Revised Draft Water Resources Management Plan 2024

Annex 20: Resilience Options

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Version 0.1

from Southern Water

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Glossary

Acronym	Term	Definition
AMP	Asset Management Plan	The AMP periods are 5-year cycles used by the Water Services Regulation Authority (Ofwat) to set the allowable price increase for consumers. AMP periods are five years in duration and begin on 1 April in years ending in 0 or 5; the current period is AMP7 (2020-2025)
CO2e	Carbon Dioxide equivalent	
DO	Deployable output	The output of a source or bulk supply as per the licence (if applicable); pumping plant and/or well/aquifer properties; raw water mains and/or aqueducts; transfer and/or output main; treatment; water quality
DWI	Drinking Water Inspectorate	The Government's drinking water quality regulator
dWRMP	Draft Water Resource Management Plan	Our draft WRMP as consulted on during November 2022-February 2023.
EF	Emission factor	Used in greenhouse gas emission calculations
HoF	Hands off Flow	A term that can be used within abstraction licences to specify a flow below which the abstraction should stop.
HRA	Habitat Regulations Assessment	Assessment to consider the potential effects of alternative options and strategies on designated European sites
HSE	Hampshire Southampton East	A water resource zone in Hampshire. Note that annex 1 of our rdWRMP24 describes how we define our WRZs.
HSW	Hampshire Southampton West	A water resource zone in Hampshire. Note that annex 1 of our rdWRMP24 describes how we define our WRZs.
HWTWRP	Hampshire Water Transfer and Water Recycling Project	An SRO with two component parts including a water recycling plant that makes use of the storage in Portsmouth Water's (PWC) consented Havant Thicket reservoir and a transfer pipeline from the reservoir to Otterbourne WSW, being progressed as a collaboration between Southern Water (SW) and PWC
ICA	Instrumentation Control and Automation	A control system using smart devices to communicate data on performance and enable automation of processes
Ml/d	Mega litres per day	Millions of litres per day. Unit of measurement for flow in a river or pipeline. 1 Megalitre = 1,000,000 litres.
MMO	Marine Management Organsation	Organisation responsible for management of operations in marine environments
RAPID	Regulators' Alliance for Progressing Infrastructure Development	The collaborative regulatory group of Office for Water Services, Environment Agency and Drinking Water Inspectorate formed to accelerate development of new water infrastructure and design future regulatory frameworks
rdWRMP	Revised Draft Water Resource Management Plan	Our revised draft WRMP as part of this consultation.
	Source	A named input to a water resource zone where water is abstracted from a well, spring or borehole, or from a river or reservoir
	Section 20 agreement	The agreement signed by Southern Water and the Environment Agency in March 2018 pursuant to Section 20 of the Water Resources Act 1991 which expires in March 2030.
SEA	Strategic Environmental Assessment	Statutory assessment to identify and assess any significant environmental effects of the WRMP
SRO	Strategic resource option	Water supply measures operating at regional or national scale (e.g. large reservoirs)
WFD	Water Framework Directive	The obligations to achieve good quality and good quantitative status of all water bodies under The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

Acronym	Term	Definition
WINEP	Water Industry National Environment Programme	A list of environment improvement schemes that ensure water companies meet European and national targets related to water
WRMP	Water Resource Management Plan	Statutory plan produced by water companies every five years to plan to meet supplies over a minimum 25 year period.
WRSE	Water Resources South East	Collaboration of water companies and regulators in South East England working together to make best use of available water resources
WRZ	Water Resource Zone	The largest possible zone in which all resources, including external transfers, can be shared and hence the zones in which all customers experience the same risk of supply failure from a resource shortfall
WSW	Water supply works	

1 Introduction

This annex describes the process we have followed to identify measures to mitigate the impacts of revised delivery dates for Havant Thicket Reservoir and the Hampshire Water Transfer and Water Recycling Project (HWTWRP) in our Western area and the Littlehampton recycling option in our Central area. We have set out our intentions to continue to explore alternatives to drought permits and orders throughout the next AMP and described the work that we intend to carry out in the 2025-30 period to reduce reliance on drought permits and orders as well as options that we expect to include in our Water Resources Management Plan 2029 (WRMP29).

Our draft Water Resources Management Plan 2024 (dWRMP24) was based on:

- the Littlehampton recycling scheme being delivered by 2026-27, providing up to 15Ml/d from 2027-28
- Havant Thicket Reservoir being delivered by 2028-29, facilitating the bulk import of up to 21Ml/d from Portsmouth Water's Source A to Southern Water's Otterbourne Water Supply Works (WSW) from 2029-30
- the HWTWRP being delivered by 2029-30, providing up to 90Ml/d from 2030-31.

For our revised draft Water Resources Management Plan 2024 (rdWRMP24), the dates have been revised as follows:

- The Littlehampton recycling option will be delivered by 2029-30, providing benefit from 2030-31
- Havant Thicket Reservoir will be delivered by 2030-31, making the bulk import to Otterbourne WSW available from 2031-32
- The HWTWRP will be delivered by 2033-34, providing benefit from 2034-35.

Following public consultation on our dWRMP24 from November 2022 to February 2023, we published a Statement of Response (SoR) on 31 August 2023. The delivery year for HWTWRP in the SoR was 2034-35. Upon further review, this has now been brought forward to 2033-34.

1.1 Impact in the Western area

The effect of the revised dates means that we will have to continue to rely on applying for the use of Candover Drought Order in Hampshire Southampton East (HSE) water resource zone (WRZ) and the River Test Drought Permit/Order in Hampshire Southampton West WRZ (HSW) in the event of a drought until 2033-34. The modelling work that we have carried out in conjunction with Water Resources South East (WRSE) group has demonstrated that it is not possible to maintain supplies to our customers in our Western area in all planning scenarios without the use of drought permits and orders. This is the basis of rdWRMP24 that we are now consulting upon. This reliance is longer than we previously planned for in our Water Resources Management Plan 2019 (WRMP19), but we are significantly restricted by a lack of alternative options that can be developed in time to provide the required volumes of water.

The process agreed by the Environment Agency and Southern Water by which the company will apply for drought permits and orders in Hampshire is set out in the agreement we signed with the Environment Agency under Section 20 of the Water Resources Act 1991 (Section 20 Agreement). The agreement was signed in 2018 and is due to expire in 2030. We will therefore need to discuss any implications of our extended timelines with regard to the Section 20 Agreement with our regulators.

Without the continued use of drought options, we cannot achieve our projected supply-demand balance in the Western area in drought scenarios. In every scenario and every adaptive pathway considered throughout the development of our plan, drought options are selected as the best value option overall. The changes in the use of drought permits and orders from the dWRMP24 are as follows:

- In dWRMP24, the Lower Itchen Drought Order in HSE was available up to 2026-27 under all drought conditions. This was in-line with our previous aim in WRMP19 of reducing reliance, ideally by 2027.

However, this aim was always dependant on having the longer-term infrastructure in place. For rdWRMP24, its use needs to be extended to 2029-30 under all drought conditions. After 2030, and by the time of expiry of our current Section 20 Agreement in March 2030, the use of the Lower Itchen Drought Order will cease. It should be noted that although our Western area resilience relied on this option in WRMP19, a Lower Itchen Drought Order has not to date been needed (and not applied for).

- In dWRMP24, the Candover Drought Order in HSE was available up to 2026-27 under 1-in-200 year drought conditions and up to 2028-29 under 1-in-500 year drought conditions. For rdWRMP24, this option needs to be available until 2033-34 under all drought conditions. As is the case with the Lower Itchen Drought Order, we have not needed to apply for the Candover Drought Order to date.

  In dWRMP24, the Test Drought Permit/Order in HSW was available up to 2029-30 under 1-in-200 year drought conditions and up to 2040-41 under 1-in-500 year drought conditions. We aim to achieve resilience to droughts of up to 1-in-500 year severity by 2040-41. For our rdWRMP24, this option needs to be available until 2033-34 under 1-in-200 year drought conditions. It is also used under 1-in-500 drought conditions until 2040-41 after which our plan requires no further use of supply-side drought permits and orders.

The continued reliance on drought permits and orders presents an ongoing concern for our customers and stakeholders. The Environment Agency expressed its concern on this matter through a letter dated 24 August 2023. Without the use of drought options in the Western area, we cannot achieve our projected supply-demand balance and they therefore remain a necessary interim measure until the longer-term infrastructure (including HWTWRP) is developed and operational. We understand that the continued use of drought options present concern but their inclusion is still aligned with the Water Resources Planning Guideline (WRPG)[1], and, in terms of the best value planning requirements, represent the best value optional overall.

We have nevertheless been looking to minimise the level of reliance on those drought permits and orders during the interim period until our longer-term infrastructure is developed. We have been in discussions with and undertaken workshops with the Environment Agency and Natural England to identify potential options to mitigate the reliance on drought options in practice. As we describe later, we have identified four options that could be introduced or accelerated and three of these are in the Western area. We refer to these in this annex as our ‘resilience options’.

1.2 Impact in the Central area

The Environment Agency has indicated that it is not supportive of the continued use of the Pulborough surface water Drought Permit/Order in Sussex North WRZ (SNZ) beyond 2029-30. We were not aware of this position when we developed our dWRMP24.

The revised date for the Littlehampton recycling option has no impact on the need for the Pulborough surface water Drought Permit/Order beyond 2029-30 as it is planned for delivery by 2029-30. We have nevertheless introduced measures in our rdWRMP24 that mean that the Pulborough surface water Drought Permit/Order is not needed beyond 2029-30 in droughts that are less severe than 1-in-500 year severity. The Pulborough surface water Drought Permit/Order is not needed beyond 2040-41 in droughts of up to 1-500-year severity (see Section 7 in our rdWRMP24 Technical Report).

[1] Environment Agency, Natural Resources Wales and Ofwat, 2023. Water Resources Planning Guideline. Version 12.

2 Identifying resilience options

In order to identify potential resilience options, we carried out a targeted re-appraisal exercise for rdWRMP24 following the consultation on dWRMP. This was not a comprehensive full options re-appraisal akin to that for the main plan preparation. Having already undertaken extensive work alongside WRSE and having considered hundreds of options (see Annex 12), a full re-appraisal exercise was not considered time or cost beneficial given that the outputs were expected to largely remain consistent with the work already undertaken.

Instead, a high-level qualitative re-appraisal identified and considered a select number of options that could potentially meet the much narrower objective of reducing the continued reliance on drought options during the time period before the larger strategic options are available.

The key criterion for the resilience options was that they had to be operational by 2030-31. This ruled out large infrastructure options with significant lead time and led to a targeted reappraisal of options. The combined Deployable Output (DO) benefit of Candover and River Test drought options is over 100Ml/d. It was therefore clear from the start that we would not be able to identify options that would eliminate the need for these drought options altogether. The aim was to offset the volume available from these drought options by as much as possible by identifying options that could be available from 2030-31. We have an ambitious demand management programme. While we would look to accelerate the delivery of demand management activities, there is limited scope to achieve significantly greater savings in the 2025-30 period. We therefore focussed on supply-side options. These fell into three broad categories:

- **Accelerated delivery of options:** We reviewed options that were selected in our dWRMP24 post 2034-35 to assess and identify whether any could feasibly and realistically be delivered earlier to provide benefit from 2030-31.
- **Reconsidered dWRMP24 options:** We reviewed a selection of options that were either available for WRMP24 but were not selected or options that were not part of the dWRMP24 constrained list.
- **New options:** These were options that were not assessed as part of WRMP24 but were suggested to us during ongoing engagement.

2.1 Option selection

An internal workshop was held on 6 July 2023 with operational colleagues with local technical knowledge of our production and distribution networks to identify a list of potential options.

Options were positively selected, in that sites and areas were considered against the potential contribution to the expected deficit. While many of the schemes were the same as those that had been considered in the past, that list was not used as a starting point, as the intention was not to repeat the work that had been done previously.

To compile this list, we used the categories above and identified a limited number of options that could hypothetically be:

- delivered by 2029-30 (or sooner) in order to provide benefit from 2030-31,
- developed as a temporary measure (e.g. for a period of five years in order to specifically reduce the reliance on drought permit/order options in the interim period until the larger strategic options (e.g. HWTWRP) are available,
- implemented without the risk of causing further delay to the progress of HWTWRP.

We subsequently received a letter from the Environment Agency on 24 August 2023 which expressed concern about continued reliance on drought permits and orders and identified some specific options for Southern Water to reconsider. These schemes were added to the initial list of options, which included 31 options for the Western area and 20 for the Central area. We shared this list with the Environment Agency and Natural England in October 2023 as part of the engagement described below. The conclusion was that,

as per our original assessment, most remained unfeasible. Those options and some others we identified after we shared this list with the Environment Agency and Natural England are included in Appendix A.

Each of these schemes was worked up to an outline design so that a high-level costing and carbon assessment could be undertaken. The cost models were the same as had been used in the initial WRMP assessment. As stated above, the main criteria to assess which schemes to develop further were based around the expected timeframe for delivery and the impact that the new scheme may have on the HWTWRP. The rejection Log for these schemes is included as Appendix A to this annex.

2.2 Internal and external engagement

2.2.1 Internal engagement

We held a workshop with internal staff, with knowledge of our sites and assets, on 6 July 2023 to see if there were any options that could be developed quickly through asset enhancement, site rehabilitation or bringing redundant sources back into service. We also looked at options that were previously considered but not taken forward to see if some of the constraints could be removed to make these options feasible.

As a result of this exercise, we selected 30 options in the Western area and 20 options in the Central area for reappraisal.

2.2.2 External engagement

Following the letter from the Environment Agency dated 24 August 2024, we held a workshop with the Environment Agency and Natural England on 28 September 2023 to discuss the scope of the work we were planning to carry out. We held another workshop with the Environment Agency on 02 November 2023 to discuss the progress on the resilience options. Ahead of the workshop, we shared the list of potential options that were reappraised and the outcome of our assessment. The list is included as Appendix A to this annex.

A third workshop with the Environment Agency and Natural England was held on 22 March 2024 to go through the final list of resilience options we have included in our rdWRMP24.

In addition to these workshops, we have held weekly meetings with the Environment Agency and Natural England. The Environment Agency and Natural England are not the only external stakeholders that we have engaged with. As discussed later in section 3.1.2, we have also engaged with the DWI (Drinking Water Inspectorate) to discuss potential implications on drinking water quality. We are in the preliminary stages of engagement with the relevant organisations associated with the Southampton Port and will approach the Marine Management Organisation (MMO) as required.

We have engaged with a variety of environmental Non-Governmental Organisations (eNGOs) for example at a site visit and presentation session held in our Western area in May 2024. Our Chief Executive Officer (CEO) also attended a national river summit in May 2024, being the only water company CEO to do so.

Given some notable changes to our dWRMP24 consulted upon earlier, we are now consulting on this updated plan. This will allow all customers and stakeholders the opportunity to provide feedback on the changes we have made and their implications. To help explain some of the topics that can be technical and complex we have developed a frequently asked questions (FAQ) section on our website to accompany this consultation. More information about the overall WRMP engagement work we have carried out is given in Annex 5.

2.2.3 Outcome of the option appraisal exercise

The options identified as having potential to help reduce our reliance on the drought permits and orders in the Western and Central areas are described in sections 2.3 and 2.4 respectively. They do not however remove the need to rely on the drought permits and orders altogether. Extended reliance on these drought

options therefore remains in our core plan and our preferred pathway. No single solution or combination of solutions was identified that could completely remove that need altogether before 2033-34. As part of our ongoing regional engagement with WRSE, no regional solution or scheme of any other south-east company could assist us in reducing the reliance on drought options in this timeframe.

2.3 Western area

2.3.1 Accelerated delivery of already selected options

Our dWRMP24 included the following groundwater options in the Western area.

- Groundwater (HRZ): New boreholes at Romsey (4.8Ml/d); first selected in 2031-32 in dWRMP24 and in 2035-36 in the interim rdWRMP24
- Groundwater (IOW): New boreholes at Eastern Yar3 (1.5Ml/d); first selected in 2039-40 in the dWRMP24 and in 2036-37 in interim rdWRMP24
- Groundwater (IOW): New boreholes at Newchurch (Lower Greensand) (1.9Ml/d); selected in 2034-35 in dWRMP24 and in 2036-37 in the interim rdWRMP24
- Groundwater (HSW): Test MAR (5.5Ml/d); first selected in 2040-41 in dWRMP24 and in 2035-36 in the interim rdWRMP24

The Romsey groundwater option in Hampshire Rural (HRZ) WRZ requires additional infrastructure development to be able to transfer more water from HRZ to HSW. The required infrastructure enhancements is already included as a constrained option for WRMP24 and accelerated delivery of this option is therefore considered feasible. This is discussed further in Section 3.

The groundwater option on the Isle of Wight (IOW) WRZ at Eastern Yar3 has zero DO under drought conditions. Accelerated delivery of this option therefore provides no additional benefit under drought conditions.

We tested a scenario whereby we pre-selected the Newchurch (LGS) groundwater option on the IOW from 2030-31. Pre-selection of this option simply reduces the utilisation of Sandown recycling option on the IOW. As water cannot currently be moved from the IOW to the mainland, maximising the utilisation of both the Newchurch groundwater option and the Sandown recycling option creates additional headroom on the IOW but does not reduce reliance on the Hampshire drought options.

The Test MAR option in HSW is a managed aquifer recharge scheme that requires further investigations and assessments to determine its feasibility. It would not be possible to complete the investigations and deliver the option by 2029-30. Earliest delivery by 2034-35 and benefit from 2035-36 is a more realistic timeframe. This option was therefore not considered for accelerated delivery.

2.3.2 Reconsidered WRMP24 options

A reappraisal of options considered for WRMP24 but not taken forward identified two options that could potentially be taken forward for rdWRMP24 after removal of infrastructure constraints. These were:

- Groundwater (HRZ): Remove constraints at Kings Sombourne (2.5Ml/d)
- Groundwater (HAZ): Recommission Chilbolton (0.5Ml/d)

We tested a scenario where both these options were pre-selected to provide benefit from 2030-31.

The Chilbolton option in Hampshire Andover (HAZ) WRZ only provides a small benefit (0.5Ml/d) but even this benefit is confined to HAZ. In the absence of an option to transfer water from HAZ to HSW or HSE, pre-selecting this option only creates additional surplus in HAZ without reducing the volume required from either the Candover Drought Order or the River Test Drought Permit/Order.

The volume from the Kings Sombourne option can be moved from HRZ to HSW through the same infrastructure enhancements needed for the Romsey groundwater option mentioned above. This option is therefore included in rdWRMP24 and pre-selected to provide benefit from 2030-31. This is discussed further in Section 3.

In its letter dated 24 August 2023, the Environment Agency had drawn our attention to three possible options that could be considered, among others.

1. Temporary desalination on the Southampton coast and/or the IOW
2. Changing our supply to a large industrial user in HSW (up to 10Ml/d)
3. Bulk import of water from Norway via sea tankers

As regards option 1, temporary desalination and changing the supply to large industrial user had previously been looked at as part of our Water for Life Hampshire (W4LH) programme. We re-appraised them for rdWRMP24 but our conclusions remain unchanged from our original appraisal (see Appendix A).

As regards option 2, changing our supply to a large industrial user in HSW, the current agreement with the industrial user expires in late 2026 and includes an obligation to negotiate a renewal of the industrial user's supply agreement. Ceasing the current supply before the existing contract expires is not feasible, meanwhile consideration of options to either not offer a future agreement or not provide a supply is not considered a viable option given the importance of the industrial use to the local area. Negotiation of a replacement contract will include consideration of a range of options. However, these options are not yet fully determined and negotiations are at an early stage so we are unable to provide the certainty required for the purposes of inclusion in WRMP24 (see further details in Appendix A).

As regards option 3, bulk import of water from Norway via sea tankers was considered for the WRSE regional plan but not taken forward. A scheme of this type has not been undertaken in the UK before. There are therefore no current industry examples to reference or follow. We had received a proposal from a commercial supplier to import water from Norway via sea tankers after we published our dWRMP24 for consultation. Following the conclusion of public consultation on our dWRMP24 in February 2023, we held a meeting with the commercial supplier in May 2023 to discuss their proposal. This was before the letter from the Environment Agency in August 2023. The meeting with the commercial supplier and subsequent internal review highlighted a number of key constraints that need to be resolved.

- A suitable berthing location for the tankers.
- A location for storing and treating the water to ensure compliance with Drinking Water Inspectorate (DWI) regulations.
- The infrastructure to transfer the water from the berthing location to the storage site.
- Agreement with regulatory bodies (e.g. DWI) on the water quality standard and ability to accept the water.
- Further environmental assessment of source water to minimise any potential water quality and Invasive Non Native Species (INNS) risk e.g. Salmon Fluke.
- Further discussions with the Environment Agency and Natural England regarding the potential impacts to designated sites, the conclusions of the Habitats Regulations Assessment (HRA) and whether any mitigation or compensation would be needed.

We consequently did not include this option for our interim rdWRMP24. Following the submission of our interim rdWRMP24 in August 2023, we have had further discussions with the commercial supplier to further refine and develop their proposal and also carried out additional work in-house to address the key issues mentioned above. As a result, we have an outline design for a solution that could potentially be in place from 2030-31. This is discussed further in Section 3.

2.3.3 New options

We have not identified any new options in the Western area for inclusion in rdWRMP24.

2.4 Central area

2.4.1 Accelerated delivery of already selected options

Our dWRMP24 included a groundwater option near Petworth in Sussex North (SNZ) (Groundwater (SNZ): New borehole at Petworth (4Ml/d)) that was first selected from 2043-44. In the interim rdWRMP24, the first need for this option was brought forward to 2040-41. In our view, it is potentially possible to deliver this option early to provide benefit from 2030-31. Its delivery has therefore been brought forward in rdWRMP24. See Section 3 for details.

2.4.2 Reconsidered WRMP24 options

Our targeted reappraisal of options in the Central area did not identify any options that could be considered feasible for rdWRMP24.

We considered the proposal from the commercial supplier to see if sea tankering could be an option in the Central area as well. However, the lack of a suitable storage site in the vicinity of a potential berthing location prevented this option from being taken forward in the Central area.

2.4.3 New options

We have not identified any new options in the Central area for inclusion in rdWRMP24.

3 Resilience options

This section provides further details on the options that we have taken forward in an effort to improve resilience and reduce reliance on drought permits and orders in the Western and Central areas. These are in addition to the other measures we have taken to improve resilience in the Central area (see Section 6.3.4 in the rdWRMP24 Technical Report).

3.1 Description of the options

3.1.1 Accelerated delivery

As an effort to reduce drought option reliance, we now propose to accelerate the delivery of two of the options that were already selected in our interim rdWRMP24. The reasons for not accelerating the other identified schemes are set out in appendix A.

Groundwater (HRZ): New boreholes at Romsey (increase of 4.8Ml/d)

Romsey WSW is an operational groundwater site. The existing boreholes and well/adits at the site are either out of service or operating below their full capacity. This option involves drilling three replacement boreholes to increase Deployable Output (DO) on site. We expect the scheme to increase DO by 4.8 Ml/d to 13.7Ml/d. Replacement borehole locations are distant from existing borehole locations and so require new pipelines to connect to the treatment works. This option was previously selected to provide benefit from 2035-36. As part of our updated plan, delivery will be brought forward so that benefit can be achieved from 2030-31. Environmental assessments for this option have already been carried out and are included in annexes 17-19 to the rdWRMP24 Technical Report.

Groundwater (SNZ): Petworth groundwater source (4Ml/d)

This scheme aims to return our groundwater source at Petworth WSW to service by drilling a new borehole ca. 700m south of the existing WSW. The present boreholes are out of service due to raw water quality risks associated with their shallow depth and proximity to the River Rother. The new borehole is expected to be a minimum of around 300mm in diameter, and approximately 80m deep.

This scheme was previously selected in our draft plan to be delivered in 2044 but we now intend to deliver this option in the Central area in 2029-30 so that it provides benefits in 2030-31.

3.1.2 Reconsidered dWRMP24 options

We reviewed the list of options that were included in the WRMP24 unconstrained list of options but were not progressed to the constrained list. Both previously rejected options and reconsidered options still carry a significant level of risk, which is why they were not included as WRMP options originally and why accordingly our plan still fundamentally requires the reliance on the drought permits and orders. These options are intended to be developed further during AMP8 (2025-30) with the aim of potentially reducing the level of risk in order to support reducing drought option reliance beyond 2030. As already stated, none of these options, even if all risk is capable of being reduced, remove the need for drought options altogether.

Groundwater (HRZ): Remove constraints at Kings Sombourne (2.5Ml/d)

This option involves recovering DO through the development of a new borehole at the site and additional pump capacity to increase the yield from the current 1.5Ml/d to the licenced capacity of 4Ml/d providing a net benefit of 2.5Ml/d.

This scheme was not previously included in our feasible options list for WRMP24 owing to potential WFD deterioration risks and the relatively small gain in DO compared to the degree of asset and network enhancement required. HRZ has also traditionally been in supply-demand balance surplus as the available

DO from Romsey and Kings Sombourne sources exceeds the typical demand in HRZ. However, by increasing the capacity of the Romsey Town and Broadlands link between HRZ and HSW, the surplus water from Romsey and Kings Sombourne sources can be transferred to HSW.

Bulk import (HSW): Sea tankering from Norway (45Ml/d)

This option involves bulk import of water from Norway via sea tankers. This option (previously involving an import from either Norway or Iceland) had not been included in our dWRMP24 due to water quality concerns, excessive and disproportionate costs and the number of ships needed to provide the required DO. A scheme of this scale and nature has not been undertaken in the UK before and so there are no current industry examples to reference or follow. However, given the volume of potential water available and the fact that the source is already available, we looked at the constraints in closer detail to see if they could be addressed prior to 2030 and this work is continuing.

The water comes from glacial melt in Norwegian highlands and is currently used for hydropower generation at a station in western Norway before being discharged into a fjord. As part of this proposal, a part of the water currently being discharged to the fjord will be loaded onto sea tankers. Infrastructure is already in place at the hydropower station for this but will require recommissioning. There is an existing berth able to handle sea tankers capable of carrying up to 45Ml/d and there is good access in and out of the fjord.

We identified Southampton docks as the only possible location in the Southern Water region for berthing such large tankers.

Food grade tankers will be used to transfer water to the Southampton port. From the Southampton port, the offloaded water will be transferred to one of the existing lakes at our Test surface water WSW in HSW for temporary storage through a temporary pipeline along the River Test. The water will be treated at our Test surface water WSW before being put into supply.

The supply could commence as early as within 6 weeks of the supplier being notified of the need. There is an estimated 8-day turnaround time for each tanker; and therefore 8 vessels on rotation would be required to maintain a constant supply during drought. This assumes that a need would be for no more than 90 days.

The commercial supplier has held preliminary discussions with the port owners in Southampton and discussed creating berthing capacity for up to 120 days in a year when needed. We are investigating suitable berths. A berth in the container port is furthest upstream and closest to the Test surface water WSW. There are two alternative berths which are situated further downstream and therefore require a longer pipeline but may have more space for a temporary pumping station.

Assuming no delays due to ships manoeuvring in the ports and/or tidal variations, we understand that a steady supply of 45Ml/d can be maintained using a series of ships.

According to the commercial supplier, water quality is very close in quality to rainwater. However, two aspects need to be addressed. The pH is around, and sometimes below, the lower limit for drinking water, ranging from 6.3 to 6.7. Secondly the water is very soft, with Total Dissolved Solids (TDS) below 10mg/l. For the local municipal supply, which is sourced from the same catchment, pH is increased to about 8.0 and the water is mineralised.

An initial discussion took place with the DWI in April 2024. Following that meeting we need to undertake additional work to assess and mitigate water quality risks to ensure that the imported water meets strict acceptability criteria. This additional work would involve the production of a Drinking Water Safety Plan (DWSP). This option would in principle comprise of the transfer of tankered water to our Test surface water WSW through temporary pipes along the banks of the River Test. The imported water will be put into our supply network after treatment at Test surface water WSW. We also considered Shoreham and Littlehampton as possible locations but ruled these out due to inadequate infrastructure for storage and treatment in the vicinity of the port and an inability to receive tankers of the proposed size.

We continue to engage with the proposed supplier and recognise that we will need to resolve the following points for the option to be delivered:

- The suitability of our identified berthing location for the anticipated size of tankers
- The further testing required to determine source water quality and hence treatment requirements and risk assessment updates at Test surface water WSW
- The time taken to offload a 45Ml tanker
- The need for additional space on the docks for installing pumps to pump water from the tankers and pipe it to Test surface water WSW
- The potential triggers for mobilisation
- The potential outline nature of commercial arrangements that will need to be in place with both the supplier and Southampton port operator to facilitate this option, including instances where the import may need to be aborted after initial mobilisation, for example, due to improving water resource situation.

The option is at the moment considered to be technically feasible from an engineering perspective, but there are a number of deliverability challenges linked to water quality, commercial agreements, environmental risks, logistical and planning consent/landowner agreement issues that are currently unresolved and which would need to be explored further throughout AMP8.

We have included this option in our rdWRMP24 but only as a potential mitigant to try to reduce the reliance on drought permits and orders which are otherwise the preferred options in WRMP24, on the assumption that these challenges may be capable of being overcome by 2030-31. We will continue to engage with relevant parties and stakeholders over the next AMP to resolve the identified issues and to develop this option further.

We have included the 45Ml/d option in our rdWRMP24 to offset the use of drought options in Hampshire by as much as possible. We have not considered larger imports at this stage due to the available storage capacity at Test surface water WSW. The environmental assessments that we have carried out on these re-considered options are covered in Section 4 of this annex and included in annexes 17-19 of the main rdWRMP24 Technical Report. We will need to discuss the outcome of our environmental assessments with the Environment Agency and Natural England.

3.2 High level design and cost

3.2.1 Groundwater options

The Romsey groundwater option had already been designed at a high level as part of dWRMP24 development. The costs for the Romsey option were adjusted to 2020-21 cost base as was done for all options in rdWRMP24. There were no changes to high level for this option.

For potential groundwater options identified as part of this exercise, the following approach was used to come up with a high-level design.

- Pumps were sized against the flow and pumping head, assuming a pump efficiency of 80%. Where only the borehole depth was known in terms of required head, additional head was included to allow the water to pass through the required treatment and to join the network.
- Filtration was assumed to be by Amazon cartridge filtration unless the requirement for pressure or sand filtration was already included in the scope. Where media-based filtration was required, the size of filter was based on a conservative estimate of a normal sand filter.
- An upgrade in disinfection was normally assumed to be achieved by installing the correct size of Ultra-Violet (UV) reactor, followed by gas chlorination. In cases where super-chlorination was already used, an assessment was made on the size of the contact tank and the need to extend this. Generally, the water quality in the region contains nitrogen in the form of nitrate. Ammonia, which

would affect the network chlorine residual is therefore not present and does not need to be removed by super-chlorination. This means that UV would be the preferred method of disinfection.

- Sand filters were sized in line with normal design practice seen at similar sites within the industry.
- Disinfection was assumed to be by UV treatment, unless adequate contact time for super-chlorination already exists.

The high-level outline designs were shared with our Cost Intelligence Team (CIT) to produce indicative costs for the defined option assets. The CIT maintains cost curves for the identified treatment processes. In the case of Kings Sombourne, where the site is to be upgraded from an existing works, it was assumed that little additional infrastructure would be required beyond that which is already there.

3.2.2 Sea tankering

The sea tankering option has two main components:

1. Procuring and transporting water from Norway to Southampton port

The costs for this component have been provided by the commercial supplier. It has a fixed element in the form of annual charge. This charge is to cover costs in Norway related to pipework and infrastructure, depreciation and maintenance, water quality sampling, updates to the Invasive Non Native Species (INNS) risk, constant liaison with the Norwegian suppliers of water, shipping agents and the port of Southampton.

The second element is the unit charge which will become payable once the option is triggered. The charge will cover:

- Purchase price of the source water in Norway
- Loading costs
- Shipping costs
- Southampton harbour costs
- Berthing costs

The commercial supplier has provided us with initial estimates of annual charge and unit charge. We have included them in our cost estimates for this option. However, these are subject to change following commercial and contractual negotiations.

2. Transfer of water from Southampton port to Test surface water WSW

We have identified potential transfer routes from Southampton port to Test surface water WSW and the length and diameter of pipe that would be needed for this purpose and the associated costs. This has been done at a very high level and will need to be refined once an exact berthing location has been agreed and infrastructure requirements are better understood.

The total cost of delivering water to Southampton port, in terms of £ per Ml has been provided by the commercial supplier who will additionally charge a 'reservation charge' on an annual basis.

An 'incident' cost for sea tankering was estimated based on a single deployment per year for a period of 90 days and includes the costs of installing the infrastructure required to transport water from the port to Test surface water WSW, including remineralisation at Test surface water WSW and removal of the pipeline after the event.

A set up cost for planning, land agreements, initial purchase and storage of the pipe, along with other development costs, has been included within the cost profile.

The costs of the resilience options we are now including in our plan and all of the other option costs are included in the WRP tables that accompany this WRMP.

3.3 Carbon costs

Carbon assessment was undertaken in the same way and using the same bespoke carbon accounting tool as for other options in the WRMP. This is a 'bottom up' approach and is likely to provide a more accurate assessment of carbon than a 'top down' approach based on generic carbon per spend estimates (e.g. tonnes CO2e per £m spent), but the results can be compared and reconciled at a later stage.

The capital (embodied) carbon of each option was estimated using assumed quantities of different items, namely: civil, mechanical, steel or glass reinforced plastic (GRP) items, instrumentation, control and automation (ICA) and consumables. These quantities are multiplied by the relevant emission factors (EFs) to calculate tonnes equivalent of carbon dioxide emissions. Due to uncertainties around end-of-life decommissioning, demolition, reuse or disposal of assets, any emissions associated with these aspects are excluded. The ongoing emissions associated with the operation of the assets such as fuel, energy, chemical use, transport, or any direct emissions from processes over the specified period (60 years assumed), are calculated by multiplying the respective EFs with the assumed consumptions or quantities.

The cumulative operational emissions are the sum of operational carbon emitted each year over the project life, and cumulative capital emissions are the sum of capital carbon from construction and capital replacements (renewals) over the project period. Ultimately, cumulative operational emissions, and cumulative capital emissions, produce the whole life carbon estimate. The approach is summarised in Figure 1 below.

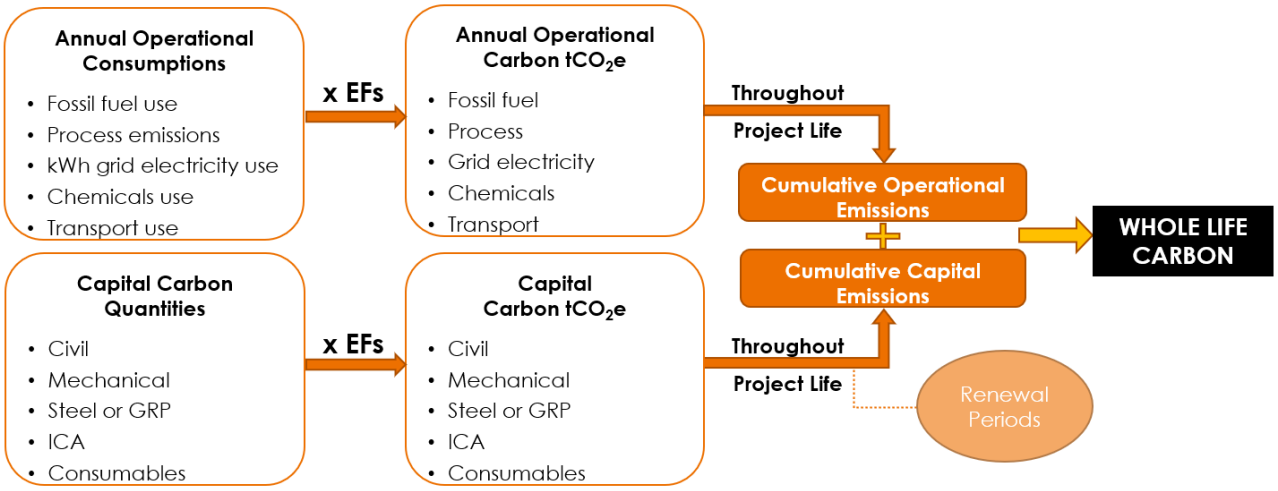

Figure 1: Cumulative operational and capital carbon approach to whole life carbon cost'

Carbon associated with each option was valued using government guidance[2] on the value of carbon over time.

The resulting option summary table outputs for carbon includes four values:

- Embodied (capital) carbon emissions (tCO2 equivalent)
- Annual operational carbon emissions (for first year) (tCO2 equivalent per annum)
- Whole-life Carbon (for 60 years) (tCO2 equivalent)

[2] Valuation of greenhouse gas emissions: for policy appraisal and evaluation" (BEIS, 2021) and HM Treasury (2022) Green Book supplementary guidance on intergenerational wealth transfers and social discounting, pg. 5.

- Total Carbon Cost for 60 years (£)

4 Environmental assessments

In developing our draft WRMP24, we have referred to statutory environmental requirements, national legislation and guidance, to inform our approach to producing a plan that seeks to provide a reliable and sustainable supply of water to our customers whilst protecting and, where possible, enhancing the environment. We have engaged with our environmental regulators (the EA and Natural England) on our environmental and social assessment approach and on our findings. Feedback informed our ongoing assessments, requiring us to reject or modify options to better address environmental concerns or opportunities. The statutory processes that we follow are set out in the figure below:

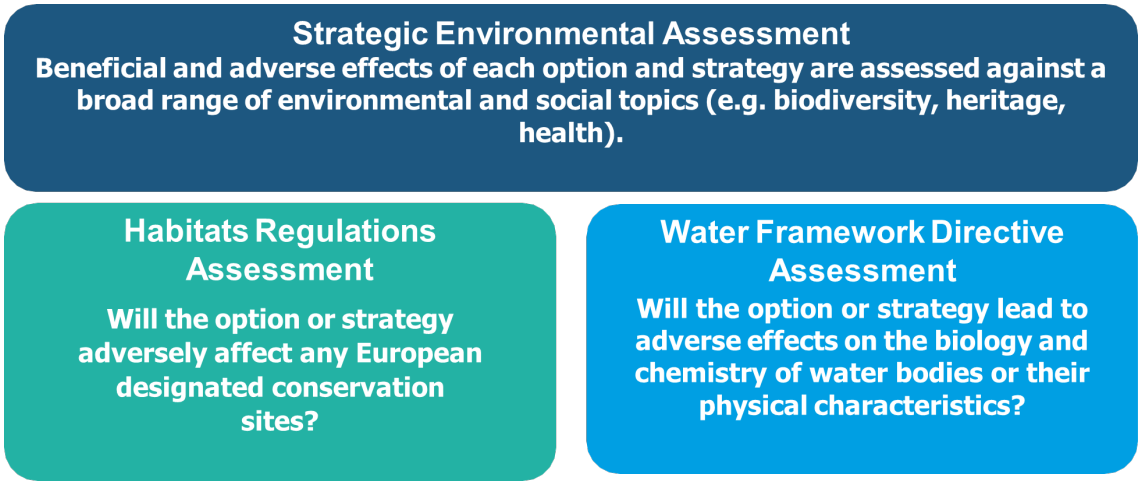

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Figure 2 Statutory environmental requirements - Habitats Regulations Assessment[3], Strategic Environmental Assessment[4] and Water Framework Directive Assessment[5].

4.1 Strategic Environmental Assessment (SEA)

The SEA regulations[6] require an assessment of the likely significant environmental effects of the rdWRMP24. The assessment can help identify ways in which adverse effects can be avoided, minimised or mitigated and how any positive effects can be enhanced.

Overall, the rdWRMP24 is considered to have significant positive operational effects against SEA objectives to: deliver reliable and resilient water supplies; and maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing. The additional design capacity for potable water that Southern Water would provide would help to ensure a continual supply of clean drinking water,

[3] The Conservation of Habitats and Species Regulations 2017
[4] The Environmental Assessment of Plans and Programmes Regulations 2004
[5] The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
[6] The Environmental Assessment of Plans and Programmes Regulations 2004

supporting economic/population growth, generating a positive effect on human health and increasing adaptability to the effects of climate change.

The rdWRMP24 (post mitigation) is also considered to have a range of likely significant negative effects on the following SEA objectives:

- Protect and enhance biodiversity, priority species, vulnerable habitats and habitat connectivity (no loss and improve connectivity where possible);
- Protect and enhance the quality of the water environment and water resources;
- Reduce embodied and operational carbon emissions;
- Conserve, protect and enhance landscape, townscape and seascape character and visual amenity;
- Minimise resource use and waste production.

These effects reflect the number, scale, proposed location and findings of the HRA and WFD assessments, including a precautionary view on the treatment of uncertainty. Many of the options have been revised from the draft WRMP24, with delivery delayed in the rdWRMP24 to allow sufficient time for investigation and consideration of additional mitigation options.

Where negative effects have been identified, generally, these are expected to be either minor or moderate only, although uncertainties remain. The exceptions to this are in respect of biodiversity, climatic factors, water quality and flood risk. The operation of three drought order options (integrated from our revised draft Drought Plan 2022) have been identified as having a likely significant effect on biodiversity. For these options, a programme of mitigation and monitoring has been discussed with the Environment Agency and Natural England.

In respect of climatic factors, significant quantities of embodied carbon are associated with the construction materials used for the desalination options. However, whilst such effects are to an extent unavoidable, as they are associated with all large-scale infrastructure proposals, mitigation measures have been identified including the completion of a carbon footprint study that considers the opportunities for use of low and net zero carbon energy materials (linked to our Net Zero Plan). A potential negative effect is identified against options involving non-essential use bans, as there are potential economic impacts on businesses that benefit directly or indirectly from certain water uses. Detailed mitigation and enhancement measures have been identified to help avoid, minimise, reduce or mitigate effects where identified.

4.2 Habitats Regulations Assessment (HRA)

The Habitat Regulations[7] require the assessment of the potential impacts of plans and programmes on the Natura 2000 network of European protected sites (European sites). The HRA determines whether there will be any ‘likely significant effects’ from a WRMP on any European site as a result of implementing the plan (either on its own or ‘in combination’ with other plans or projects) and, if so, whether these effects will result in any adverse effects on the site’s integrity.

[7] The Conservation of Habitats and Species Regulations 2017

The HRA screening is precautionary, and to be compliant with case law, does not take into account the effects of mitigation measures. In consequence, the majority of options needed to be screened for the more detailed appropriate assessment as significant effects were considered either likely or uncertain for a range of European sites. However, once the appropriate assessment was able to take into account the nature of the options and the potential for mitigation through scheme design and delivery, the September 2023 HRA (Annex 18), plus the July 2024 HRA Addendum (Annex 18A[8]), concluded that for virtually all of the rdWRMP24 options, there will be no adverse effects on any European protected sites (and Ramsar sites) that cannot be reliably avoided through scheme design or mitigated with measures that are known to be available, achievable and likely to be effective at the project-level. However, it is recognised that there are some residual uncertainties associated with some options due to the absence of detailed design and the long planning horizon for delivery. In these instances, this does provide substantial time for any residual uncertainties associated with these options to be resolved and (if necessary) the option set aside and replaced in future WRMP cycles.

The HRA of the rdWRMP24 provides a strategic, plan-level assessment to support the WRMP. It is not an application-specific ('project' level) assessment. A more detailed, project-level HRA (with Stage 2 Appropriate Assessment where required) will be needed to support any actual planning application and environmental permit or consent.

4.3 Water Framework Directive (WFD) assessment

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 sets a default objective for all rivers, lakes, estuaries, groundwater and coastal water bodies to achieve 'good' status or potential by 2027 at the latest.

If an option has been assessed to definitively not comply with the WFD Assessment Objectives set out above, then the option has been reported as WFD non-compliant and removed from the WRMP process.

If an option is assessed to potentially not comply with the WFD Assessment Objectives set out above, then the option has been reported as 'potentially WFD non-compliant'. If an option is reported as 'potentially WFD non-compliant' it may remain in the WRMP process as it may be appropriate to consider the option further where it is considered that additional evidence to improve confidence in the assessment and/or enhanced design could mitigate the potentially WFD non-compliant issues.

The September 2023 WFD assessment (Annex 19) plus the July 2024 WFD addendum, which assessed new and changed options since the 2023 report (Annex 19A), should be read in conjunction with each other. These assessments have concluded that the majority of the supply options contained in our preferred plan would be compliant with the WFD requirements. The WFD assessments did identify that 19 options were anticipated to be potentially non-compliant (with either low or medium confidence) relating to the potential for impacts on water quality and, in some cases flow (where discharge is to a river) or change to the groundwater abstraction regime. Some potential cumulative effects between options, as well as potential in-combination effects with other water companies, could also occur. These options include some groundwater sources, a reservoir and all of the desalination and effluent re-use schemes.

These conclusions are provisional and reflect relatively precautionary assessments. For all options, further evidence and assessment is required, and is being progressed through the programme of work to reduce

[8] Annex 18A assessed new and changed options since the 2023 HRA. Annex 18 and Annex 18A should be read in conjunction with each other.

delivery risk as well as programmes to support the HWTWRP SRO. Given the significant lead in time for some options, it is considered sufficient to provide an adequate period with which to conclude such investigations.

4.4 Next steps

Following consultation, we will review the proposed options and once the final WRMP24 has been published, the selected schemes for water resource management will need to be implemented through specific projects. As part of this process, further study, investigations and assessment will be undertaken to understand and manage the potential environmental and social impacts. These assessments, which may include EIA and project-level HRA, will take account of the issues identified but will also be informed by the greater detail available as the work progresses about option design, siting and pipeline routing, construction methods and scheme operation.

All will be supported by active engagement with the relevant regulators. Further details are provided in the July 2024 updated SEA Environmental Report, September 2023 HRA Report plus July 2024 HRA Addendum and September 2023 WFD Technical Note plus July 2024 WFD Addendum (Annexes 17-19).

5 Impacts of resilience options on drought permits and orders

The accelerated delivery of Petworth groundwater option along with other measures we have introduced for rdWRMP24 mean that the Pulborough surface water drought option is no longer required beyond 2029-30 unless we are faced with a 1-in-500 year drought (see section 6.3.4 and 7.2 of our rdWRMP24 Technical Report). This section is therefore focussed on the Western area.

5.1 Impact on supply-demand balance

Our preferred plan includes the use of Candover Drought Order and River Test Drought Permit/Order under drought conditions for the period 2030-31 to 2033-34. This is the case after the inclusion of resilience options as described in the preceding sections. Given the high degree of uncertainty associated with the sea tankering option, we have considered the impact on the overall supply demand balance for three different alternative scenarios in Figure 2.

- Bulk import via sea tankers is unavailable (shown as blue lines in Figure 2)
- Bulk import via sea tankers is available but the River Test Drought Permit/Order, Candover Drought Order and Lower Itchen Drought Order are not available (shown as the orange line in Figure 2)

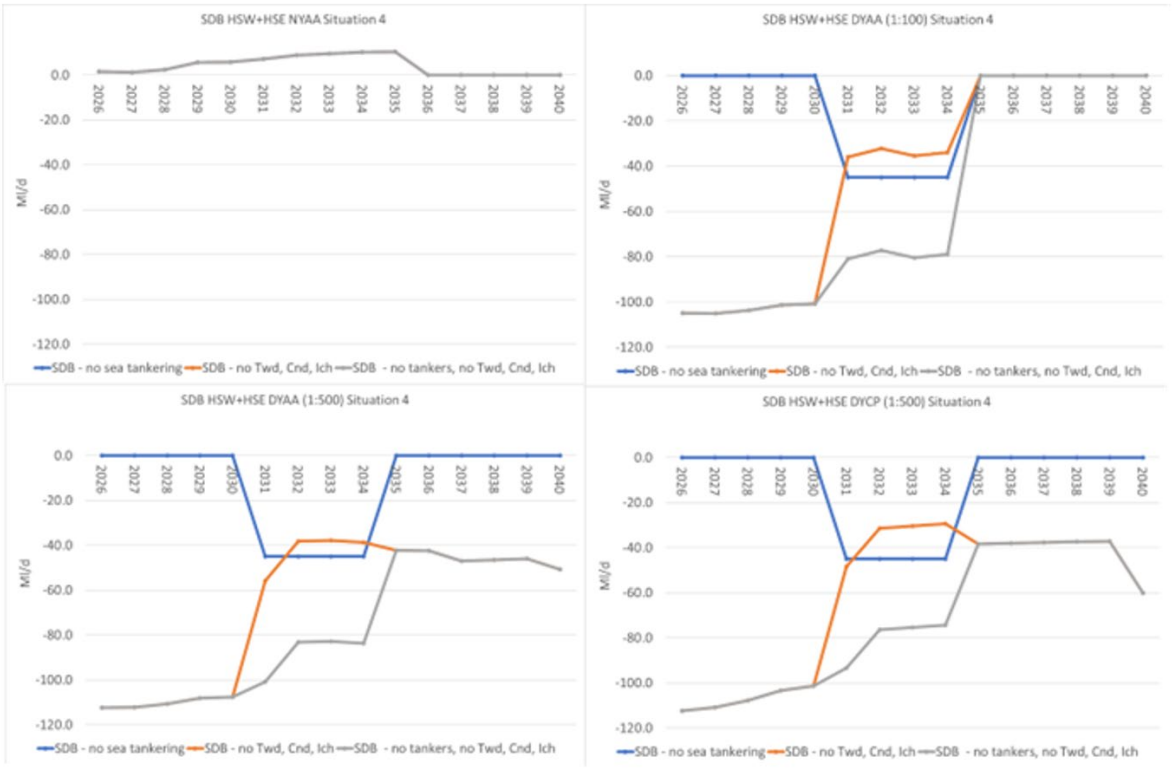

Figure 3: Supply-demand balance in HSE and HSW under 1-in-100 year (1:100) and 1-in-500 year (1:500) drought conditions with and without the availability of bulk import via sea tankers and drought options in Hampshire.

These results are also tabulated in Table 1 and highlight the following trends:

- Prior to 2030, before bulk import via sea tanker option (and other resilience measures become available), we are likely to be reliant on drought permits and orders in HSE and HSW to maintain our

supply-demand balance under drought conditions. In the absence of these drought permits and orders, we forecast an average supply-demand balance deficit of around 100Ml/d to 110Ml/d in the two WRZs during drought when our River Test and Lower Itchen sources may be unavailable due to HoF restrictions.

- Between 2030 and 2033-34 our resilience measures, including bulk import via sea tankers, are still insufficient to maintain our supply demand balance during drought without the Candover Drought Order and the River Test Drought Permit/Order. The residual supply-demand balance deficit would be around 34Ml/d to 43Ml/d. If the Sea Tanker bulk supply is also unavailable during this period that deficit increases to around -80M/d to -88Ml/d.
- From 2034-35 once the HWTWRP becomes available, the reliance on drought permits and orders, is reduced to River Test Drought Permit/Order for up to 46Ml/d in a 1-in 500 year drought until 2039-40.

Table 1: Supply-demand balance in HSE and HSW under 1-in-100 year and 1-in-500 year drought conditions.

Drought interventions	Planning scenario	Average supply-demand balance (Ml/d)		
		2025-26 to 2029-30	2030-31 to 2033-34	2034-35 to 2039-40
Bulk import via sea tankers unavailable	Normal Year	3.3	9.0	1.7
	1-in-100 DYAA	0.0	-45.0	0.0
	1-in-500 DYAA	0.0	-45.0	0.0
	1-in-500 DYCP	0.0	-45.0	0.0
Bulk import via sea tanker available but Hampshire drought options unavailable	Normal Year	3.3	9.0	1.7
	1-in-100 DYAA	-103.1	-34.4	0.0
	1-in-500 DYAA	-110.2	-42.7	-45.8
	1-in-500 DYCP	-107.1	-34.9	-41.4
Neither bulk import via sea tankers nor Hampshire drought options available	Normal Year	3.3	9.0	1.7
	1-in-100 DYAA	-103.1	-79.4	0.0
	1-in-500 DYAA	-110.2	-87.7	-45.8
	1-in-500 DYCP	-107.1	-79.8	-41.4

5.2 Beneficial impact of resilience options on utilisation of drought permits and orders

A key aim of introducing these additional resilience options and changes into our plan is to reduce the overall reliance on drought permits and orders for the River Test, Itchen and Candover Stream to maintain our supply-demand balance whilst our long term solutions for the Western area are delivered.

Through our supply-demand balance and investment modelling we have undertaken additional sensitivity analyses to quantify the benefits that the resilience options provide at different levels of drought severity and any residual supply-demand balance deficits if drought permits and orders are unavailable. In all cases, the investment modelling selects and utilises the Romsey and Kings Sombourne groundwater schemes from 2030-31.

The data included here therefore show the benefits of including bulk supply via sea tanker as a resilience option to reduce use of drought permits and orders. Figure 3 (three paired comparisons) shows the effect of sea tankering on the use of drought permits, specifically the Test surface water, Candover and Lower Itchen drought permits. For each pair of figures, the left panel shows how the drought permit is used when the sea tanker bulk supply option is enabled and the right panel when the sea tankering option is excluded.

The largest effect of the sea tanker bulk supply is on abstraction from the Lower Test where tankering reduces the use of the permit by up to 46Ml/d. This can be at the expense of the Candover drought option (in

cases where the Test surface water drought option is reduced by 46Ml/d, the use of Candover increases by 1Ml/d in a 1:100 DYAA event. Other than that, Candover use is unaffected i.e. even with the resilience options in place. These impacts are summarised in Table 2**.** In all cases, the Lower Itchen drought option is not planned to be used after 2030.

Figure 4: Effect on utilisation of drought permits and orders with resilience schemes depending on the inclusion and exclusion of sea tankering.

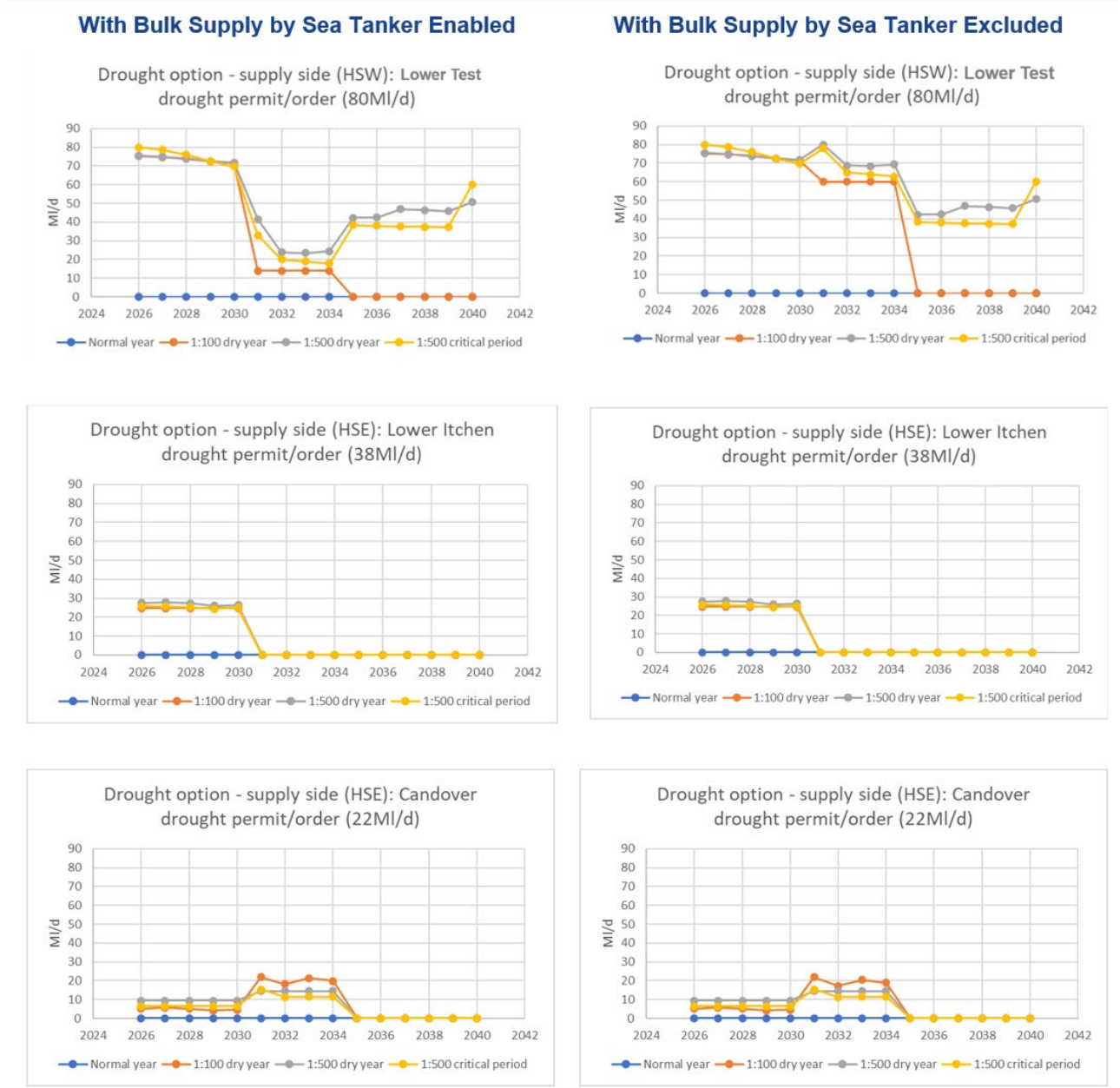

Table 2: Benefit of bulk supply via sea tanker (and other resilience options) on drought permit and order use in Hampshire (negative values indicate reduction in drought permit/ order use).

Drought permit/order	Planning scenario	Change in drought permit/ order usage with bulk supply via sea tanker (Ml/d)			
		2031	2032	2033	2034
Test surface water	Normal Year	0	0	0	0
	1-in-100 DYAA	-46	-46	-46	-46
	1-in-500 DYAA	-39	-45	-45	-45
	1-in-500 DYCP	-45	-45	-45	-45
Lower Itchen	Normal Year	0	0	0	0
	1-in-100 DYAA	0	0	0	0
	1-in-500 DYAA	0	0	0	0
	1-in-500 DYCP	0	0	0	0
Candover	Normal Year	0	0	0	0
	1-in-100 DYAA	0	1	1	1
	1-in-500 DYAA	0	0	0	0
	1-in-500 DYCP	0	0	0	0

We have used an investment model (IVM) to optimise the selection of options for our Best Value rdWRMP24. We are not planning to use the Lower Itchen Drought Order after 2029-30. It was therefore not available to the IVM for selection after 2029-30. The groundwater options in Romsey (HRZ) and Kings Sombourne (HRZ) support HSW during droughts through the interzonal transfer between HRZ and HSW. Bulk import via sea tankers directly benefits HSW. These options do not support HSE and therefore have no impact on the utilisation of Candover Drought Order. Their main impact is on the utilisation of River Test Drought Permit/Order.

In developing our rdWRMP24, we pre-selected Romsey and Kings Sombourne groundwater options along with bulk import via sea tankers from Norway to provide benefit from 2030-31. This pre-selection was necessary as the IVM would otherwise not select the resilience options in the Western area as long as Candover and River Test drought options are available in Hampshire. This is because drought options are considered as temporary, low cost solutions with limited or no additional CAPEX compared to developing new schemes. Even when options such as water recycling are available, the IVM prioritises the utilisation of drought permits and orders over such types of options due to their high operational costs. We are working with WRSE to improve the IVM so that it would maximise the utilisation of non-drought options, regardless of the costs, before selecting drought options. We hope to have this in place for WRMP29.

In order to maximise the utilisation of bulk import via sea tankers and other accelerated options in Hampshire, we reduced the volume available from the River Test drought option from 80Ml/d to 14Ml/d during droughts of up to 1-in-200 year severity. This was done through an iterative process whereby the DO available from the River Test drought option in a 1-in-200 year drought was progressively reduced. 14Ml/d is the minimum DO needed from the River Test drought option to meet supply-demand balance in the event of a 1-in-200 year drought between 2030-31 and 2033-34. Without bulk import via sea tankers, the volume needed from the River Test drought option in the same drought will be 60Ml/d.

Once the HWTWRP becomes available from 2034-35, the Candover Drought Order and bulk import via sea tankers is no longer available and the River Test Drought Order is only available under 1-in-500 year drought conditions up to 2040-41.

5.3 Duration and frequency of sea tankering during drought

To understand the likely duration of use for both sea tankering and drought permits and orders, we have used our hydrological modelling of the Lower River Test to investigate the impact of different drought intervention on flows compared to the presently proposed HoF for the River Test that is due to come into operation from 2027.

In undertaking this assessment, we have used stochastic flow sequences generated using the regional stochastic climate data (ca. 20,000 years) in combination with the existing Catchmod River Model developed by the Environment Agency to estimate total flow in the River Test. This model is regularly used for our operational drought forecasting and management for the River Test.

We have assumed two distinct modes of operation for our Test surface water WSW in this assessment.

- Demand on the Test surface water WSW is set to 'recent actual' value of 55Ml/d. This reflects the long-term average Distribution Input (DI) from the site and is the rate typically adopted in our drought forecasting.
- Demand on the Test surface water WSW is set to the maximum treatment capacity at the site (80Ml/d). This might reflect a severe drought position where both bulk import via sea tankers and drought permits and orders are in use and output from the Test surface water WSW is being maximised to reduce or replace abstraction pressure on the River Itchen e.g. because the River Itchen is approaching or is below its HoF.

The ca. 20,000 year stochastic flow dataset generated by the Catchmod model was analysed to determine the duration over which the river flow would be below the HoF at different levels of drought severity. The impact of abstraction on flow was determined by using the two demand scenarios mentioned above but then adjusting for the benefit of drought interventions:

- Bulk import via sea tankers for up to 45Ml/d Test surface water SW
- Other proposed short term resilience options (Romsey and Kings Sombourne) which can provide an alternative supply of up to 7.3Ml/d of additional water into HSW
- Operation of River Test Drought Permit/Order following the same procedure as currently set out under the agreement we signed with the Environment Agency under Section 20 of the Water Industry Act 1991, allowing up to 80Ml/d of daily abstraction down to a reduced HoF of 200Ml/d.

Table 3 summarises the duration of which flows would be below the proposed 2027 HoF for both 'natural' flow with no abstraction at Test surface water WSW and for different combinations of drought interventions.

Table 3: Summary of duration of drought (defined by the days below River Test Hands off Flow) by drought severity and different levels of resilience and drought interventions.

	Drought options	Drought severity					Abstraction scenario
		1-in-20 year	1-in-50 year	1-in-100 year	1-in-200 year	1-in-500 year	
Total duration (Days)	Natural Flow	106	194	234	262	287	None
	Sea tankering, drought permits and orders	117	203	261	268	296	Typical (55Ml/d)
	Sea tankering, drought permits and orders and resilience options	108	196	234	263	289	Typical (55Ml/d)
	Drought permits and orders only	166	259	273	297	287	Typical (55Ml/d)

	Drought options	Drought severity					Abstraction scenario
		1-in-20 year	1-in-50 year	1-in-100 year	1-in-200 year	1-in-500 year	
	Sea tankering, drought permits and orders	146	226	261	286	311	Full (80Ml/d)
	Sea tankering, drought permits and orders and resilience options	138	221	256	280	306	Full (80Ml/d)
	Drought permits and orders only	190	259	287	311	332	Full (80Ml/d)
Difference from natural (days)	Sea tankering, drought permits and orders	11	9	27	6	9	Typical (55Ml/d)
	Sea tankering, drought permits and orders and resilience options	2	2	0	1	2	Typical (55Ml/d)
	Drought permits and orders only	60	65	39	35	0	Typical (55Ml/d)
	Sea tankering, drought permits and orders	40	32	27	24	24	Full (80Ml/d)
	Sea tankering, drought permits and orders and resilience options	32	27	22	18	19	Full (80Ml/d)
	Drought permits and orders only	84	65	53	49	45	Full (80Ml/d)

A number of trends are apparent.

- Given the high HoF, even under relatively mild (1-in-20 year) drought with 'natural' flows and no abstraction from the River Test, there are likely to be extended periods of time where flows are below the proposed 2027 HoF.
- Use of the proposed resilience options can create near 'natural' conditions in the River Test if demands are close to long term average rates (ca. 55Ml/d).
- If the bulk import via sea tankers and only drought permits and orders are used to maintain supplies, the period for which river flows are likely to be below the future HoF is extended by around 9-12 weeks (compared to the natural flow recession and recovery).
- For the most severe droughts (1-in-100 year or more severe) when abstraction from the River Itchen may be significantly curtailed due to HoF, it is likely that bulk import via sea tankers, other resilience options and drought permits and orders will be required to operate together to maintain supplies.

Under this scenario the duration of a drought where flows are below the HoF could be between 8-10 months even with all resilience options and is largely driven by natural flow.

- The use of all resilience options, including drought permits and orders would extend the duration that flows are below the River Test HoF compared to natural flows by around 20-40 days. If drought permits and orders alone are used this same duration would be extended by between 40 and 80 days.

Figure 5 shows the difference in duration below HoF from natural for each of the drought interventions.

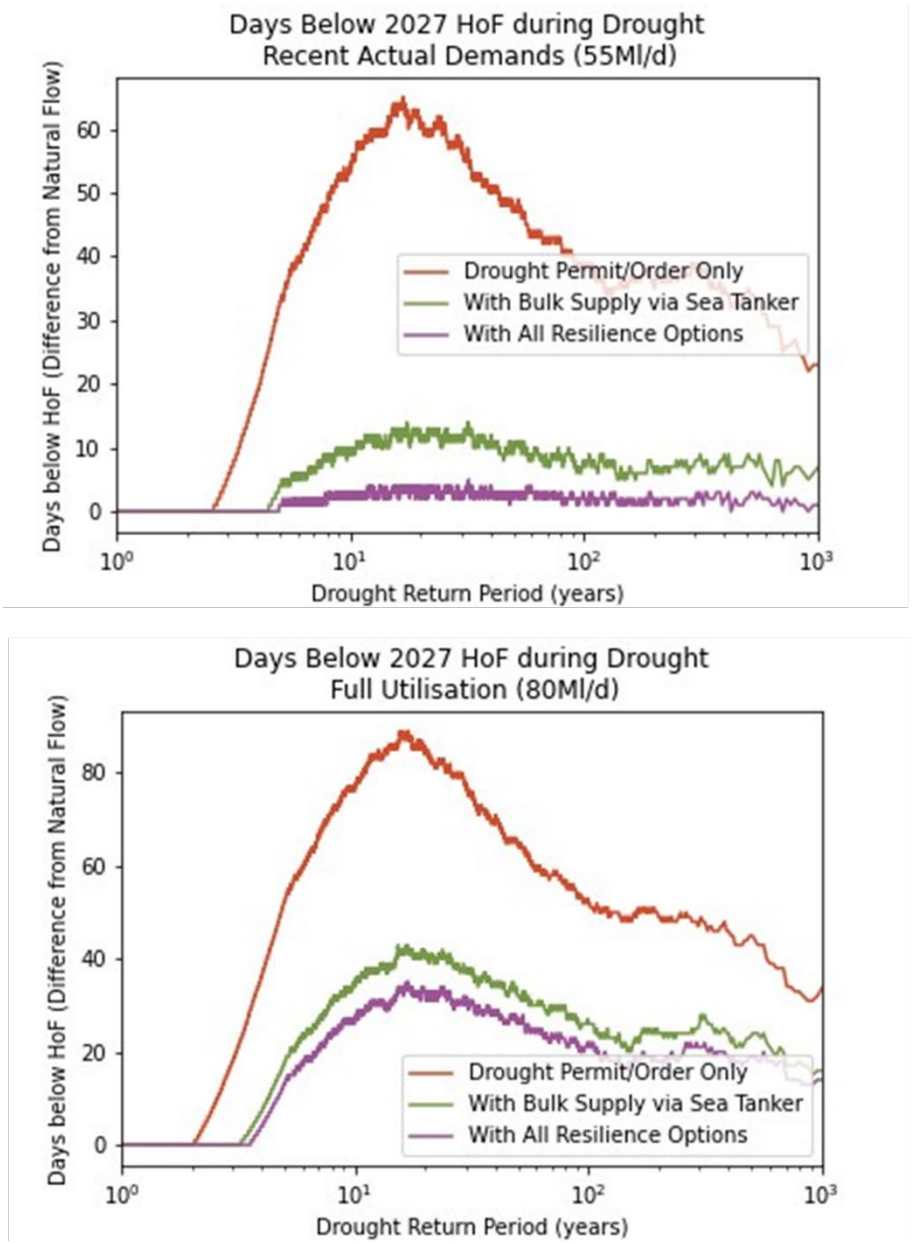

Figure 5: Difference in forecast duration of drought (days below the 2027 River Test HoF) compared to 'natural' conditions with no abstractions under a typical demand of 55Ml/d (top) and full treatment capacity of 80Ml/d (bottom) at Test surface water WSW.

5.3.1 Sequencing of operation

We envisage that operation of the bulk import via sea tankers would be exercised before the implementation and utilisation of River Test Drought Permit/Order. Given the lead-in time of several weeks for both the sea tankering and drought options, applications for drought permits or orders may still need to be submitted in parallel or combination with the mobilisation of the sea tankering operation.

Consequently, whilst the effect of deploying the bulk import via sea tankers is that it reduces the amount of water needed by the River Test Drought Permit/Order, it does not necessarily reduce the frequency of application. However, if granted, the implementation of River Test Drought Order/Permit could be suspended while sea tankering can meet demand.

We may be required to ensure that the bulk import via sea tanker option is in operation before we submit any application for the River Test Drought Permit/Order. Figure 4 shows the difference this timing of mobilisation would make on flows and trigger crossings in the River Test for an indicative 1-in-200 year drought scenarios:

- If the bulk import via sea tankers is required to be in place before an application for River Test Drought Permit/Order is made, we would need to begin mobilisation of sea tankering close to our existing 90-day (Level 1) drought trigger for the River Test and mobilisation would occur nearly every year between 2030 and 2034. The option may not be needed and thus there is likely to be significant abortive cost.
- If the mobilisation of bulk import via sea tankers was delayed to reduce the risk of abortive action but still in time to ensure the supply was in place prior to the River Test HoF being reached, it would need to be mobilised at or around our existing 60 day flow trigger for pre-consultation on the River Test Drought Permit.
- In both scenarios the sea tanker option is effective at both delaying and reducing the utilisation of River Test Drought Permit/Order.

As with the existing drought permit and order arrangements for the River Test, the long lead-in times coupled with high HoF for the River Test licence from 2027 are likely to mean the mobilisation of sea tankering and application for the River Test Drought Permit/Order will be frequent and could occur in very mild conditions. As has been the case in both 2019 and 2022, the need for early application has meant that the drought actions may be abortive i.e. it is likely that sufficient rain will occur between mobilisation or application such that actual operation of either the sea tankering option or drought permit/order will not be required. As might be expected, a delayed mobilisation of the sea tankering option reduces the risk of abortive action, including associated environmental impacts of the temporary pipeline installation and mobilisation costs.

This position will continue to be reviewed and assuming the option develops, will be factored into our next iterative Drought Plan along with a more detailed development of the triggers and sequencing of interventions. This will also need to reflect any changes to licence conditions following renewal of the Lower Itchen abstraction licences in 2025 and the River Test Abstraction licence in 2027.

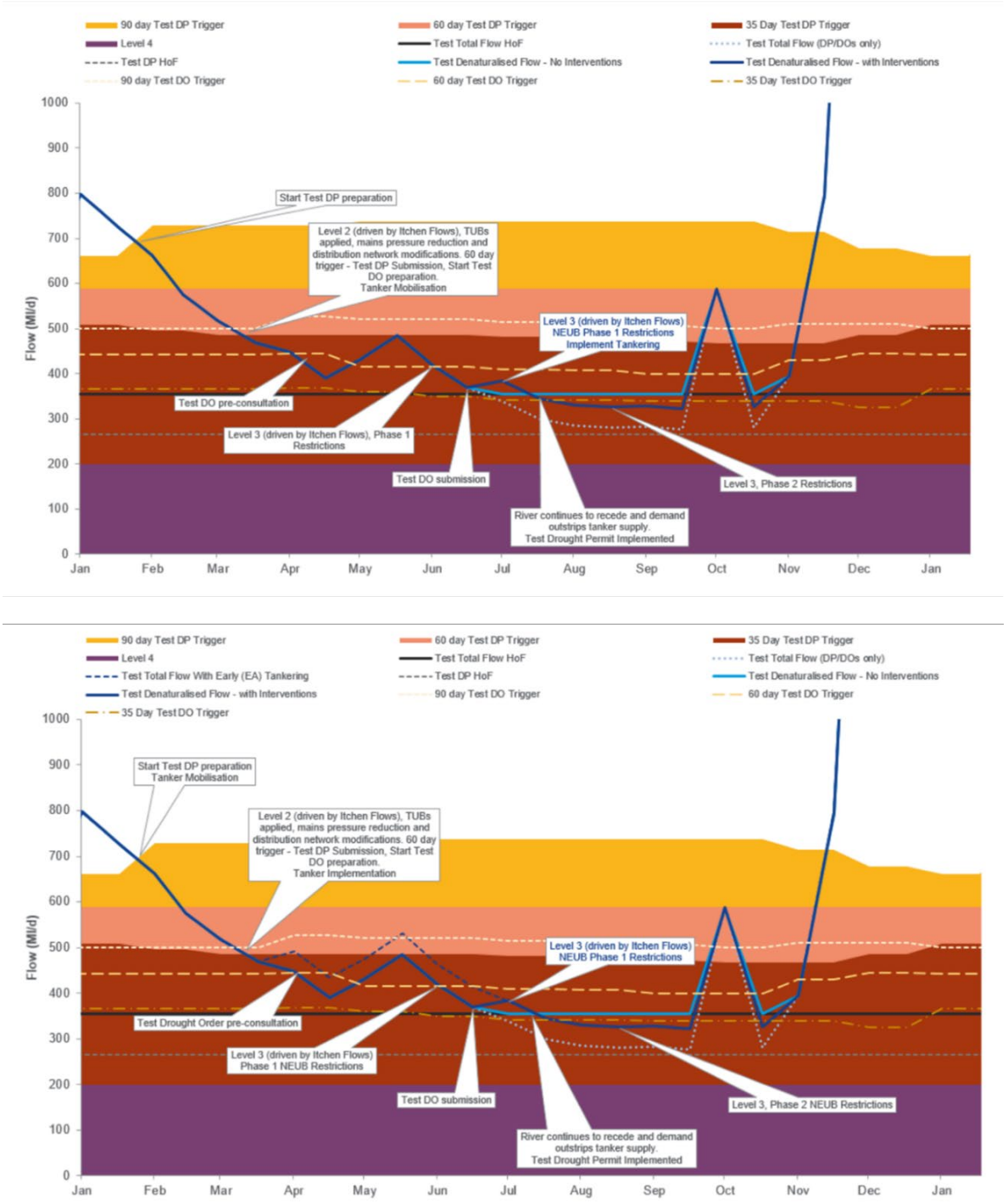

Figure 6: Sequencing of drought interventions in a 1-in-200 year drought event. The top panel shows sequence if mobilisation of sea tankering is not required before application for a drought permit or order. The bottom panel shows the scenario if mobilisation is required before such an application. In both scenarios, sea tankering is effective at both delay and reducing the utilisation of the River Test drought permit/order.

Table 4 summarises the probability of both having to mobilise the sea tanker bulk supply and application thresholds/timing for the River Test drought permit and order.

Table 4: Summary of likelihood of mobilisation of sea tankering option and River Test drought permit/order application, including risk of abortive action based on potential flow triggers for the River Test abstraction.

Scenario	Trigger	Annual probability trigger is reached	Return period (years)	Probability of abortive drought Intervention	Overall risk (Annual probability of risk of abortive action)
Current (2025) abstraction licence and Drought Plan 2022 triggers	90 day to 355Ml/d HoF (Drought Plan 2022 trigger)	100.0%	1	97.0%	97.0%
	42 days to 355Ml/d HoF (6 week sea tankering mobilisation trigger)	50.0%	2	95.0%	47.5%
	60 day to 355Ml/d HoF (Drought Plan 2022 trigger)	50.0%	2	95.0%	47.5%
	35 day to 355Ml/d HoF (Drought Plan 2022 trigger)	25.0%	4	89.0%	22.3%
	28 days to 355Ml/d HoF (4 week Sea tankering mobilisation trigger)	33.0%	2	93.0%	30.7%
	21 days to 355Ml/d HoF (3 week Sea tankering mobilisation trigger)	20.0%	5	86.0%	17.2%
	14 days to 355Ml/d HoF (2 Week Sea tankering mobilisation trigger)	11.0%	9	75.0%	8.3%
	Flow at which Test surface water average output restricted (flows below 410Ml/d)	10.0%	10	73.0%	7.3%
	7 days to 355Ml/d HoF (1 Week Sea tankering mobilisation trigger)	10.0%	10	73.0%	7.3%
	355Ml/d HoF Reached (2018 Licence condition)	2.8%	36	0.0%	
Future position under 2027 River Test licence condition (HoF at 355-390Ml/d)	42 days to 355Ml/d HoF (6 Week Sea tankering mobilisation trigger)	100.0%	1	97.0%	97.0%
	28 days to 355Ml/d HoF (4 Week Sea tankering mobilisation trigger)	50.0%	2	95.0%	47.5%
	21 days to 355Ml/d HoF (3 Week Sea tankering mobilisation trigger)	50.0%	2	93.0%	46.5%
	14 days to 355Ml/d HoF (2 Week Sea tankering mobilisation trigger)	33.0%	3	93.0%	30.7%
	7 days to 355Ml/d HoF (1 Week Sea tankering mobilisation trigger)	33.0%	3	91.0%	30.0%
	Test surface water average output restricted (flows below 410 or 445 Ml/d)	20.0%	5	85.0%	17.0%
	355 / 390 Ml/d HoF Reached (2027 Licence condition)	2.8%	36	0.0%	

6 Conclusion

The effect of revised dates for certain large infrastructure schemes means that we will have to continue to rely on applying for the use of drought permits and orders in Hampshire (Western area) until those schemes are fully operational. Without the use of drought options in the Central and Western areas, we cannot achieve our projected supply-demand balance and they remain a necessary interim measure until the longer-term infrastructure is developed and operational. Through stakeholder and customer engagement, we understand that the continued reliance on drought options present ongoing concern.

The Environment Agency asked us to reconsider specific options to mitigate the reliance on drought permits and orders. In developing our plan and in response to regulatory feedback, we undertook a targeted reappraisal of options to identify those which could potentially reduce our dependency on drought options in the Western and Central areas in the interim period until our large infrastructure schemes could be delivered.

As a result of that process, our plan now includes four options. These include one new option (groundwater option at Kings Sombourne), two accelerated groundwater options (groundwater options at Romsey and Petworth) and a bulk import via sea tankers in the Western area. All four of these options were pre-selected to deliver benefit from 2030-31 i.e. the IVM (investment model) was not given free choice to select them.

The inclusion of these options does not remove the need to rely on drought options altogether, nor does it alter the frequency of application for drought permits or drought orders in the Western area. The bulk-import via sea tankers, if used in the Western area in parallel with drought options, can however, by providing water from an alternative source, reduce the volume of water needed from the River Test Drought Permit/Order. The Candover Drought Order will still be needed at its full capacity in the event a drought up to 2033-34.

As a result of the measures we have introduced in rdWRMP24, the Pulborough surface water drought option will no longer be needed in the Central area after 2029-30 unless we are faced with a drought of 1-in-500 year severity.

The implementation of the bulk-import by sea tanker option presents a number of deliverability challenges (which had previously resulted in it being rejected) and we are committed to exploring these further throughout AMP8. We have considered the implications, potential risks, costs and uncertainty from the bulk-import via sea tanker and other resilience options and have balanced this with the wider concern about the continued reliance on drought options in the Western and Central areas and the environmental driver to reduce to this reliance.

Our plan has been developed using the WRSE IVM. It optimises the selection of options to meet supply-demand balance using a ‘best value’ approach as required under WRPG. The IVM selects the use of the continued reliance on drought options because of the high operational costs associated with the bulk import via sea tankers, when compared with the drought options, which the investment model considers as temporary, low-cost solutions with limited or no additional CAPEX. In order to incorporate the utilisation of the bulk import via sea tankers (and the other accelerated resilience options in the Western area) into our plan, we pre-selected this and other resilience options and reduced the volume required from the River Test Drought Permit/Order through an iterative process. This therefore comprises a variance from the way other options are selected by the investment model and which otherwise were materially aligned with the best value requirements in WRPG.

As supported by the IVM, the continued reliance on drought options represents the best value option overall when considered with the addition of the sea tankering option. These new options are however being included in our plan as potential mitigants to the drought options, which are otherwise the preferred basis of our plan, on the assumption that the deliverability challenges can be overcome by their anticipated utilisation dates. In line with the WRPG requirement to achieve a 1-in-500 year drought resilience level, our plan requires no further use of supply-side drought options after 2040-41, in all but the most extreme droughts. Without this manual intervention to the IVM, these resilience options which are being included for the specific

beneficial purpose of reducing reliance on drought options, would not be selected as early as 2030-31 in the case of accelerated and new groundwater options and not at all in the case of bulk import via sea tankers.

It is important to note that the WRMP process is a cyclical approach to long-term planning and our appraisal of options will continue into the next phase to keep developing and to build resilience in the Western area. As we progress towards WRMP29, we will be working with other water companies to seek new opportunities and ways of working that are mutually beneficial and serve to improve the availability of water as well as protecting the environment.. Where possible we will bring options forward during AMP8 should the feasibility increase along with our ability to deliver them.

7 Future Water and the transition into WRMP29

In view of the challenges we face across our supply area, we have recently started a project which involves a different way of thinking about water resources in our region.

The traditional approach to water resources management planning has historically been dependent on abstraction from surface and ground water sources of water. However, as we move forward the impacts of climate change are likely to have an ever-increasing impact on the way our customers use water. We acknowledge, that as a progressive water company, we need to be agile in our approach to water resource management and adapt our thought processes to consider and develop different options that may currently, or in the past, have been ruled out. This includes a review of innovation and ways of working which may have changed the feasibility of options that previously were not feasible. As we move forward with our 'Future Water' resource planning we will be considering emerging technologies and evolving approaches to water resource management, including addressing some of the challenges associated with desalination and water recycling. Taking desalination as an example, there are challenges to overcome which includes energy intensity, disposal of hyper saline brine, and compliance with the DWI Regulation 31 for components such as reverse osmosis membranes. The areas identified as current challenges will be reviewed to consider how alternative technologies or relationships could be used to address them. For example, could the waste brine become a by-product with commercial value and eliminate disposal to the environment? Such considerations are typical of the challenges which will need to be addressed as we progressively develop our thinking about future water needs, seeking opportunities to maximise the water available in water-stressed areas. We will continue to explore all avenues available to us to provide the resilience we need in the South East.

We are currently developing and adopting our Future Water approach which will feed into the annual updates of our WRMP24 and also inform the process as we begin to develop our WRMP29.

As with any form of change, we will continue to be open to new ideas and approaches. We will strengthen our engagement with all concerned stakeholders to involve them in shaping Future Water so they are involved in water resources management developing effective plans in partnership with us. As we move forward with our thinking, we will develop shared learning opportunities to ensure our mutual understanding of our catchments and strategic options develop in tandem so we can capture and develop ideas from outside of our business and influence and inform the organisations and communities around us too. Internally we will empower people to think differently about water resources strategies to inform future WRMP's to ensure we not only meet the needs of our customers and the environment but work together to provide water for people and the environment for life.

Outside of this WRMP24 process, and in preparation for WRMP29, we have started to explore our Future Water approach to thinking about water resources and we are excited to share a first look at some potential future options for our Pulborough site in our Central area and our Test surface water WSW in our Western area. In summary we have undertaken pre-feasibility reviews of the following options:

1) Recirculation of water on the River Rother, River Arun and also on the River Test. This option is not currently considered to be viable and would require extensive environmental investigations to ascertain potential for environmental impact.
2) Desalination of water to create potable drinking water. At the current time this option is not being progressed in the early stages of our rdWRMP24 due to significant environmental constraints in the locations where desalination has been considered (set out in the rejection register) regarding the disposal of hyper saline material, and energy intensity. We will investigate potential innovative techniques to assess whether desalination can become more attractive as an option by undertaking research in potential uses for the hyper saline solution and whether energy consumption could be reduced.
3) Abstraction of increased volumes of water on the transitional waters of the River Arun. We currently believe this option is worth investigating further and we will be pursuing more work on

this option which we are keen to work on collaboratively with the relevant stakeholders. We are aware of the environmental considerations required in the Pulborough area which can be complex in nature hence a joined up and collaborative approach will be essential to exploring this option further. We intend to provide updates on the development of this option during our annual review updates and potential for inclusion for consideration in our WRMP29.

We will develop Future Water thinking further as we move into the development of WRMP29 but should any option prove to be feasible at an earlier stage we will bring it forward if appropriate and update stakeholders via the WRMP annual review process.

Appendix A: Re-appraisal rejection register

Western area options (appraised before 28 September 2023)

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for re-appraisal rejection
HSW	Test surface water WSW process loss recovery	Re-considered option - The existing works at Test surface water WSW currently discharges 3.4Ml/d to the river. Recycling this process loss to the head of the works could deliver a DO benefit of up to 3.0 Ml/d. An additional DO benefit of 0.35Ml/d could also be realised by further treating this wastewater to create a solid waste which would need to be taken for land spreading or landfill. This is already programmed for delivery end of AMP8 but is not included in WRMP24 baseline. Recycling of waste is a well-established process enabling water companies to maximise their licenced output from an abstraction which needs to be treated. The return of this water is regulated to ensure that it has no detrimental effect on the quality of water being produced. As such it would be treated such that no more than 10% of the works flow is recycled to the head of the works, with a return turbidity of less than 10 NTU, ideally around the same quality as the incoming water.	3.35	There are issues with the current treatment process on site which would need to be resolved before this scheme can be implemented. There would need a much larger upgrade to the site as opposed to only the wastewater handing system. The enhancement of the site could still be considered for WRMP29, but would not be able to respond as a resilience option.
HSE	Otterbourne process loss recovery	Re-considered option - The existing works at Otterbourne WSW currently discharges 2.0 Ml/d to sewer. Recycling of this to the head of the works could deliver a DO benefit of up to 1.7 Ml/d. An additional DO benefit of 0.27Ml/d could be realised by further treating this waste water to create a solid waste which would need to be taken for land spreading or landfill. Recycling of waste is a well-established process enabling water companies to maximise their licenced output from an abstraction which needs to be treated. The return of this water is regulated to ensure that it has no detrimental effect on the quality of water being produced. As such it would be treated such that no more than 10% of the works flow is recycled to the head of the works, with a return turbidity of less than 10 NTU, ideally around the same quality as the incoming water.	1.97	Under the drought conditions covered by WRMP24, it is unlikely that Otterbourne WSW would be running. Therefore, this scheme would provide no supply benefit in a drought. Additionally, there are issues with the current treatment process on site which would need to be resolved before this scheme can be implemented. There would need a much larger upgrade to the site as opposed to only the wastewater handing system. The enhancement of the site could still be considered for WRMP29, but would not be able to respond as a resilience option.
HSW	Test surface water – Little Lake	Re-considered option – Dredging of lake to increase storage. Enabling option to support DO to be delivered by other options	NA	No DO benefit because additional volume from dredging is negligible and these options are linked to other schemes. For

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for re-appraisal rejection
				example, these lakes could form an environmental buffer for wastewater recycling or sea tankering options.
HSW	Test surface water Lakes	Re-considered option – Dredging of lake to increase storage. Enabling option to support DO to be delivered by other options	NA	As above.
HRZ	Near Andover 2	New option – Rehabilitation of existing source. Installation of nitrate treatment plan to overcome water quality issues. Modification of existing catchment management scheme. Provides limited benefit	0.5	Rejected because the option's maximum potential DO was low (c. 0.5 Ml/d) and it was not directly supplying the HSE or HSW zones. IVM results have shown that introducing this option has no material impact on the transfer to Winchester zone. As such, this option does not provide a DO benefit where it is needed.
HAZ	Andover	Re-considered option – Andover WSW is a mothballed site due to the high nitrate concentration in the raw water. When the site was mothballed, the abstraction licence was rescinded and a new licence would be required to run the works. This scheme involves recommissioning the site, with the inclusion of nitrate removal plant, as well as disinfection. The generated waste stream will require removal by tanker or discharge to sewer. Bringing this groundwater fed site into operation, with new borehole pumps, could provide a DO benefit of 0.8 Ml/d.	0.8	Although the site was decommissioned due to water quality issues rather than environmental concerns, it has not been run in 20-30 years and is highly likely to impact on nearby rivers, such as the Test and the Avon. The environmental impact will need to be carefully understood; increasing groundwater abstraction is not without its local impacts. The time that would be required for the environmental surveys as well as ensuring that it did not impact on other sources in the area means that this scheme is impractical under the timeframe required.
HRZ or HAZ	Overton	Re-considered option This involves the addition of a filtration process to address turbidity issues at higher flows from the groundwater fed Overton WSW. This could provide a DO benefit of 0.09Ml/d, taking the site to its licence flow.	0.1	The site already operates very close to its maximum output, with turbidity issues only noticeable at the higher flows. This scheme has very low potential benefit with a risk that other water quality issues may also present themselves at the higher flow, with this risk being most prevalent during the low ground water levels seen during drought periods. It is thus unlikely to be a benefit during drought conditions.
HAZ	River Way, Andover	Re-considered option – The site is subject to a licence reduction to protect the local environment. The aim of this scheme is to delay the reduction in abstraction to provide resilience. There is no additional work to be done on the site to enable this.	5.0	The licence reduction was undertaken on the basis of the environmental assessment of the local area. Maintaining the flow at the site would delay a change designed to improve environmental sustainability. In addition, Natural England raised concerns about the environmental impact of this option. Because it would mean increasing abstraction in part of the Test catchment (River Way is tributary of the Test) it is not a suitable option for reducing the abstraction pressure in the Test catchment.
HWZ	Twyford	Re-considered option – Twyford is currently running at an output of 18Ml/d, which is below the site licence of 36Ml/d. There are water quality issues with nitrate and	5.0	Although the site is licenced for 36Ml/d, the maximum it can achieve is the current DO of 18Ml/d, due to the level of the water in the well. The well level will drop further under times of

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for re-appraisal rejection
		turbidity on the site, particularly during the startup of Borehole 2. However, the main reason for the lower than licence flow is due to the level of water in the well, which cannot sustain a flow of higher than 18Ml/d.		water stress, so this option will not be available during droughts. There are also likely to be environmental concerns around the increased abstraction during drought conditions. Surveys would be required to understand the impact on the nearby River Itchen. There is a high degree of uncertainty about completing these surveys to conclusively demonstrate that there would be no detriment to the environment. This would increase the timeframe to deliver the option so much that it would not be deliverable in the timescale required.
HRZ	Romsey 2	Re-considered option – Romsey 2 is based on taking advantage of available land on the existing Romsey WSW site and combining raw water flows from the Near Andover 2 and Near Salisbury groundwater sources through an expanded network for treatment in a single ion exchange nitrate removal plant. The generated waste stream will require removal by tanker or discharge to sewer. This could provide a DO benefit of 3.7Ml/d. The abstraction licences have been rescinded at Near Salisbury and would require new applications. An earlier iteration of this scheme also included the site of Broughton, which has also been mothballed with the licence rescinded. This scheme would require a raw water pipeline to be built between the three sources, delivering the water to Romsey. This scheme has no impact on the Romsey1 project, other than to have the treated water in the same place.	3.7	There are environmental concerns around the boreholes at Broughton and Near Salisbury. Neither site has been run for around 20 years, so there is great uncertainty over yield and the environmental impact on the surrounding areas. There would also be an environmental impact in building an extensive raw water pipeline to bring the water to the Romsey site. Time would also be an issue for building this scheme within the timeframe required, particularly the raw water pipeline, which would pass through rural and urban areas.
IOW	Rookley	Re-considered option – Development of a new raw water storage reservoir within the footprint of the existing Rookley WSW, with associated new process given existing sources are groundwater. This would require pumped transfer of raw water from Sandown and therefore a new abstraction licence. There are currently 2 boreholes on site. The nearest surface water is Sandown, so there is no surface water connection on site. There is no existing structure at Rookley, so this would need to be constructed, nor is there a current source pathway. As well as a new reservoir and raw water main from Sandown to Rookley, the scheme would require the building of a full surface water treatment works.	2.1	There would need to be a raw water transfer from Sandown, the development of a new raw water reservoir and the construction of a full surface water treatment works. This is not technically feasible within the timeframe required for these schemes. The scheme would also require a new abstraction licence at Sandown, which would be subject to environmental studies, again extending the timeframe for the project.

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for re-appraisal rejection
IOW	Caul Bourne	Re-considered option – By reducing the MRF on the River Caul Bourne, more water can be abstracted in addition to the current output, providing a potential benefit of 0.7Ml/d. The disinfection process on the existing treatment process would need to be uprated, otherwise, there are no site changes required.	0.7	This is not practical as a resilience option as it is unlikely that the additional water would be available under drought conditions without causing further environmental damage to the local environment. Water will not be available to maintain river flow and support the local habitats. Further increasing the abstraction at this time will only increase this.
IOW	Ventnor3	Re-considered option – Reintroduction of previously abandoned borehole. The site would need to be re-licenced and the treatment process reinstated.	0.6	There are environmental concerns over re-licensing a new borehole. The reintroduction of an abstraction licence for the site will require lengthy testing and may show environmental issues. So, this option was rejected on environmental grounds.
IOW	Ventnor2	Re-considered option - Reintroduction of previously abandoned borehole. The site would need to be re-licenced and the treatment process reinstated. There are also know water quality issues at Ventnor2, and an organic chemical removal process will need to be installed to ensure the water quality is not compromised.	0.5	There are environmental concerns over re-licensing a new borehole. The reintroduction of an abstraction licence for the site will require lengthy testing and may show environmental issues. So, this option was rejected on environmental grounds.
IOW	Shalcombe	Re-considered option - Reintroduction of previously abandoned borehole. The site would need to be re-licenced and the treatment process reinstated.	0.6	There are environmental concerns over re-licensing a new borehole. The reintroduction of an abstraction licence for the site will require lengthy testing and may show environmental issues. So, this option was rejected on environmental grounds.
IOW	Lukely Brook	Re-considered option - Reducing the linked Minimum River Flow (MRF) associated with the existing groundwater abstraction licence could provide a combined DO benefit of 1.5 Ml/d. The existing treatment on the site is able to treat 18Ml/d, which is significantly above the anticipated 3Ml/d at which the site would need to run.	1.5	The licence has been capped at current output to maintain the flow in the local watercourse. This scheme would impact this flow. Additionally, in times of drought, it is very unlikely that there would be sufficient flow available to increase the output from the site. Therefore, while the treatment is adequate, it is unlikely that the water would be available and would cause an environmental impact if was available.
IOW	Newport	Re-considered option - Newport WSW takes water from a mixture of underground drainage water and groundwater. The aim of the scheme was to take additional groundwater by drilling a new borehole producing an extra 2Ml/d.	2.0	There is also no certainty that drilling a new borehole would result in additional yield, particularly under drought conditions. The water levels are sufficiently low enough to cause turbidity issues when increasing the flow from the current boreholes. As the groundwater level would drop further under drought conditions, It is likely that turbidity would become worse, reducing the water available from the site. The scheme would require a number of pump tests and environmental surveys to ensure there was sufficient water of adequate quality as well as no environmental impact from the additional abstraction. There would also need to be an assessment of the impact on the existing boreholes, in terms of yield and quality. The time required to carry out these surveys and the substantial risk to the existing supply and the environment for

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for re-appraisal rejection
				potentially little to no benefit means that this scheme should be rejected.
IOW	Newchurch	Re-considered option - There are currently 2 greensand boreholes running at 2Ml/d plus a chalk well at 6Ml/d. The greensand cannot run without chalk due to arsenic concerns, although there is aeration and filtration treatment in place for this. The aim of this scheme is provision of a new borehole and pump to increase yield from the greensand groundwater source. The existing treatment process would need enhancement with sand filters to accommodate this additional water and provide a DO benefit of 2Ml/d.	2.0	There are environmental concerns over drilling a new borehole due to the impact of removing more water from the environment. There is also a risk that a new borehole would impact the existing abstractions in terms of both quality and quantity. Surveying work would be required, which would cause a delay to the implementation of the scheme. Additionally, increasing the greensand proportion of the water has a known quality risk due to the amount of dissolved metals. A major treatment improvement would be required to enhance the removal of these substances, to ensure the water continued to meet the high standards required by the regulations.
HSW	Recycling of final effluent from Test Estuary WTW	Re-considered option – Final effluent (FE) from this works would be recycled using reverse osmosis (RO) technology to ensure that it is of sufficient quality to be used as a raw water elsewhere. This would result in a waste stream to be combined with the remaining FE. The recycled water produced would have to be carefully controlled to ensure that it does not interfere with the local ecology in these water courses.	Desalination with 10 Ml/d capacity considered here	This project is not yet suitably mature to achieve the deadlines for these resilience options. It remains in its very early development stage, and while it is likely to be an option in the future, it cannot be considered as a resilience option for these purposes within the required timeframe. There would also be a requirement for catchment sampling to ensure that there was no detrimental effect on the alternative discharge location.
HSW	Recycling of waste from New Forest,	Re-considered option - Final effluent (FE) from the wastewater would be recycled, using reverse osmosis technology, to Test surface water WSW via a new pipe across the New Forest. This would also result in a waste stream to be combined with the remaining FE from New Forest WTW.	9.0	This project is not yet suitably mature to achieve the deadlines for these resilience options. It remains in its very early development stage, and is unlikely to be an option in the future due to the transfer across the New Forest and the estuaries along this coast.
HSE	Recycling of waste from Woolston.	Re-considered option - Wastewater would be recycled into Test surface water Little Lake (or the River Itchen was previously rejected and not re-considered)	5	There are two key issues making this option unfeasible: 1) the space for a water recycling plant at Woolston and then 2) the transfer under Southampton Water and dock yard. The area around Woolston is heavily developed and the transfer from this site under the water complicated, due to the length.
HSE or HSW	Desalination on the Solent	Re-considered option - Taking water directly out of the Solent to treat through removing the salt from the water. This water would then be sent as raw water to one of the larger treatment works (for example Test surface water via the lakes) with the concentrate being discharged back into the Solent. We have considered temporary and permanent variations of this option.	10.0	There are strong environmental concerns about the hypersaline waste stream that would be produced by this process (for either permanent or temporary desalination) and would be discharged into the Solent and Dorset Coast SPA and/or South Wight Maritime SAC. It is unlikely that a suitable location could be found for this option at this time as the exercise has already been conducted as part of the RAPID process. At the workshop we held in November 2023, our

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for re-appraisal rejection
				environmental regulators expressed concern about desalination in this location. For example, Natural England (NE) provided the following comment about this desalination option "Due to the environmental risks and expected impacts, constrained nature of the Solent and likely compensation that would be needed NE's view is this should not be taken forward in this location." The investigations into desalination at Fawley, an option from our WRMP19 plan, also showed the Solent not to be a suitable location for a desalination plant at this time. Should there be new technology to embrace and lessons to learn from other water companies installing (temporary) desalination in less environmentally sensitive areas then we will incorporate these in WRMP29.
IOW	Desalination on the Isle of Wight	Re-considered option - Water would be taken directly from the English Channel and sent as raw water to a treatment works on the Isle of Wight, enabling water to either be exported from the Island, or removing the need to import water from the mainland. Due to the constraints on discharging desalination waste into the Solent, this would need to take place at the south of the island, so that the waste would be discharged into the English Channel, which would have a lower environmental impact.	10.0	Power would be a major constraint for this option. Desalination is a power intensive process and there is no spare power capacity on the island to enable the process to work. Temporary diesel generation could be used to cover the power shortfall but this would have environmental impacts from greenhouse gas emissions. Building on the south of the island would also require a lengthy pipeline to be constructed across the island. The timeframe required for this would take the project outside of the requirements of this process. In addition there are potentially unacceptable negative impacts on the South Wight Maritime SAC and, as referred to above (desalination on the Solent), it is unlikely that NE would support this option in this location, due to the environmentally sensitive habitats in the vicinity and due to the environmental impacts being similar to options situated elsewhere in the Solent. Should there be new technology to embrace and lessons to learn from companies installing (temporary) desalination in less environmentally sensitive areas then we will incorporate these in WRMP29. This is part of the Future Water work described earlier in this annex.
HSE	Accelerate the option to take more water from Portsmouth Water	Accelerated delivery option - Accelerate the option to increase to existing bulk import or new bulk supply.	Variable	Discussion held with PWC; currently no surplus available, however this may change depending on the outcome of PWC's WINEP investigations. Therefore, we will explore this for WRMP29 but cannot adopt it in the required timescales so that it is operational by 2030.

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for re-appraisal rejection
All	Licence Trading	Re-considered option - If there are any holders of abstraction licences with material volumes of unused abstraction licences they might be willing to trade these with Southern Water on a permanent or temporary basis.	Variable	We have considered trades with neighbouring companies as part of WRSE and that is covered in our rdWRMP24. For WRMP19 we published a bid assessment framework to support the market to deliver WRMP options to help meet our supply duty. This did not lead to any viable options. As set out in section 4 of annex 12 for our rdWRMP24 we explored options with two large industrial companies, but we rejected both options. Also, in annex 12 we say why we rejected the option of "explore licence trading with large abstraction licence holders." When we consulted on our dWRMP24, any third party with a supply/ demand option could have presented it but we received no viable, sustainable options. It is logical that there are very few sustainable options of this sort because other abstractions in our region are likely to be subject to similar concerns and any increases in abstraction would need to demonstrate no deterioration.
HSW	Recycling New Forest WTW direct to supply the bulk export to a large industrial user in Hampshire Southampton West WRZ.	Re-considered option - Transfer direct to large industrial customer at Southampton West WRZ via existing infrastructure as an industrial use. Process capacity increase and enhancement. This option is similar to the recycling options described above except that this option exports that water to the large industrial customer.	9	The same reasons for rejection described above for the New Forest wastewater recycling option apply here but with the added complexity, as this option proposes a transfer via the existing infrastructure, 1) we would be mixing drinking water and raw water – not acceptable for customer safety - 2) Limit capacity in the old pipe to increase flow / pressure for the additional 9 Ml/d, over the existing SWW transfer, and 3) it reduces the resilience of the supply to the large industrial user, thereby increasing the risk of a "crash shutdown" of the industrial process due to any failures of the pipe. In addition, the current agreement with the industrial user expires in late 2026 and includes an obligation to negotiation a renewal of the industrial user's inclusion in Southern Water's licence supply area. Ceasing current supply pre-expiry of existing contract and/or imposing a future no-contract or no-supply scenario is not considered a viable option given the nature of the industrial use. Negotiation of a replacement contract for post-2026 supply will include consideration of various options for renewal including reducing maximum supply volume; flexing maximum supply volume in normal and drought periods; exploring alternative supply provision by Southern Water, by another water undertaker, or by self-supply; etc. However, these considerations are not determined and negotiations are not sufficiently progressed to provide the certainty required for the purposes of inclusion in WRMP24.

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for re-appraisal rejection
IOW	Isle of Wight Cliff dewatering - Ventnor	Re-considered option - Cliff dewatering on Greensand to prevent cliff slumping. Scheme viability subject to NE and EA approval that this scheme is suitable for this location and the environment, and that the water is available. Tests and assessments into this scheme are at an early stage, so subject to outcomes of these investigations. But if this is deemed a viable option, this would be a source of water that would otherwise be discharged to sea.	0.5	Reason for rejection is that the time required for the environmental, hydro-geological and engineering studies needed would not allow it to be delivered by 2030.
HSW	Large industrial user at Hampshire Southampton West WRZ - recycling	Re-considered option - Water recycling but large industrial user building their own recycling plant at their site to enable reduce consumption of water at the site.	TBC	The same reasons for rejection described above for the wastewater recycling options apply here but with the added complexity that this option would involve the re-negotiation of an existing supply agreement (see above).

The table above lists 28 of the 31 western area options shared with the EA and NE following the 28 September 2023 workshop referred to in section 2.4 of this annex. The three options not listed in this table are the selected options (bulk-import via sea tankering, Kings Sombourne and Romsey).

We have also considered a number of other options that have been suggested as part of the internal and external engagement but weren't on the list of 31 schemes circulated with the EA and NE in October 2023. These options are included in the following table:

Western area options (appraised after 28 September 2023)

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for re-appraisal rejection
IOW	Groundwater (IOW) New borehole at Eastern Yar3	Re-considered option - This option was added after we shared the list of options to the EA/ NE in October 2023. It involves drilling a new replacement borehole, ca. 100m deep, for Eastern Yar3 augmentation well on the Isle of Wight (IOW). The existing borehole has ca. 90% loss in performance, and previous well rehabilitation and cleaning has not provided a notable improvement. A replacement well is required to regain resilience.	1.5	Following more detailed investigations we have established that the DO of this augmentation is already included as part of the baseline DO for Sandown. Therefore, this scheme does not provide a direct DO benefit so we have rejected it.
HSE or HSW	Recycling Test Estuary WTW to bulk export to large industrial user at Hampshire Southampton West WRZ	Re-considered option - As per WRMP19 option description – transfer of recycled water to large industrial user at Hampshire Southampton West WRZ to offset water supplied currently for industrial use from Test surface water. Process capacity increase and enhancement.	TBC	The same reasons for rejection described in the table above for the Test Estuary WTW water recycling option apply here but with the added complexity that this option would involve a new pipeline touching on the New Forest. In addition, the current agreement with the industrial user expires in late 2026 and includes an obligation to negotiation a renewal of the industrial user's inclusion in Southern Water's

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for re-appraisal rejection
				licence supply area. Ceasing current supply pre-expiry of existing contract and/or imposing a future no-contract or no-supply scenario is not considered a viable option given the nature of the industrial use. Negotiation of a replacement contract for post-2026 supply will include consideration of various options for renewal including reducing maximum supply volume; flexing maximum supply volume in normal and drought periods; exploring alternative supply provision by Southern Water, by another water undertaker, or by self-supply; etc. However, these considerations are not determined and negotiations are not sufficiently progressed to provide the certainty required for the purposes of inclusion in WRMP24.
HSE or HSW	Bi-directional link from IoW	Re-considered option - At the 22 March 2024 workshop with EA/ NE it was suggested that the link main from Hampshire to the Isle of Wight could be used in a different direction to use any future 'spare' capacity from Sandown. This option to take water from the IoW to the mainland was part of the dWRMP24 options appraisal.	TBC	We confirmed at the workshop that this option has a lead in time of 10 years so it does not satisfy the criteria set out in section 2.2
HSE or HSW	Bulk import via sea tanker from different location than Norway	Re-considered option - There are variations on the sea tankering option that we have selected. For example, options include sourcing the raw water from Wessex Water, France or other countries. In addition, there are sub options relating to where the sea tanker delivers the raw water to e.g. to Portsmouth, the Isle of Wight or the bulk export to large industrial user at Hampshire Southampton West WRZ.	TBC	These other sources of water for sea tankers are less certain and less well developed than the Norway option. However, for WRMP29, we will continue to pursue alternatives. The largest ships that have contain 45 Ml/d and Southampton container port is the only location suitable for ships of this size. We note that sourcing the water from Norway does not place additional pressure on a UK source. It is likely that any 'surplus' water in the Wessex Water area would be subject to WFD no deterioration assessments. In addition, another reason for progressing the bulk import from Norway as opposed to from any other country is that there is more known about the Norway option than imports from any other location. As a result, any sea tankering option from another source location would take longer to develop and have greater uncertainty associated with it than the Norway option.
Geology dependent	ASR/ MAR	Re-considered option - Aquifer Storage and Recharge/ Managed Aquifer Recharge. There are several options of this sort included in the WRSE investment modelling.	5.5	The uncertainties over yield, environmental impacts and engineering deliverability prevent options of this sort being ready by 2030. Whilst this means the lead in times are too long for this process, the Test surface water MAR scheme has been selected in 2036 in our updated WRMP24. It is also worth noting that these schemes are unlikely to provide as large a volume as the 45 Ml/d sea tankering option.

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for re-appraisal rejection
HSE or HSW	Variations on the large bulk export to the large industrial user at Hampshire Southampton West WRZ/ desalination options	Re-considered option and variations of this- There are variations and sub options relating to the bulk export from Southern Water to a large industrial user. For example, the bulk supply could be sourced from water from new recycling or desalination schemes or directly supplied by sea tankering.	TBC	The reasons for rejection for the bulk export to the large industrial user at Hampshire Southampton West WRZ and desalination options in the table above apply to these sub options too. In summary that there are unique, contractual and legal complications that mean the bulk export to a large industrial user cannot be altered in the required timescales. The delivery times and uncertainty associated with new desalination/ recycling schemes prevent sub options of those being delivered in the required timescales. A desalination plant in this location would also have the same environmental impacts as our rejected WRMP19 desalination at this location, so would likely be unviable for this reason also.

Central area options

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for rejection
SWZ	ASR Worthing (Sussex Coast Lower Greensand)	Re-considered option - Reinstatement of ASR scheme previously removed due to land availability issues.	TBC	Due to technical, hydro geological uncertainties as well as land availability concerns, this option could not reliably be investigated and delivered in the timescales required.
SBZ	Housedean WSW	Re-considered option - The site is constrained by pump capacity, UV performance and the size of the filtration plant. Increasing both would increase the amount of water available from the site.	1Ml/d	This work is part of the Falmer/ Brighton East project. This source will become a remote borehole and water will be transferred to Falmer for treatment. Option rejected because it would not provide any additional DO.
SWZ?	Sompting WSW	Re-considered option - This option involves recommissioning of borehole 2. This work has been completed during AMP7.	n/a	This work is complete borehole 2 has been re-commissioned however whilst this improves site resilience by creating duty-assist arrangement output is still restricted by capacity of the nitrate treatment plant. So, we rejected this option because it would not provide any additional DO.
SWZ	Littlehampton WSW	Re-considered option - The output of the site can be increased from 3Ml/d to 4Ml/d by increasing the size of the pumps. These should be capable of achieving 4Ml/d (each of the two boreholes has a pump nominally capable of achieving 2Ml/d). However, this has not been achieved for nearly 20 years. There are turbidity issues which are expected to increase as more water is abstracted from the ground. However, the filters on site were designed to treat 4Ml/d.	1.0	This scheme is already being taken forward by the Southern Water operations team. However, it is believed that the pump size is not the flow constraint for this site; it is the lack of water in the borehole which is preventing the site from reaching its output. This is likely to be worse during drought conditions, so the scheme should not be taken forward on the basis of this scenario.
SWZ	North Worthing WSW	Re-considered option - This is currently running at 7.2Ml/d, which is an increase over the historic output of	4.2	There are a large number of uncertainties with increasing the flow at this site, in terms of water quality and network capacity.

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for rejection
		6Ml/d. The increase in flow was due to valving restrictions being rectified. The site has a licence of 11.4Ml/d, so an additional 4.2Ml/d is theoretically feasible. It is not known whether the increased flow would result in water quality issues. There is turbidity treatment on site, but other contaminants may become prevalent. Increasing the flow to the licence would require a full refurbishment as 8.9Ml/d is the maximum possible flow through the existing disinfection process. The pumps and drives would also need upgrading to achieve higher than 8.9Ml/d, while the capacity of the sand filter will need to be checked, although it is believed to be adequate for the design flow. It is also not known whether the network would be able to cope with the additional water and any modifications that would need to be made		Continuing the current programme of incremental enhancements would be required before decisions can be made about further increase of the site output, and that would mean it is outside of the timeframe of these measures.
SWZ	East Worthing WSW	Re-considered option - The site is currently running at 6Ml/d and has a licence of 7Ml/d. It is believed that the lower flow from Northbrook is due to a throttled valve as any increase in flow above 6Ml/d leads to an increase in turbidity which cannot be treated with the processes that are currently on site. It will therefore need bespoke turbidity removal treatment for the full 7Ml/d. The design capacity of the UV unit is 7.7Ml/d, so this will be adequate for an increase in flow from 6Ml/d to 7Ml/d. There may be demand constraints on the site, which will need to be resolved.	1.0	The water quality issues that may come from increasing the flow at the site means that there is a great deal of uncertainty as to the potential benefit from the site. Turbidity is known to be an issue as the flow increases. However, given the presence of industrial pollution within the raw water, it is likely that increasing the flow would also lead to a deterioration of the water quality with respect to hydrocarbon contamination.
SWZ	Durrington WSW	Re-considered option - The current flowrate is 3.36Ml/d, whereas the licence is 7Ml/d. The site runs off a single well, with the pump designed to supply 7.24Ml/d. This will need to be replaced or refurbished should the site need to meet the increased flow as it cannot achieve additional flow. The disinfection is sized for 9.2Ml/d, so will be able to treat a higher flow. The reason for the lower flow is demand constraint. A higher flow is achievable from the site providing that it can be moved off site. The site pumps to a reservoir, which maintains its demand with the flow received from the site.	3.6	The changes required to the network will make this scheme unfeasible within the timeframe required for these schemes.

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for rejection
		There are some turbidity issues during recharge of the aquifer during the autumn and winter periods. There is no treatment on site to deal with this as the water is not generally needed during these periods and the lost volume can be made up from elsewhere.		
SNZ	Pulborough	Re-considered option - The site runs at 75Ml/d with a potential additional 10Ml/d available from the tidal River Arun abstraction. The treatment on site is adequate for treating the current and additional flow. However, 2.5Ml/d lost as washwater is returned to the river rather than to the head of the works. The reason for the loss of the water is due to poorly functioning filter presses and the acrylamide content of the concentrate. Once the out of service filter presses are repaired, this will allow water to be returned to the head of the works along with the settled supernatant rather than being discharged to the river. Repairing or replacing these presses would enable the sludge to be thickened to a much higher concentration, allowing the filtrate to be returned to the process.	2.5	Under the drought scenarios covered by WRMP24, it is unlikely that this WSW would be running. Therefore, this scheme would not provide additional water in a drought.
SWZ	Steyning	Re-considered option - The current flow through the works is 1.8Ml/d, with the licence being 2.5Ml/d. The disinfection is sized for 5.9Ml/d. There are two boreholes with one pump in each, capable of producing 1.4Ml/d and 1.8Ml/d. These act as duty/standby, so new pumps would be required for an increase in flow. There are concerns over the nitrate levels at Steyning, although catchment management is currently considered a viable option. The main issue with this site is the demand constraint and a network solution is required to move the additional water.	0.7	The changes required to the network will make this scheme unfeasible within the timeframe required for these schemes.
SWZ	South Arundel	Re-considered option - South Arundel, despite being groundwater fed, suffers from high turbidity in the spring, possibly due to tidal affects in the river Arun. Conductivity, saline ingress, turbidity and Cryptosporidium are all an issue on the site. There is a filtration system on site which is capable of treating the full flow, which will address turbidity and Cryptosporidium, but not the salinity or conductivity issues. The licence is 25Ml/d and the site runs at around 12Ml/d.	5.0	Desalination produces a hypersaline waste stream that cannot be discharged to the environment without causing damage. The use of desalination technology within the treatment process is currently not feasible under current DWI regulations. This would also require a major change to the way that the treatment works operates, so that the water remains both safe to drink and non-corrosive to the distribution system. The extent of the upgrade to the treatment works and the work within the network mean that this scheme is unfeasible within the timeframe required.

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for rejection
		To increase the flow to a reliable 25Ml/d, desalination technology would be required to deal with the saline ingress that is seen on the site. However, the additional water would then lead to a demand constraint as the network is not capable of accepting that quantity of water, so network modifications would be required.		
SWZ	Long Furlong B	Re-considered option - Long Furlong B is demand limited at its current output of 3.4Ml/d. The site licence is 4.9Ml/d, and disinfection is sized to 6.2Ml/d, so no increase in the UV capacity would be required. The site has nitrate and is blended with water from Pennyhill. This would need to be considered if the output is increased, but it is not thought to be problematic as there is adequate water. There are 2 pumps on site, capable of treating 4.3Ml/d. These can run duty/ duty, but currently run duty/standby due to the demand constraints.	1.5	There is no spare capacity within the network to increase the output from the works. The changes required to the network will make this scheme unfeasible within the timeframe required for these measures. Deployable Output from Long Furlong B is groundwater level constrained during drought, so this scheme will only lead to a resilience benefit to output at the site under normal year conditions.
SWZ	Long Furlong A	Re-considered option - The licence for the site is 4.5Ml/d but the site currently runs at 2.7Ml/d. There is one pump which can do a maximum of 3.3Ml/d and turbidity is an issue when the site output exceeds 2.7Ml/d, particularly within the winter period, when water quality is impacted by recharge. Filtration would be required to deal with the additional turbidity. However, there is a further concern with the capacity of the network. The site is unable to push more water into the local network, so changes to the distribution system would be required.	1.8	The turbidity issues at a flow higher than the current operating flow indicate that it is likely that the maximum yield of the borehole has been reached. The extent of the upgrade to the treatment works is feasible within the timeframe. However, improvements to the network cannot be made by the required time.
SBZ	Hove B	Re-considered option - The site has a licence of 17.5Ml/d but is currently providing 9.2Ml/d. The disinfection process is sized for 18.2Ml/d so would be adequate for any uplift in flow. There are three boreholes, each of which could supply 6Ml/d. All have variable speed drives so would be able to change their flows to a required amount so that it is possible to increase the flow to what is required. The site has a filtration stage which will accommodate the required flow. The water from the site is blended with water from Hove as part of the nitrate control measures. This would need to be assessed along with the ability of the network to receive the additional water. It may be that once the	8.0	The main issue with this scheme is the capacity of the network to accept the additional water as well as the increased blend flow that would be required from Hove to maintain the required water quality in terms of nitrate. The increased water would need to be sent to a storage facility so that the blending with Hove water is controlled and understood. The time and complexity required for the construction of a new storage facility along with the need to expand the capacity of the network to allow additional water from Hove B as well as the blend water means that it is unlikely to be achievable within the timeframe required for these schemes.

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for rejection
		flow increases, there is insufficient blending volume available, so a nitrate removal plant would be required.		
SBZ	Shoreham	Re-considered option - There are three pumps on site, running at 6.6Ml/d, 4.1Ml/d and 2.25Ml/d so they can provide the 10Ml/d licence capacity. The highest the site has run was 7.2Ml/d during the summer of 2018. The disinfection process is also sized for the site licence. The water quality at a higher output is poor, with turbidity increasing significantly when the flow increases above the current operating flow. It is likely that this is due to the availability of water in the borehole. Therefore, for any additional output, a filtration system would be required. It is likely that the losses due to a filtration system would offset any increased output from the works.	2.8	The cause of the turbidity at higher flows is not known, but likely to be due to the drawdown of the water level caused by the flow increase. This makes the scheme unworkable as a drought scheme as water levels will be significantly lower during these times. It is also highly likely that the losses caused by a filtration system would significantly reduce any benefit from increasing the flow from the works. Deployable Output from Shoreham is groundwater level constrained during drought, so this scheme will only lead to a resilience benefit to output at the site under normal year conditions.
SBZ	North Shoreham	Re-considered option - The site has a licence of 4.5Ml/d and currently operates at 3Ml/d. The borehole pump is sized to 6.5Ml/d but has only achieved a maximum of 4.2Ml/d in the past, so it is likely that a new borehole pump would be required to achieve the licence flow. It is also likely that turbidity and nitrate removal would be needed to treat the water with this increased flow. Ion exchange is already planned for the site in the next AMP; a filtration system will also be required. The disinfection process would also need to be upgraded as it is currently sized to 3.6Ml/d.	1.5	This work has already been planned into the next AMP. Deployable Output from North Shoreham is groundwater level constrained during drought, so this scheme will only lead to a resilience benefit to output at the site under normal year conditions. We rejected this option because it would give no benefit in a drought.
SBZ or SWZ	Temporary desalination - Sussex	Re-considered option - Temporary desalination at Coastal Sites: Sussex Coast. Located at Shoreham or Littlehampton.	TBC	Temporary desalination cannot be delivered in a shorter timescale than the options selected in our WRMP for the central area. As described in relation to desalination options in the western area, there are a number of environmental concerns relating to desalination options. This, coupled with the planning and engineering uncertainties, mean that it will be faster to deliver schemes that are already selected in our WRMP than these less mature schemes. This is because they are more developed and have more feasibility studies carried out. Despite that, we continue to follow the progress South West water is making on the desalination plant it plans to deliver in AMP7. Should there be new technology to embrace and lessons to learn from companies installing (temporary) desalination in less environmentally sensitive areas then we will incorporate these in WRMP29.

WRZ	Option Name	Option Description	Estimated DO (Ml/d)	Reason for rejection
SBZ or SWZ	Tankering (Norway/ France / Welsh Water / Wessex Water)	Re-considered option - Similar option to that being pursued in the western area but using a port in the central area.	TBC	As described earlier in this annex, we have included a bulk import via sea tankers from Norway in our updated WRMP. This option is available for our western area because Southampton Docks is large enough for the tankers. There are no other suitable ports in our region. We have previously considered other supply sources than Norway, inclusive of Wessex Water (no longer available to us) and other countries. As noted above, it is likely that any 'surplus' water in the Wessex Water area would be subject to WFD no deterioration assessments. We will continue to pursue alternatives for WRMP29, however tankering is not a viable option to supply the central area (and Sussex North specifically. For WRMP29, we will continue to monitor new technologies and methods which could enable further release of rejected options, or acceleration of existing options
Any zone	Licence trading	Re-considered option - To trade abstraction licences or abstracted water we engage with other abstractors in the region. This engagement occurs through regional groups such as WRSE and can result in receiving water from neighbouring water companies as new bulk supplies. It can also involve potential permanent or temporary trading of abstraction licences. The following website is one tool for pursuing options of this sort: Trade water abstraction rights - GOV.UK (www.gov.uk)	TBC	Our updated WRMP includes future bulk supplies from SES Water (see below), South East Water, Portsmouth Water and Thames Water. There are no additional options for the following reasons: - For WRMP19 we published a bid assessment framework to support the market to deliver WRMP options to help meet our supply duty. This did not lead to any viable options. - As set out in section 4 of annex 12 for our rdWRMP24 we explored options with two abstraction licence holders but rejected both options. Also, in annex 12 we say why we rejected the option of "explore licence trading with large abstraction licence holders." - When we consulted on our dWRMP24, any third party with a supply/ demand option could have presented it but we received no viable, sustainable options. - It is logical that there are very few sustainable options of this sort because other abstractions in our region are likely to be subject to similar concerns and any increases in abstraction would need to demonstrate no deterioration.
SNZ	Additional bulk supply from Sutton & East Surrey Water	Re-considered option - This is a sub option of licence trading that was specifically suggested by the EA during ongoing WRMP engagement.	TBC	As above, we have considered trades with neighbouring companies as part of WRSE and that is covered in our rdWRMP24. Our updated WRMP includes a supply from SES of 10 Ml/d to become available before 2035 and smaller volumes prior to that. There are no additional supplies available from SES within the WRSE modelling.