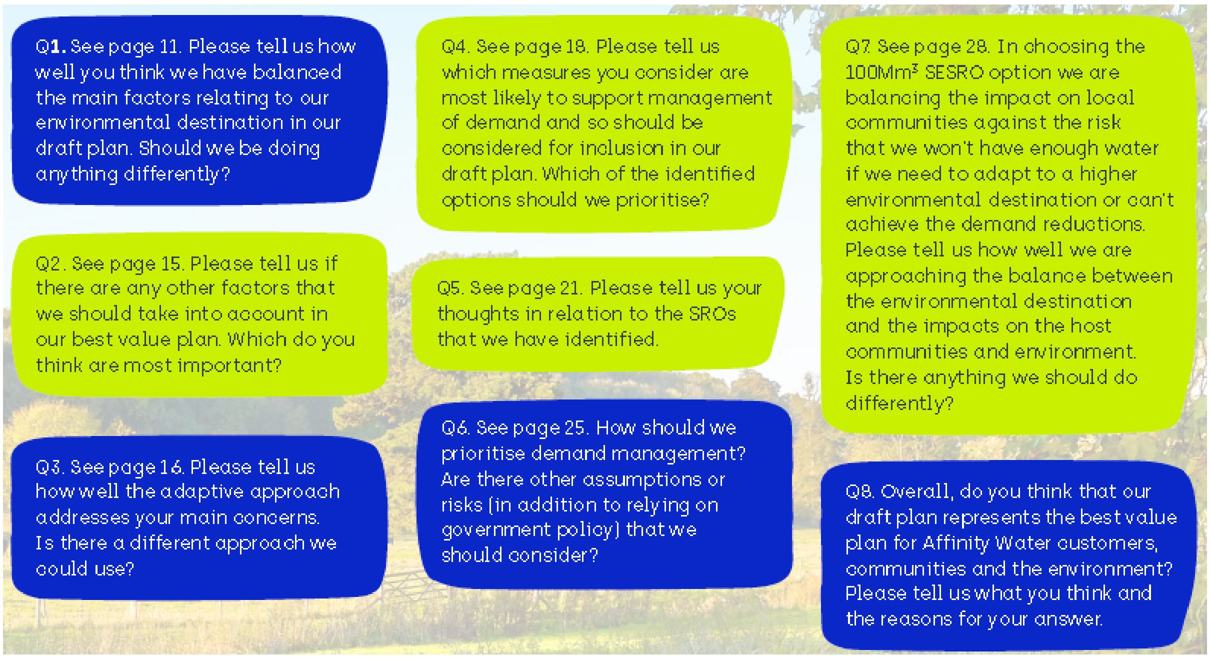
2. The drought support would only be needed about once in 25 years. Flows in the chalk streams in drought years would be increased by the WBGWS-type releases and would be slightly less in the following year (but still much more than with abstraction at recent levels).
3. Although the net gain in London supplies requires much more investigation, the introduction of the WBGWS concept would remove much of the doubt that currently exists over the amount of flow recovery from abstraction reductions.
4. In principle, the conjunctive use of the chalk aquifer and the reservoirs downstream appears a much better way of using the chalk water resource, with far less impact on chalk streams than continuous pumping of water supplies directly from the chalk.
5. The concept should now be investigated as a matter of urgency, with the aim of implementing one or more pilot schemes in AMP8 and full implementation in AMP9.

A similar proposal for using the WBGWS concept at a pilot scale has been put forward for the River Ivel catchment. This would entail much reduced existing abstraction for day-to-day supplies, replacement supplies brought in from Grafham reservoir, enhanced Ivel flows into the River Ouse used to augment Grafham reservoir refilling and use of the existing Ivel groundwater storage as a drought source in a similar fashion to the WBGWS. A pre-feasibility study of this proposal is currently being undertaken jointly by Affinity Water and Anglian Water, with a report due in summer 2023.

The Ivel investigation can point the way for investigation of the WBGWS concept at a larger scale in the Chilterns chalk streams. If the concept is found to be viable, it removes most of the uncertainty surrounding river flow recovery and maintaining supplies if recovery is found to be less than expected. This would allow the proposed upper Colne, Lea and Ouse abstraction reductions to proceed quickly with more confidence, being in place by 2034, without any need for a major new source like Abingdon reservoir or the Severn to Thames transfer.

Appendix A – Responses to Consultation questions

The consultation questions and our responses are shown below, with cross-referencing to this main response document:



Q1. See page 11. Please tell us how well you think we have balanced the main factors relating to our environmental destination in our draft plan. Should we be doing anything differently?

See Section 2.3 of our main response document. In essence, we think Affinity Water's plan includes unnecessary abstraction reductions and delivers the urgently need chalk stream reductions far too slowly.

Q2. See page 15. Please tell us if there are any other factors that we should take into account in our best value plan. Which do you think are most important?

Your plan should have addressed the urgency of achieving improvements to the upper catchment chalk streams (Section 2.3 of our main response) and the urgency of smart meter installation to get PPC down to the 110 l/h/d target as fast as possible, facilitating chalk stream reductions (Section 3.2 of our main response).

Q3. See page 16. Please tell us how well the adaptive approach addresses your main concerns. Is there a different approach we could use?

The adaptive plan fails to deliver the urgently needed chalk stream improvements because it makes them dependent on completion of the unneeded Abingdon reservoir, which is the least adaptive of the SROs. Your plan should prioritise the upper chalk stream abstractions as per Section 2.3 of our response and enable them as fast as possible by building the GUC transfer as soon as possible, bringing forward the Thames to Affinity transfer as fast as possible, bringing forward Connect 2050 to Connect 2030 (Section 3.6 of our main response), accelerating the upper Ouse chalk stream reductions by connection to Grafham reservoir (Section 3.7 of our main response)and building WBGWS-type drought support schemes as insurance against flow recovery being less than expected (Section 3.8 of our main response).

Q4. See page 18. Please tell us which measures you consider are most likely to support management of demand and so should be considered for inclusion in our draft plan. Which of the identified options should we prioritise?

You should prioritise smart metering with associated tariff structuring (Section 3.2 of our main response).

Q5. See page 21. Please tell us your thoughts in relation to the SROs that we have identified.

See response to Question 3.

Q6. See page 25. How should we prioritise demand management? Are there other assumptions or risks (in addition to relying on government policy) that we should consider?

See response to question 4.

Q7. See page 28. In choosing the 100Mm^3 SESRO option we are balancing the impact on local communities against the risk that we won't have enough water if we need to adapt to a higher environmental destination or can't achieve the demand reductions. Please tell us how well we are approaching the balance between the environmental destination and the impacts on the host communities and environment. Is there anything we should do differently?

The so-called SESRO (Abingdon reservoir) is not needed because the deficit can be met with safety margins by the measures shown in Section 3.4 and Figure 18 of our main response. The WBGWS-type schemes described in Section 3.8 provide insurance against flow recovery from chalk stream reductions being less than expected.

Q8. Overall, do you think that our draft plan represents the best value plan for Affinity Water customers, communities and the environment? Please tell us what you think and the reasons for your answer.

No, it is far from the best value plan for the many reasons explained in our main response.