Strategic Solution Gate 2 Submission: Detailed Feasibility & Concept Design Report iii

Havant Thicket

6 December 2021

RAPID

Environment Agency dwi Ofwat

Contents

1 Executive Summary

<table>
<tr><td>Strategic Challenge</td><td>This Detailed Feasibility and Concept Design Report (CDR) describes the stage of work completed to analyse the feasibility and viability of Havant Thicket-based options, in response to Southern Water's (SW) Water Resource Management Plan 2019 (WRMP19) and Section 20 agreement (s20) obligations, to deliver the Strategic Resource Option (SRO) by 2027. The SRO is part of the wider Water for Life Hampshire (WfLH) programme which, across a series of projects, aims to reduce SW's reliance on groundwater and drought orders increasing resilience of supply. In anticipation of potential increases in future drought resilience requirements, a high-level assessment of how these options can be evolved to meet future needs (during a 1-in-500-year drought scenario) has been completed.</td></tr>
<tr><td>What SW has done to date</td><td>Since Gate 1 SW, in collaboration with Portsmouth Water (PW), has progressed analysis into the feasibility and viability of the Havant Thicket-based options. Option D.2 (61Ml/d direct transfer from Havant Thicket Reservoir (HTR) to Otterbourne WSW), and Option B.4 (75 Ml/d DO transfer between HTR and Otterbourne WSW (augmented with a 15 Ml/d WRP to supplement HTR)), as alternatives from the WRMP19 Base Case, as required by the Regulatory Alliance on Progressing Infrastructure Development (RAPID) Gate process. Both Havant Thicket-based options have been considered in greater detail across multiple areas including technical engineering, environmental impact, procurement, customer and stakeholder engagement, schedule, regulatory compliance, costs and benefits to identify the most preferable option at Gate 2. Note that PW are responsible for the delivery and future ownership of the HTR.</td></tr>
<tr><td>Key findings</td><td>The key findings of the analysis are:
Reservoir storage and raw water transfers are well-understood and regularly utilised across the UK market.
Water Recycling is understood and utilised internationally, however, the limited UK market for Water Recycling systems may present challenges for this solution from several perspectives
The Havant Thicket-based options are the lowest cost (Capital Expenditure (CAPEX) and Operational Expenditure (OPEX)) options, relative to the other options considered at Gate 2. Existing and widely used technology in the UK, like raw water transfers is the lowest cost option. The estimated CAPEX for Option D.2 is £261m, while the use of new technologies to the UK market, like water recycling is expected to increase CAPEX. The estimated CAPEX for Option B.4 is £451m.
Both Havant Thicket-based options are expected to cause adverse environmental impacts, such as biodiversity, flora and fauna, and air and climate impacts, although opportunities to avoid, mitigate and offset impacts exist.
The supply capacity of Option D.2 is unable to be expanded or increased, due to the capacity of the HTR. Any future efforts to expand the capacity of this option would require transfers from the HTR to be supplemented with alternative sources. The supply capacity of Option B.4 is able to be expanded to meet any increases in future needs, primarily through varying the capacity of the Water Recycling Plant.
Stakeholders and customers were typically more in favour of the Havant Thicket-based options, although customer perception of water recycling is a high-risk item that will need to be managed closely throughout project delivery.
Both Havant Thicket-based options would be expected to be completed and operational in Q1 2030 – partially driven by time required to fill the Havant Thicket Reservoir.</td></tr>
<tr><td>Results of Options Appraisal Process</td><td>The results of the Options Appraisal Process (OAP), which included Economic Appraisal comprised of Cost Benefit Analysis (CBA) and Multi Criteria Decision Analysis (MCDA), consenting risk assessment and assessment of options against the against programme Legal and Policy Obligations and Strategic Objectives are summarised below.
<table>
<tr><th rowspan="2">Option</th><th rowspan="2">Operating Scenario</th><th colspan="4">Hierarchy Ranking</th><th rowspan="2">NPV (£m)</th></tr>
<tr><th>Economic Appraisal</th><th>To meet 1-in-200-year needs</th><th>To meet greater than 1-in-200-year needs*</th><th>Capacity evolve and to meet 1-in-500 year needs*</th></tr>
<tr><td rowspan="2">D.2</td><td>'Business as usual' (BAU)</td><td>1st of 6</td><td rowspan="2">1st of 6</td><td rowspan="2">4th of 4</td><td rowspan="2">4th of 4</td><td rowspan="2">265</td></tr>
<tr><td>Drought</td><td>1st of 6</td></tr>
<tr><td rowspan="2">B.4</td><td>BAU</td><td>2nd of 6</td><td rowspan="2">2nd of 6</td><td rowspan="2">1st of 4</td><td rowspan="2">1st of 4</td><td rowspan="2">554</td></tr>
<tr><td>Drought</td><td>2nd of 6</td></tr>
</table>
These results compare all options included at Gate 2. * Paused options removed from this stage of OAP.</td></tr>
<tr><td>Key risks & assumptions</td><td>The key risks identified through the analysis competed are to be managed closely following Gate 2, these include:
Customer and stakeholder perceptions and views surrounding the quality and acceptability of recycled water and ensuring that water quality meets Drinking Water Inspectorate (DWI) and customer wholesomeness requirements.
The SRO is unable to be delivered within the s20 obligation timescales, potentially leading to enforcement action if not sufficient managed with relevant stakeholders and regulators.
The interfaces between infrastructure components required to delivery either Havant Thicket-based option and the HTR project which will be addressed collaboratively with PW.</td></tr>
<tr><td>Recommendations</td><td>Based upon the robust OAP and supporting technical analysis completed to date, it is recommended that:
SW proceed with delivering Option B.4, as Option B.4 is the Selected Option
Development and progress of Option D.2 exclusively is stopped. Noting that Option D.2 is a component of Option B.4, infrastructure associated with Option D.2 will continue to be developed, but as part of Option B.4.</td></tr>
</table>

2 Background and Objectives

This document provides a technical summary of the analysis completed to determine the feasibility and viability of two Havant Thicket reservoir-based options to provide a sufficient supply of water in an event of a severe (1-in-200 year[1]) drought in the Hampshire Water Resource West Zone (WRZ). Delivery of the option selected by Southern Water (SW) aims to reduce reliance on drought orders and protect the rivers Itchen and Test, using All Best Endeavours (ABE), as required by SW's Section 20 (s20) agreement with the Environment Agency (EA).

Although current requirements are to provide sufficient supply to customers during severe drought scenarios, SW is anticipating future increases to this resilience requirement, so that customer demand can be met during an extreme (1-in-500-year[2]) drought, on a regional level.

While this document focuses on how the Havant Thicket-based options can meet the 1-in-200-year supply requirement, key factors considered on how these options can been adapted and evolved to meet 1-in-500-year supply requirements have been highlighted in the respective sections of this document. Further detail of the anticipated future supply requirements during an extreme drought is detailed in Section 3.2.2.

3 Concept Design

3.1 Solution and Options

3.1.1 Solution Context and Background

WRMP19 identified that a 75Ml/d Strategic Resource Option (SRO), alongside the full and successful delivery of all other components of the WfLH programme, would provide 222Ml/d, a 30 Ml/d surplus, in a severe drought. This modelling included conservative assumptions which continue to be tested and validated through the development of the SROs currently being considered. At Gate 1, a 14Ml/d saving in the supply/demand balance was identified, through the testing of previously made assumptions regarding the process and supply losses. Further detail on this is provided in Annex 2 of SW's Gate 1 submission. This led to the introduction of 61Ml/d capacity SRO options.

The introduction of 61Ml/d capacity SRO options allowed for an alternative Havant Thicket-based option to be included for consideration. Following Gate 1, further testing of the assumptions relating to wastewater treatment discharges to rivers led to a further 10Ml/d reduction in the remaining deficit, to 51Ml/d. More detail is included in Annex 4, Water Resources Modelling.

However, since the Interim Update, further modelling has been conducted on the Supply Demand Balance to determine the deficit against WRMP19 requirements to account for the likely future needs. A boundary date of 2040 was agreed as elements becoming relevant beyond this date have a higher degree of uncertainty and therefore could not reliably inform infrastructure capacity specifications. The revised residual deficit is now calculated to be 83 Ml/d, as detailed in Section 3.7 of Annex 4 - Water Resource Modelling, which has been carried through to the evolution plans included in Annex 12 - Outline Option Evolution Plan and Annex 13 - Selected Option Evolution Plan. However, to account for process losses at Otterbourne Water Supply Works (WSW) an additional allowance of +5% in deployable output (DO) is required from the SRO. Therefore, a revised DO required of the selected SRO is 87 Ml/d. The revised calculation now allows for future changes in requirements, such as supporting regional 1-in-500-year extreme drought resilience. At this stage, each of the options considered at Gate 2 meets the supply/demand balance up to 75Ml/d, factoring in the performance and progress of the non-SRO components of the WfLH programme. The potential for either options B.4 or D.2 to meet future needs that differ from 1-in-200-year drought resilience has now been considered, with a particular focus on the potential of the options to adapt to meet these needs. A summary of the re-calculation of the supply/demand balance and therefore informing the residual deficit, required to be supplied by the selected option is detailed in Table 1.

[1] The National Framework published by the Environment Agency in March 2020 sets out a higher level of drought resilience (1 in 500-years), following the publication of WRMP19. Our proposed solution was submitted to RAPID in accordance to our existing 1-in-200-year WRMP guidance.

Table 1 - Supply Demand Balance update since Gate 1

		WRMP19	Gate 1	Gate 2 Re-calculation	Gate 2 Revision
Supply	Deployable Output	134	134	147	147
	Sustainability Reductions & Climate Change	-61	-61	-61	-69
	Outage Allowance & Process Losses	-16	-5	-7	-8
	Inter-company Transfers	5	5	5	5
	Baseline Supply	62	73	84	75
Demand	Baseline Demand	218	218	218	218
Non-SRO Elements		**84**	**84**	**84**	**59**
Residual Deficit		**73**	**61**	**51**	**83**

For the purposes of this document, technical analysis and assessment has been completed on the assumption of resolving a deficit of 51 Ml/d as per 'Gate 2 Re-calculation'. For consideration of the ability of these Options to evolve to meet the revised residual deficit of 83 Ml/d, technical analysis is held within Annex 12, Outline Options Evolution Plan. Adaptability is one of three programmes strategic objectives, which were used to identify the preferred option at Gate 2. Details regarding how the strategic objectives were applied are included in Annex 5, Options Appraisal Process. In addition, modelling of the required water volumes for any increased supply requirement is being led by Water Resources South East (WRSE) and is in its early stages. Further detail on modelling completed to date is provided in Section 3.3.2.

3.1.2 Solution Description

The Havant Thicket-based options use the 8700ML capacity reservoir, being constructed by PW, as a storage lake or environmental buffer, with a transfer pipeline from the reservoir to Otterbourne Water Supply Works (WSW).

Both PW and SW are currently working to identify the impacts across both their networks and any indirect infrastructure requirements. This is an ongoing process, which is currently being led by a formal design alignment review process where engineering teams from both organisations are collaborating to identify and propose approaches for mitigating infrastructure interface risks, such as identifying opportunities where SW initial infrastructure components can be expedited and included early in the construction of the Havant Thicket Reservoir.

In addition to the SRO, the existing [redacted] for a 21Ml/d treated water transfer into SW's distribution network via PW's Gater's Mill asset will be confirmed. This has not been considered as part of this SRO and is being delivered as a separate project within the WfLH programme.

3.1.3 Options and configurations

Two Havant Thicket-based options have been continued from Gate 1 through to Gate 2. These options are:

- **Option D.2**: This option provides a direct water transfer from Havant Thicket reservoir up to a peak capacity of 61 Ml/d via a new proposed pipeline to Otterbourne WSW;
- **Option B.4:** This option consists of the infrastructure listed above for Option D.2, plus a Water Recycling Plant (WRP) producing 15 Ml/d located near [redacted], with associated transfer pipelines between [redacted], the WRP and Havant Thicket reservoir. A maximum deployable output of 75Ml/d is supplied from this option.

Since Gate 1 the capacity of the WRP required for Option B.4 has been reduced from 61Ml/d to 15Ml/d. Otherwise, the key components of the Havant Thicket-based options have remained consistent.

The balance of supply for Option B.4 is made up by yield from the Havant Thicket Reservoir, which together can be transferred to SW's Otterbourne WSW to meet SW's severe drought supply need. Further details are provided in Section 2.2 of Annex 3, Havant Thicket Technical. Each of the options are illustrated in Figure 1.

Figure 1 – Schematic diagram of transfer routes for Options B.4 and D.2

3.1.4 Asset Operation

Two operating regimes are described for both options, maximum flow, option operating at the maximum deployable output (75Ml/d) and minimum flow, where the deployable output is 5Ml/d.

Option D.2

Once Havant Thicket reservoir is filled and operational, and in a minimum flow scenario, a continual 'sweetening flow' of 5Ml/d will be transferred to Otterbourne WSW via the direct pipeline to be constructed as part of this option. For clarity, this will be part of a separate BSA from the existing arrangement being prepared regarding Gater's Mill, which is to provide a deployable output of 21Ml/d of treated water to SW via PW's [redacted]

In a maximum flow scenario, flows from Havant Thicket reservoir are increased to 61Ml/d to support supply requirements during a severe drought event, via the direct transfer pipeline. However, the capacity of Havant Thicket reservoir is insufficient to support demand of 75Ml/d (peak flow, design capacity for the SROs) for the full duration of a severe drought event. An overview of the process is illustrated in

Figure 2, highlighting all components and supplies from the Havant Thicket Reservoir, with the flows specific to Option D.2 considered in this document circled.

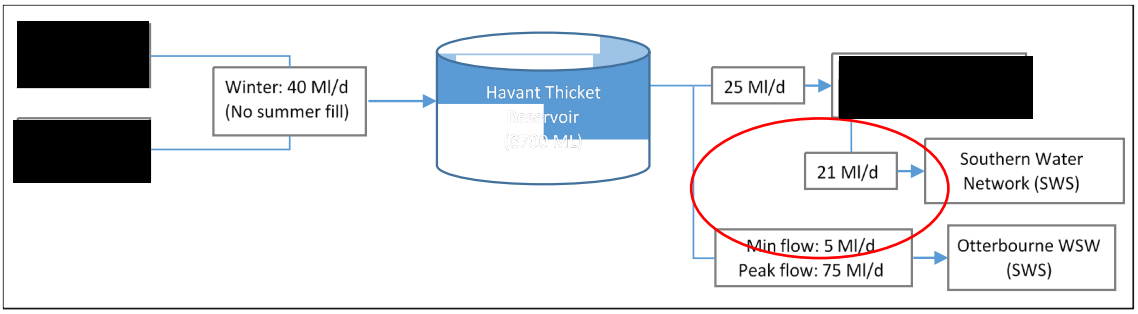

Figure 2 - Process Flow Diagram - Option D.2

Note that Option D.2 can meet a peak flow of 75Ml/d during short periods, but not for the full length of time the asset would need to be operational for. Further detail is provided in Annex 4, Water Resource Modelling.

Option B.4

Similar to the asset operation of Option D.2, the transfer pipeline between Havant Thicket reservoir and Otterbourne WSW will maintain a 5Ml/d 'sweetening flow', with the WRP designed to provide a deployable output of 5Ml/d to the reservoir, specifically to match the 'sweetening flow' along the direct transfer pipeline. At maximum flow (75Ml/d) from the reservoir, the WRP is designed to provide a deployable output of 15Ml/d. An overview of the process flow is illustrated in Figure 3, highlighting components specific to Option B.4 considered in this document circled in grey.

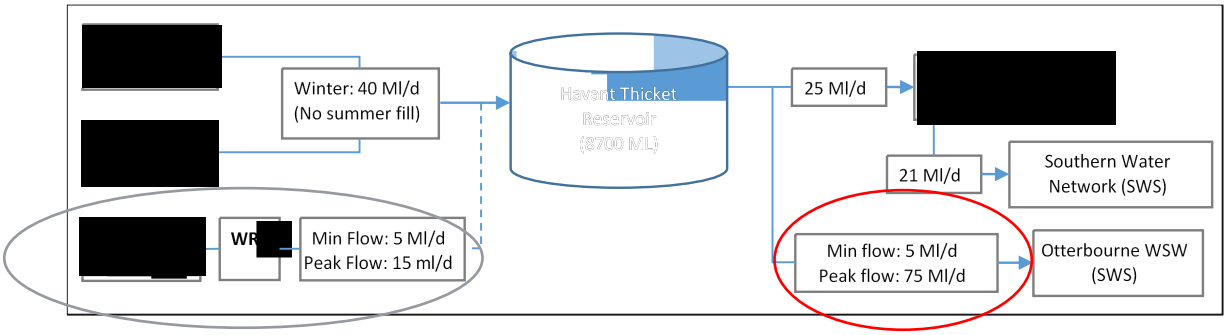

Figure 3 - Process Flow Diagram - Option B.4

3.1.5 Assets to be Constructed – Non-Infrastructure

3.1.5.1 Havant Thicket Reservoir

As detailed in Section 3.1.2, PW is responsible for the design and construction of the Havant Thicket Reservoir.

3.1.5.2 Water Recycling Plant

Relevant for Option B.4 only, the final effluent will be transferred from the outlet channels at [redacted] via a short pipeline to a new water recycling plant (WRP). The treatment of the final effluent needs to include reverse osmosis (RO) due to saline intrusion at the coastal [redacted]. SW proposes using the globally adopted approach for water recycling, i.e., Full Advanced Treatment comprising Microfiltration (MF), RO followed by Ultraviolet-Advanced Oxidation Process (UV-AOP) as illustrated in Figure 4.

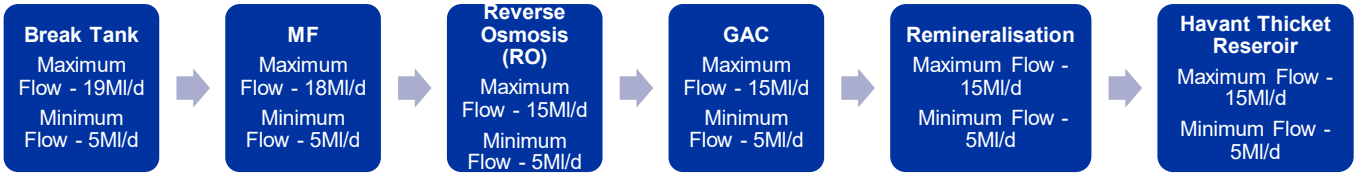

Figure 4 - Flow volumes at each stage of the water recycling process

The required flow at each stage of the water recycling process to meet either of the two operating regimes considered are detailed in Figure 4, with treatment losses ranging between 21 and 28% of influent flow volume, depending on the operating scenario, through the entirety of the water recycling process.

WRP influent from [redacted] will be collected in feed tanks. From the WRP feed tank;

- MF feed pumps will send flow through the MF system to the MF Filtrate tank;
- RO feed pumps will transfer flow through RO membranes and gravitate into the UV-AOP using hydrogen peroxide; and
- UV-AOP treated water will be transferred to granular activated carbon (GAC) contactors prior to remineralisation and gravitating into the high lift pump station wet well.

These treatment processes in series provide a multi-barrier treatment process capable of meeting regulatory expectations. The WRP will also produce the following waste streams:

- MF reject and RO concentrate from the membrane process will be blended with small volumes of neutralised clean-in place (CIP) chemical waste and discharged to the Solent, alongside remaining [redacted] final effluent via long sea outfall; and
- Minor waste flows such as compressor cooling water, sample drains, and trench/slab drains which will be discharged to foul sewer.

3.1.5.3 Otterbourne WSW proposed pre-treatment process

Outside of the Havant Thicket-based options being considered as part the WfLH programme, Otterbourne WSW is due to undergo refurbishment to reconfigure a new combined disinfection stream comprising of UV and chlorination of the surface water and ground water stream. SW aims to launch a pilot of ceramic membrane technology starting in 2021 and currently assumes a full-scale membrane plant for concept design of the proposed pre-treatment process, detailed in Figure 5. It should be noted that, unless the pilot trial is successful, SW will consider other pre-disinfection technologies to meet the DWI notice requirements to identify a solution by December 2022.

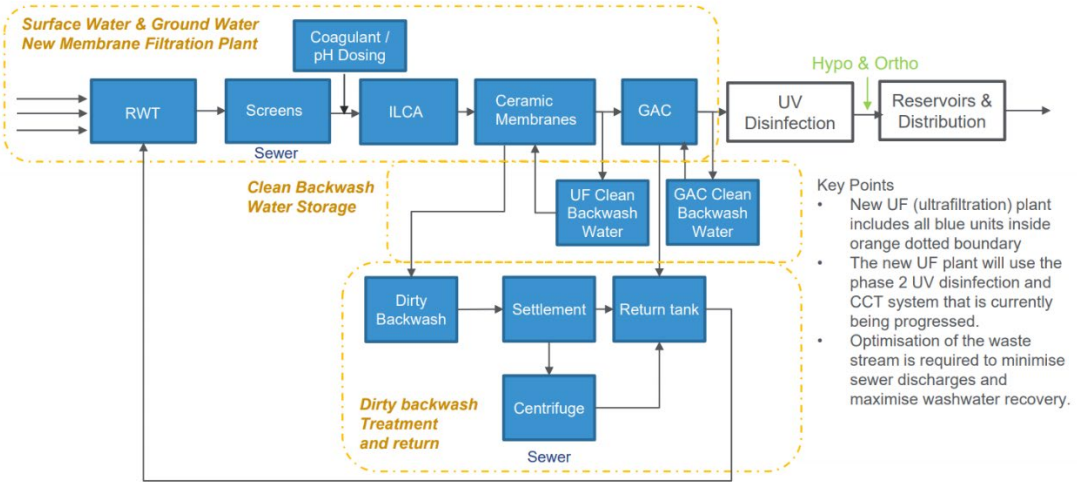

Figure 5 – Otterbourne WSW simplified process flow diagram

3.1.6 Assets to be Constructed - Infrastructure

Although not responsible for the construction of Havant Thicket Reservoir, SW is responsible for the delivery of any required infrastructure that would support the required transfer pipelines. In addition, SW will construct the following infrastructure components:

- For Option D.2 and Option B.4:
  - Direct transfer pipe between Havant Thicket Reservoir and Otterbourne WSW; and
  - Break pressure tank and booster station located at separate points along the pipeline.
- For Option B.4 only:
  - Transfer pipelines between [redacted] and the WRP, and the WRP and Havant Thicket Reservoir;
  - Pump stations along each transfer pipeline section; and
  - Waste stream pipeline from WRP to [redacted] – Eastney Long Sea Outfall.

Due to the significant distance and large static head, dual stage pumping stations are proposed between the Havant Thicket High Lift Pump Station and Otterbourne WSW. Whole life cost analysis of options for pumping arrangements and technical assessment (i.e. dual stage or single stage pump stations) will be completed at later stages of the design process to support decision making to identify the optimum design configuration.

3.1.7 Interaction of this Solution with Other Proposed Water Resource Solutions

New water resource models are being developed for the whole of the South East by WRSE to assess strategies for future regional planning. As detailed in Section 3.3.2 , SW is working with WRSE to ensure model consistency. Additional to the two Havant Thicket-based options, the WfLH programme also includes the delivery of a Bulk Supply (including associated bulk supply agreement) for 21Ml/d direct transfer direct from Havant Thicket Reservoir to Otterbourne WSW.

3.2 Feasibility Assessment

3.2.1 Identification of Mutually Exclusive Solutions

The options considered in this document are not mutually exclusive. Each option is reliant on the construction of the Havant Thicket Reservoir by PW. The Havant Thicket reservoir is due to be constructed by 2027, with the reservoir to be filled between 2027 and 2029, at which point the reservoir is

expected to be operational. The delivery of Option B.4 is reliant on all the asset components of Option D.2, plus the delivery of Havant Thicket Reservoir (being delivered by PW), and other additional components. These components include the WRP, transfer pipelines ([redacted] to the WRP and WRP to Havant Thicket Reservoir) and other associated components such as pump stations.

3.2.2 Identification of Sub-optimal Solutions

Since Gate 1, no other options using the Havant Thicket Reservoir have been identified as being sub-optimal or unviable and subsequently removed from consideration. As detailed in Section 3.1.3, since Gate 1 the capacity of the WRP as part of Option B.4 has been reduced from 61Ml/d to 15Ml/d.

3.3 Water Resource Assessment

3.3.1 Supply Demand Balance Delivery Plan

In WRMP19, SW set out its preferred approach to provide a resilient water supply to customers during a 1-in-200-year drought event. The strategy included several interventions, which together formed the Water for Life Hampshire (WfLH) programme and combined will meet the projected supply/demand deficit during a severe drought. These interventions can be classified and include the following:

- Strategic Resource Option (SRO) project: desalination plant at Fawley as the base case[3]; and
- Non-SRO projects, including New Supplies: PW bulk supply (as mentioned in Section 3.1.7) and a [redacted] transfer; and: demand reductions from leakage prevention and per capita consumption.

As detailed in Section 3.1.1, the supply demand modelling has evolved since WRMP19, driven by testing and validation of modelling assumptions and updates in projected deployable output in the various projects of the WfLH programme.

Since the Interim Update, further Supply Demand Balance modelling has been conducted. The forecast residual supply deficit is 83Ml/d from this modelling, as detailed in Section 3.1.1. This takes into account the most likely scenarios for bulk transfer and demand reduction performance. Further detail can be found within Annex 4, Water Resource Modelling.

3.3.2 Alignment with regional plans

Since the publication of WRMP19, modelling has been initiated by WRSE to consider possible options that could provide a resilient supply during an extreme (1-in-500-year) drought scenario, when considering supply options on a regional scale. SW is actively liaising with WRSE, including sharing modelling information and detailed technical options that supported SW's Gate 1 submission. It should be noted that WRSE's draft modelling has not yet concluded and outputs are not expected to be available until post Gate 2.

In-lieu of final modelling results, SW has undertaken a preliminary modelling exercise based on high-level information currently available. The primary purpose of this is to gain a high-level understanding of the possible order of magnitude for the supply/demand balance during an extreme drought scenario. These calculations are indicative and based upon significant assumptions, which will be tested and validated once WRSE draft modelling is complete. Initial SW modelling on further future requirements consider the 1-in-500-year extreme drought scenario and suggest that SW and PW needs can be met by an SRO which delivers a deployable output of 87Ml/d, which is in-line with the revised Supply Demand Balance as per 3.3.1. Further detail can be found in Annex 12, Outline Option Evolution Plan.

3.3.3 Water resource benefit assessment

There is potential that in future additional supply may be required to meet customer demands (i.e. above the 87Ml/d deployable output, as outlined in Table 1 during a 1-in-500-year drought scenario). Opportunities for increasing the capacity of Option D.2 are limited due to the finite yield from Havant Thicket reservoir. As a result, Option D.2 would need to be evolved. The most obvious evolution would be the addition of a WRP, to prevent Havant Thicket from being exhausted, but as this is effectively Option B.4, Option D.2 becomes defunct. The key benefit of Option B.4 is the future flexibility provided by the supplementary supply from the WRP. The potential for combined maximum final effluent from [redacted] and Peel Common WTWs, or influent to the water recycling process, can contribute a deployable output of

[3] For clarity, the desalination Base Case is essentially a 'placeholder' until the decision is made which of the three solutions is chosen (i.e. desalination/water recycling/Havant Thicket)

up to 95Ml/d from the water recycling component that can support any required increases to the deployable output. The Havant Thicket reservoir supports these options and provides additional benefits, such as community and recreational use. Further detail on additional benefits provided by options D.2 and B.4 are detailed in Section 3.7.

3.4 Drinking Water Quality Considerations

3.4.1 Progress since Gate 1 and Future Water Safety Plan Developments

Since Gate 1 the following progress has been made:

- A Water Recycling Pilot System has been commissioned at Peel Common WTW alongside a sampling plan to gather extensive water quality data
- Hazards have been identified in the water supply system that impact microbial and chemical parameters that are required as part of compliance with water quality standards
- Donor site selection has been conducted to confirm the source water for the water recycling plant
- Water Safety Plans (WSP) have been developed, with a committee of water treatment practitioners and experts with knowledge and experience in public health; and
- Several meetings with the DWI were undertaken to share findings and gather implications of findings from a regulatory standpoint.

3.4.2 Water Safety Plan Development Timeline

The development timeline proposed at Gate 1, identifying the key data gathering exercises for each gate is illustrated in Figure 6 which shows the stage of WSP development.

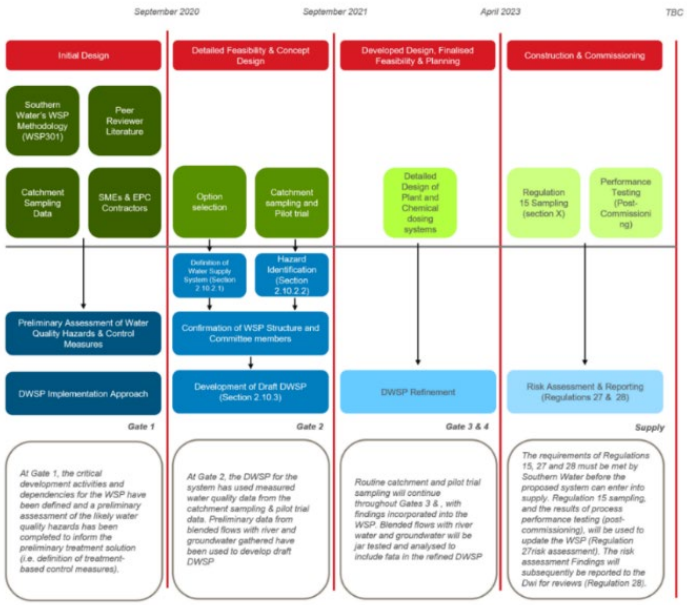

Figure 6 - Water Safety Plan Timeline – Havant Thicket

Several consultation meetings have been held with the Drinking Water Inspectorate (DWI), the Environment Agency (EA) and Natural England (NE) since the start of Gate 2 and SW has provided updates and a draft of the WSPs for review to the DWI. The final WSPs are available. Further detail is held in Section 2.2.9 Annex 3, Havant Thicket Technical.

A specific consideration for the Havant Thicket-based options is the development of a WSP that considers multiple sources, including two of those with existing WSPs. As a result, the Havant Thicket Reservoir WSP brings separate components together, as illustrated in Figure 7.

Since Gate 1, SW has developed WSPs for the Havant Thicket Reservoir in consultation with PW. Key steps included collating the existing PW WSPs for the [redacted] and Havant Thicket catchments and conducting a risk assessment of the recycled water influent to the Havant Thicket Reservoir under Option B.4. Further details of this approach are provided in Section 2.3.1 of Annex 3, Havant Thicket Technical.

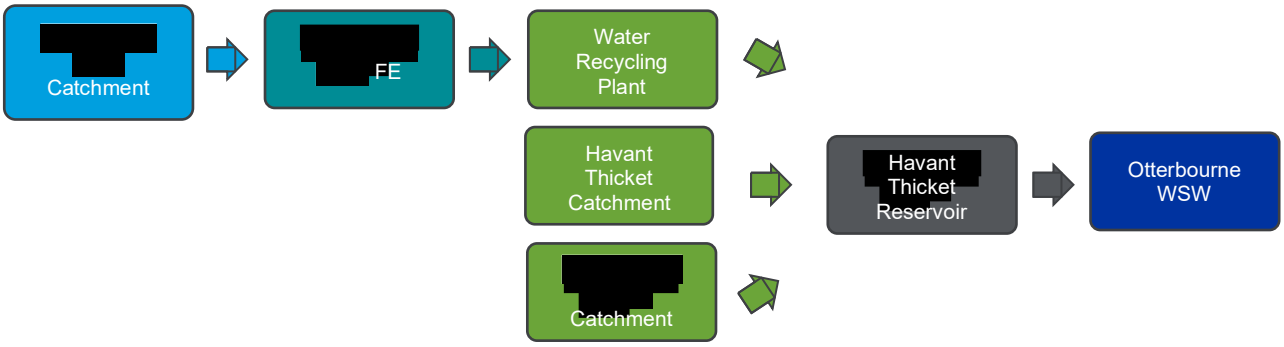

Figure 7 - Water supply components contributing to DWSP

3.4.3 Quality Regulatory Considerations

SW has engaged with multiple regulators, including DWI, and will continue to do so throughout the programme lifecycle. A key purpose of this engagement is to ensure that the WSP meets DWI requirements, DWI concerns are managed and factored into drinking water safety planning, appropriate detail is provided on how SW will manage and ensure water safety once operational. This includes ensuring that water is acceptable to customers.

Engagement meetings with the DWI were held in September 2020, December 2020 (two meetings) and April 2021 to share findings, understand the implications of those findings from a regulatory standpoint and to resolve issues and concerns arising from the findings. WSPs were submitted to the DWI on 13 April 2021 and were developed in alignment with SW's WSP Risk Assessment & Monitoring Methodology (WSP301) aligned with the specifications of British Standards document BS EN 15975-2:2013, detailed in Section 2.3.1 of Annex 3, Havant Thicket Technical. SW has received no feedback from the DWI in respect of concerns about the WSPs.

SW is currently engaging with PW to develop the Havant Thicket Reservoir WSP. This includes assessing possible hazards and risks to be managed from using water from three different sources (see Figure 7). Proposed mitigations will be included in the draft WSP. Following Gate 2, SW plans to continue sampling to test proposed mitigations using the water recycling pilot plant at Peel Common WTW. SW will continue to work closely with PW, DWI and other stakeholders to further refine and develop the Havant Thicket WSP.

The main DWI concerns related to the conditioning and blending of water and the impact these will have on drinking water quality, and customer acceptance. It also required a comprehensive sampling programme of source water for the water recycling element of Option B.4 which is explained further in Section 3.4.4. Outcomes of the sampling programme are key to managing regulator concerns and will guide the detailed treatment requirements, that will be included in the WSP.

3.4.4 Source Water Considerations

For Option D.2, extensive water quality sampling of [redacted] was undertaken during development of the reservoir scheme. PW's sampling data, the capacity of the reservoir, and assumptions such as algae formation potential have been provided to SW. This WSP for transferred water from Havant Thicket has been developed without data from the WRP and therefore applies to the D.2 option only.

The full WSP for Option B.4 will require hydraulics and additional water quality modelling work to be undertaken, in-line with the water safety plan development timeline, detailed in Section 3.4.2.

For the water recycling component of Option B.4 SW has used a water recycling pilot plant at Peel Common WTW to support and inform water safety planning needs, which is derived from The World Health Organisation (WHO) approach, to identify inherent risk to source water. Further details of these are provided in Section 2.2.1 of Annex 3, Havant Thicket Technical.

In addition, SW has also initiated a six-stage source water sampling process to determine detailed treatment requirements. Both the pilot plant operation and sampling will continue after Gate 2 to ensure seasonal changes are understood and that there is a sufficiently large dataset to demonstrate the data is statistically representative, as required by the DWI. Further detail of the sampling process is detailed in Section 2.21 of Annex 2, Water Recycling Technical.

3.4.5 Enforcement Action at Otterbourne WSW

As detailed in Section 3.1.5.3, SW are planning refurbishment of the Otterbourne WSW pre-treatment requirements, following DWI enforcement action.

The disinfection refurbishment is required irrespective of the option selected and will be delivered by SW as a separate capital project, but the choice of a water recycling option will change pre-treatment requirements. To allow for appropriate cost comparisons between options, SW assumes that 50% of the costs of the membrane treatment plant relate to the water recycling SRO options, as current assumptions include that 50% of the flows treated by the new treatment measures will be directly from the Havant Thicket-based options. Further detail is available in Section 2.2.9 of Annex 2, Water Recycling Technical, with further detail regarding cost implications within Section 3.8.1.

3.4.6 Conditioning, remineralising and blending

A key risk to be managed for Option B.4 is the mixing or blending of water from multiple sources, including recycled water, within the reservoir. At all times the treated water must be meet quality standards and be acceptable to customers. As detailed in Figure 7, the Havant Thicket Reservoir will include water from three different sources and drinking water quality risks will need to be managed within the Havant Thicket Reservoir WSP.

Risks associated with including recycled water within the reservoir more easily managed when volumes of recycled water fed to the reservoir are small, compared to from other sources. As a result, the smaller deployable output (15Ml/d) WRP will assist in reducing the risks regarding drinking water quality and customer acceptance. These risks will continue to be explored and considered post Gate 2.

3.5 Environmental Assessment

Multiple assessments and appraisals have been completed prior to Gate 2 considering the environmental impact and any mitigation and off-setting opportunities that exist regarding Options B.4 and D.2. As both options include the Havant Thicket Reservoir and transfer pipeline to Otterbourne WSW, environmental impacts and benefits from these components are applicable. For Option B.4, environmental impacts and benefits caused by the water recycling plant and necessary transfer pipelines are in addition to those environmental impacts caused by Option D.2.

Environmental impacts have been considered by component. Key components for Option D.2 are the transfer pipeline from Havant Thicket reservoir to Otterbourne WSW and supporting booster pumping stations. Key additional components of Option B.4 are the water recycling plant, transfer pipelines, from [redacted] to the WRP and from the WRP to Havant Thicket reservoir, plus supporting pumps stations, as outlined in Section 3.1.

3.5.1.1 Environmental Surveys

The completed surveys can be categorised in three groups; Terrestrial Ecology, Aquatic Ecology and Marine Environment. Details of the specific surveys within each are detailed Section 2.5.2.2 of Annex 3, Havant Thicket Technical. The purpose of using these survey protocols is to ensure a consistent, transparent and standardised approach to the environmental survey methodologies and to provide robust baseline to inform the relevant application documents. The collected baseline survey data will be used to inform the scheme development process, EIA process and the identification of appropriate mitigation measures.

3.5.2 Marine Conservation Zone (MCZ) Assessment

No marine survey was required for Option D.2. However, marine works are required for Option B.4, due to possible alterations to the Eastney Long Sea Outfall (LSO). Three MCZs – Yarmouth to Cowes, The Needles and Bembridge – were included in the analysis completed, which concluded that there is no overlap of the plume extent into the Bembridge MCZ. For Yarmouth and Cowes MCZ and The Needles MCZ, the extent and concentrations of the existing plume are not predicted to be altered significantly by the changes in flows to the discharges associated with B.4. For this reason, it is concluded that the effects associated with Option B.4 will not result in an adverse impact on the conservation objectives of any of the three MCZs considered. Further details are included in Section 2.5.3.2 of Annex 3, Havant Thicket Technical.

3.5.3 Habitats Regulation Assessment (HRA)

A high-level HRA has been completed to test if either of the Havant Thicket-based options could significantly harm the designated features of a Habitats sites (SAC, Special Protection Area (SPA) or

Ramsar sites). It should be noted that a statutory HRA assessment is not required further to the gated process, but a statutory HRA will be required in the context of the DCO application.

Details of the stages of the HRA methodology consistently applied across each of the options are detailed in Section 2.5.2.4 of Annex 3, Havant Thicket Technical. At an overview level they include two stages – Stage 1: Screening; and Stage 2: High-level Appropriate Assessment. A summary of the HRA Screening results is detailed in Table 2.

Table 2 - HRA Screening: High-Level results – Havant Thicket-based options – construction and operational effects

Risk Area	Construction Effects	Operational Effects	Options
Subtidal	• None identified	• Indirect – Changes to water quality	B.4 only
Terrestrial	• Direct effects – Habitat loss if located within a habitats site • Indirect effects – Temporary disturbance due to noise, vibration and human activity; Changes in water quality; and Introduction of INNS; and Barrier to species migration / movement	• Direct effects – Habitat loss if located within a habitats site • Indirect effects – Temporary disturbance due to noise, vibration and human activity; and Changes in air quality.	B.4 & D.2
Ornithology	• Direct effects – Habitat loss if located within a habitats site • Indirect effects – Temporary disturbance due to noise, vibration, human activity and light; Change in supporting habitat quality due to release in sediment during river crossing construction; Barrier to species migration/movement; and Changes to prey resource	• Direct effects – Habitat loss if located within a Habitats site • Indirect effects – Temporary disturbance due to noise, vibration, human activity and light; and Barrier to species migration/movement.	B.4 only
Freshwater	• Direct habitat loss if located within a habitats site • Indirect effects – Temporary disturbance due to noise, vibration and human activity; Changes in water quality; and Introduction of INNS. • Barrier to species migration	• Connectivity with subtidal effects for migratory species • Changes to water quality due to potential emergency environmental buffer lake overflow	B.4 & D.2

Following identification of the high-level risks, potential mitigations were explored to understand what mitigations may be required if either Option B.4 or D.2 are selected for construction. At this stage, uncertainties regarding the extent of potential impacts remain. More detailed and comprehensive surveys are planned to commence in Q4 2021 and continue to 2023, which will provide a clearer understanding of potential HRA impacts.

3.5.3.1 Potential Mitigation Measures

Stage 2 of the HRA focused on considering potential mitigation measures to Adverse Effect on Integrity (AEoI) on the Habitat sites and Ramsar sites screened in during Stage 1 of the HRA. Potential mitigations based upon the identification of AEoI's and analysis completed to date is summarised in Table 3, with further detailed in section 2.5.2.4 and 2.5.3.3 of Annex 3, Havant Thicket Technical. Note, results only for the areas screened through Stage 1 of the HRA.

Table 3 - Potential habitat impact mitigation measures, following High-level Appropriate Assessment – Havant Thicket

Area / Zone	Potential Environmental Effect	Potential mitigation requirements	Options
Butser Hill Special Area of Conservation (SAC) and Woolmer Forest SAC	Temporary changes to air quality	• Construction Traffic Management Plan (CTMP) • Enforcing of a 'no idling' rule for construction traffic	B.4 & D.2
River Avon Compensatory SAC, River Meon Compensatory SAC and River Itchen Compensatory SAC	Temporary Habitat loss	• Micrositing of pipeline route and construction compounds to avoid sensitive features • Utilising trenchless crossing techniques, where possible	B.4 & D.2
	Temporary disturbance	• Identify birds during breeding season – protections during breeding seasons	
	Changes to water quality	• Utilise trenchless construction and crossings • Best practice construction methods may comprise of: – Bunding and appropriate storage of sediment – Onsite treatment/polishing of silted water – Use of sediment traps – Regular cleaning of haul roads to prevent waste dirt runoff – Appropriate storage and application of both hazardous and non-hazardous waste and chemicals (e.g. diesel)	

Area / Zone	Potential Environmental Effect	Potential mitigation requirements	Options
	Barrier to movement	• As per water quality	
	Introduction of INNS	• Best practice biosecurity measures to ensure clothing, boots and machinery are free from propagules	
Solent and Isle of Wight Lagoons SAC	Changes to water quality	• Best practice construction methods may comprise of: – Bunding and appropriate storage of sediment – Onsite treatment/polishing of silted water – Use of sediment traps – Regular cleaning of haul roads to prevent waste dirt runoff – Appropriate storage and application of both hazardous and non-hazardous waste and chemicals (e.g. diesel)	B.4 only
Solent and Dorset Coast SPA	Disturbance	• Seasonal restrictions on certain construction activities to avoid adverse effects on site integrity	B.4 only
	Changes to water quality	• Best practice construction methods may comprise of: – Bunding and appropriate storage of sediment – Onsite treatment/polishing of silted water – Use of sediment traps – Regular cleaning of haul roads to prevent waste dirt runoff • Appropriate storage and application of both hazardous and non-hazardous waste and chemicals (e.g. diesel)	
	Changes in prey resource	• As per water quality	
Solent Maritime SAC	Changes to water quality	• Best practice construction methods may comprise of: – Bunding and appropriate storage of sediment – Onsite treatment/polishing of silted water – Use of sediment traps – Regular cleaning of haul roads to prevent waste dirt runoff – Appropriate storage and application of both hazardous and non-hazardous waste and chemicals (e.g. diesel)	B.4 & D.2
	Introduction of INNS	• Best practice biosecurity measures to ensure clothing, boots and machinery are free from propagules	B.4 only
Chichester and Langstone Harbours SPA and Ramsar	Temporary disturbance	• Seasonal restrictions on certain construction activities to avoid adverse effects on site integrity	B.4 & D.2
	Changes to water quality	• Best practice construction methods may comprise of: – Bunding and appropriate storage of sediment – Onsite treatment/polishing of silted water – Use of sediment traps – Regular cleaning of haul roads to prevent waste dirt runoff – Appropriate storage and application of both hazardous and non-hazardous waste and chemicals (e.g. diesel)	

3.5.3.2 In-Combination Effects

A high-level assessment of other major infrastructure projects in the region was undertaken, considering possible in-combination effects. This analysis revealed three other projects – AQUIND Interconnector; Portsmouth City Council flood and coastal erosion management scheme; and Havant Thicket Reservoir – the projects other than the Havant Thicket Reservoir (which is part of each option) are expected to be located approximately five kilometres from Havant Thicket Reservoir. Analysis completed to date has indicated there are no Likely Significant Effects (LSE). If the option selected may cause LSE on any Habitats sites or Ramsar sites, or it is not known whether the SRO may cause such LSE, this is likely to trigger the need for an Appropriate Assessment. Further detail is provided in Section 2.5.2.4 of Annex 3, Havant Thicket Technical.

3.5.3.3 Water Framework Directive

Assessment of WFD impacts has continued since Gate 1. For Option D.2, the proposed activities will not result in significant changes to the hydromorphology, biology, physico-chemistry and chemistry of surface waters or the quantity and quality of groundwaters. Further detail is included in Section 2.5.2.3 of Annex 3, Havant Thicket Technical. For Option B.4 there is potential for there to be minor impacts to the hydromorphology, biology, physico-chemistry and biology of the River Itchen. Proposed mitigations for these impacts align with industry guidance detailed in Section 2.5.2.3 of Annex 2, Water Recycling Technical. Further development of detailed mitigations will be prepared after Gate 2.

3.5.3.4 Invasive Non-Native Species (INNS) Risk Assessment

The core infrastructure components of options B.4 and D.2 has been assessed individually, with results combined together to calculate the INNS risk score for each option overall. Across the two Havant Thicket-based options, the greatest INNS transfer risk is associated with the transfer between the [redacted] and the WRP and the WRP to Havant Thicket Reservoir. The transfer between Havant Thicket Reservoir and Otterbourne WSW has no risk of INNS transfer because it will not be stored in a bankside reservoir at Otterbourne.

The approach and detailed results are in Section 2.5.2.4 of Annex 3, Havant Thicket Technical regarding Option D.2, and Section 2.5.2.4 of Annex 2 - Water Recycling Technical regarding Option B.4. INNS risk scores for each option are detailed in Table 4.

Table 4 - INNS risk scores

INNS Risk Score Type	Option D.2	Option B.4
Inherent	624	1,144
Adjusted	0	1,708
Weighted	0	3,717

3.5.4 Biodiversity Net Gain and Natural Capital

Biodiversity Net Gain and Natural Capital evaluations completed for options B.4 and D.2, have followed methodology guidance set by the All Company Working Group (ACWG), with the outputs of assessments being consistent with the requirements set by the WRSE Regional Plan Environmental Assessment Methodology Guidance, as well as the Water Resource Planning Guidance for WRMP24 and UKWIR Environmental Assessment Guidance.

The Biodiversity Net Gain assessment has been based upon the application of Defra 'Biodiversity tool, 'The Biodiversity Metric 2.0', which applies quantitative metric to scoring various biodiversity components and considerations. Further details of the assessment methodologies utilised are provided in sections 2.5.2.5 and 2.5.3.5 of Annex 2, Water Recycling Technical and Annex 3, Havant Thicket Technical.

Table 5 - Detailed Quantified Biodiversity and Natural Capital Net Gain - Havant Thicket

Metric	Assessment	Direct Transfer – component total (Option D.2)	WRP & WRP to HTR Route 2 (B.4 only)	[redacted] WTW to HTR pipelines (B.4 only)
Biodiversity		[redacted]		
	Total temporary habitat			
	Total permanent habitat loss			
	Total on-site re-instatement / creation			
	Total off-site habitat creation / BNG uplift			
Climate regulation				
	Change in non-traded carbon value – temporary			
	Change in non-traded carbon value – permanent			
Natural hazard regulation				
	Change in natural hazard value – temporary			
	Change in natural hazard value – permanent			
Recreation & tourism				
	Estimated Welfare Value			
	Estimated visits			
Agriculture				
	Temporary loss estimated agriculture value			
	Permanent loss estimated agriculture value			

Further detail on the Biodiversity Net Gain assessment, are provided in Section 2.5.2.5 of Annex 3, Havant Thicket Technical for Option D.2 and Section 2.5.3.5 of Annex 2, Water Recycling Technical for Option B.4.

3.5.5 Strategic Environmental Assessment (SEA)

As with the approach undertaken for the SEA level option assessment at Gate 1, the principles of SEA have been applied in analysing the Havant Thicket -based options at Gate 2. A SEA is not required for Gate 2 from a statutory perspective. The SEA level options assessment from Gate 1 has been updated to reflect changes in the design of options B.4 and D.2. The SEA level option assessment has been completed in line with the WRSE Regional Plan Environmental Assessment Methodology Guidance (2020), ODPM A Practical Guide to the Strategic Environmental Assessment Directive (2005) and UKWIR (2020) Draft Environmental

Assessment Guidance for Water Resource Management Plans and Drought Plans. The five-stage process utilised is detailed in Section 2.5.2.7 of Annex 3, Havant Thicket Technical.

The key for this high-level assessment is detailed in Table 6. These are presented by component. Further detail on the assessment process and the key results are included in Section 3.5.2.1 of Annex 3, Havant Thicket Technical.

Table 6 - High-level SEA level options screening assessment criteria and key

High-level screening - RAG	
Risks of adverse effects grading	**Opportunity for beneficial effects grade**
Negligible	No beneficial effects / no applicable
Minor adverse impacts likely, 'standard' best practice mitigation activities	Potential for beneficial effects
Moderate adverse impacts likely, mitigation required to overcome	Potential or moderate beneficial effects
Major adverse impacts likely, challenging to overcome	Potential or major beneficial effects
Substantial adverse impacts, significant challenge to overcome	

Table 7 - High-level SEA level options assessment results (per component) – Havant Thicket

Component	Adverse Effects		Beneficial Effects		Option
	Risk	Commentary	Risk	Commentary	
Water Recycling Plant		• Two major adverse effects are identified – biodiversity flora and fauna, air and climate		• Five minor effects – water use efficiency, reduce pressure on other sources, minimise abstraction risks, minimise surface water risks and reduction in climate change risks	B.4 only
		• Four moderate adverse effects are identified – resource use, water quality, archaeology and cultural heritage and landscape / visual			
Changes to Waste Stream, via Eastney LSO		• One major adverse effect – biodiversity flora and fauna		• As per Water Recycling Plant	B.4 only
		• Five minor adverse effects – resource use and water quality, population and human health, water, material assts and resources and air and climate			
Pipeline – WRP to Havant Thicket Reservoir		• Three major adverse effect – biodiversity, air quality and archaeology and cultural heritage.		• Five major beneficial effects to human health, materials assets and resources, air and climate	B.4 only
Pipeline – Havant Thicket to Otterbourne		• One major adverse effect –archaeology and cultural heritage.		• Five minor beneficial effects to human health, materials assets and resources, air and climate	B.4 & D.2
		• Four moderate adverse impacts - biodiversity, flora and fauna, human health, material assets and resource use, air and climate			
2nd stage pump stations and break pressure tanks		• Two major adverse effects - biodiversity, flora and fauna, human health, archaeology and cultural heritage, landscape and visual		• five minor beneficial effects – human health, material assets and resources, water, and air and climate	B.4 & D.2
Ceramic membrane plant at Otterbourne WSW		• Two major adverse – biodiversity, flora and fauna and air and climate		• Five minor beneficial effects – human health, material assets and resources, water, and air and climate	B.4 & D.2

3.5.6 Carbon Impact

SW is committed to meeting existing carbon commitments, such as the water industry's Public Interest Commitment of net zero by 2030 for operational emissions and the UK government's target to bring all greenhouse emissions to net zero by 2050. Notwithstanding appropriate mitigation, the construction of any SRO considered at Gate 2 is expected to have a negative carbon impact that will need to be offset. Once the carbon impact can be calculated, required offsetting initiatives will be designed with greater confidence. Further detail is provided throughout Section 2.5.2.10 of Annex 3, Havant Thicket Technical for Option D.2 and Section 2.5.2.8 for Option B.4.

Carbon modelling across the whole life of the asset for both Havant Thicket-based options has been completed. Operational carbon emissions were calculated based on quantities for power use, chemical use, transport and operational maintenance requirements. The monetised cost of carbon was also calculated using the traded and non-traded carbon price forecasts from the Green Book Supplementary Guidance: Valuation of

energy use and greenhouse gas emissions for appraisal can be seen in Table 8 (Carbon prices and sensitivities 2010-2100 for appraisal, 2018 £/tCO_2, central price). The traded carbon price was applied to power related emissions only, with the non-traded carbon price applied to all other emissions.

The current estimate of emissions provides a view of how much the options would add to SW's existing emissions once commissioned. Under SW's net zero operational emissions by 2030 commitment these operational emissions will need to be reduced and potentially offset by 2030. The potential costs of offsets have not been included at this stage as this would be considered as part of SW's overall net zero and offsetting strategy. The capital carbon, operational carbon (associated with chemical use, power and transport), whole life carbon and the non-discounted monetised cost of carbon for each Havant Thicket-based option is included in Table 8.

Table 8 - WLC carbon summary calculations for Havant Thicket-based options

Option	Operating regime	Flow (Ml/d)	Capital carbon (tco2e)	Operational carbon (tco2e)	Whole life carbon (tco2e)	Monetised whole life carbon (£m)
D.2	MAX	75	42,000	1,500	98,000	18
	MIN	5	42,000	100	55,000	7
	AVERAGE	6.69	42,000	100	55,000	7
B.4	MAX	75	71,000	4,600	363,000	86
	MIN	5	71,000	1,100	193,000	41
	AVERAGE	6.69	71,000	1,200	195,000	41

3.6 Site Selection, Option Configuration and Consenting Evaluation

3.6.1 Site Selection

A five-stage site and route selection process was applied to determine the most suitable sites and routes for key components of the two Havant Thicket-based options. Further detail of the process utilised included in Section 3.1 of Annex 5 Options Appraisal. For Option D.2, analysis related to the transfer pipeline corridor, and an indicative location for a high level pumping station in the vicinity of Havant Thicket reservoir, For Option B.4, site selection considered the pipeline route as for D2, and additionally considered the location for the WRP plant and pipeline corridors between [redacted] and the Water Recycling Plant, and from the Water Recycling Plant to Havant Thicket Reservoir.

3.6.2 Option Configuration

The sites and pipeline corridors identified at the end of Stage 4 of the site and route selection process and the associated stakeholder feedback was utilised to inform the Consenting Risk Assessment. Details of the Site and route Selection process, and the results through each of the stages related to the two Havant Thicket-based options are provided in sections 3.1.5 and 3.1.6 of Annex 5 - Options Appraisal. Based upon the site selection analysis completed, the preferred configurations for each of the Havant Thicket-based options were identified as detailed in Table 9.

Table 9 – Preferred configurations for each Havant Thicket-based option

	Option D.2	Option B.4
Marine intake / outfall	Not applicable	Not applicable
Site	HTPS5	WRP 72 (parcel 71 held at Stage 4)
Pipeline Route	• Route 3 to Otterbourne (from Havant Thicket Reservoir) • Route 4 to Otterbourne (from Havant Thicket Reservoir)	As per Option D.2, plus: • [redacted] to WRP Pipeline • [redacted] to Havant thicket – route 1 and route 2
Other Infrastructure / Components	Not applicable	Eastney LSO (no new infrastructure)

Further detail on the specific sites and routes listed in Table 9 is included in Section 3.1.5.7 of Annex 5, Options Appraisal and Section 2.4 of Annex 3, Havant Thicket Technical. For some component, primarily the pipeline corridors there are multiple corridors being considered. These options continue to be considered at this stage.

3.6.3 Consenting Evaluation

The preferred option configurations identified, as detailed in Section 3.6.2, were included within a detailed consenting evaluation – a component within the overall options appraisal process. The two Havant Thicket-based options were ranked as 1st and 2nd (Option D.2, 1st and Option B.4, 2nd, out of six options) within the Consenting Risk Assessment. Key conclusions of the assessment included:

- Option D.2 is assessed to perform best under the Consenting Evaluation
- Option B.4 has fewer consenting risks that water recycling-based options that use an Environmental Buffer Lake
- Further consenting risk evaluation analysis is required post Gate 2 for both Havant Thicket-based options, primarily related to pipeline route selection.

Further detail related to the consenting evaluation, including the approach and the results for each option specifically are included in Section 4 of Annex 5, Options Appraisal Process.

3.7 Wider Benefits Assessment

3.7.1 Resilience

A quantitative assessment of resilience for the options progressed at Gate 2 was completed, which built on the methodology presented at Gate 1 (Annex 17). The resilience assessment explored non-drought (BAU) resilience benefit provided by the SROs to Otterbourne WSW and Testwood WSW, and the benefit to Otterbourne and Testwood in a 1-in 200-year drought situation in comparison to a baseline in which no SRO is implemented. Testwood and Otterbourne WSWs account for half of the total zonal risk in the Hampshire region. Both sites currently have very poor redundancy and are critical to the supply of two-thirds of the customers within the zone (298,654 properties served). There is not enough spare capacity in the network to make up the loss of either of these sites in the event of a full outage. Hence, the resilience assessment focusses on the loss and the resilience criticality of these sites. The shocks and stresses considered as part of the non-drought assessment included raw water loss, severe flooding, contamination, and critical asset failures, further details are provided in Section 2.2.10 of Annex 3, Havant Thicket Technical. Criteria utilised to conduct this assessment includes Integration with existing network strengthening solutions / plans; Adaptability of operation emergency response in a stressed situation (e.g. peak week demand); and Regional resilience.

The resilience assessment completed utilises key elements of SW's established resilience framework. This framework is based upon the Cabinet Office's '4Rs of Resilience' – resistance, reliability, redundancy, and response and recovery. Further detail on the assessment criteria (which reflects RAPID resilience criteria and the WRSE guidance) is provided in Annex 4, Water Resource Modelling.

3.7.2 Value for Customers and Environment

As part of the options appraisal process, all the SROs have been assessed under the multi-criteria decision analysis (MCDA) framework to identity the best-value solution. Twenty-three criteria were used, covering customer aspects (customer acceptability of drinking water, security of supply), environment (biodiversity, air pollution), societal considerations (recreation and amenity), deliverability and affordability. Further detail on the MCDA, within the wider options appraisal process is detailed in Section 3.8.5 and Annex 5, Option Appraisal Process.

3.7.3 Social and Environmental Benefits

The Havant Thicket-based options provide social and environmental benefits, primarily driven by the Havant Thicket reservoir. As detailed in , there are multiple opportunities for benefits, inclusion increased supply resilience, human health benefits, reduced material and resource use and air and climate benefits. As detailed in Section 3.7, options B.4 and D.2 provide amenity and conjunctive use benefits for the public. Estimated values on these benefits are detailed in Table 5, which include carbon and recreational use benefits. Furthermore, there are reduce quantity and extent of environmental impacts caused by the Havant Thicket-based options. As detailed in Section 3.5 and , greater impact is expected from Option B.4 when compared to Option D.2, also contributing the improved expected social and environmental benefits provided by Option D.2.

3.8 Solution Costs

3.8.1 Overall Costs of the Solution - Construction and Operation

Refined cost estimates for Options B.4 and D.2 are set out in Table 10. Detailed information is provided in Section 2.10 of Annex 3, Havant Thicket Technical. OPEX, NPV and AIC values are for the maximum DO (Deployable Output) flows and minimum flows. A third operating regime was also modelled, an average flow that assumes 1 year in the 100 operating years will be operating at maximum (DO) flow, with the remaining 99 years operating at minimum flow.

NPV estimates have been calculated over a 108-year period, comprising 8 years for development and construction followed by 100 years of operation. The 100-year operation duration has been selected as

this is the life of the longest lasting asset proposed in any option in accordance with latest HM Treasury Green Book recommendations. CAPEX (including maintenance and replacement costs) and OPEX forecasts (both fixed and variable costs) have been profiled over the 108-year analysis period. This longer period is more appropriate than the 60 years used in the Gate 1 cost estimates to meet All Company Working Group (ACWG) guidance by aligning to the longest expected useful lifespan of any component in the asset, plus the expected time from today to the asset being operational.

Table 10 - Summary of costs: Havant Thicket options (2017-18 price)

Option	Operating regime	Flow (Mld)	CAPEX (£m)	OPEX (£m/y)	NPV (£m) Gate 2=108yr Gate 1=60yr	AIC (£/m3) Gate 2=108yr Gate 1=60yr
B.4	Max (DO)	75	451	5.8	554	0.88
	Min	6	451	2.8	483	0.76
	Average	6.69	451	2.9	486	0.77
	Gate 1	*61*	*458*	*10*	*722*	*2.99*
D.2	Max (DO)	75	261	2.2	265	0.42
	Min	6	261	0.8	231	0.36
	Average	6.69	261	0.8	231	0.37
	Gate 1	*61*	*176*	*0.3*	*158*	*0.53*

Overall CAPEX values have remained consistent with the exception of Option D.2 where a complex tunnel solution has superseded a previous open cut pipeline design between Havant Thicket reservoir and the proposed High Lift Pumping Station (HLPS). Average Incremental Cost (AIC) estimation has followed the process from the ACWG to ensure consistency in the calculation of NPVs and AICs across all SROs. The estimation method is consistent with that used in WRMP24.

Options B.4 and D.2 both include a ceramic membrane plant (CeraMac) at Otterbourne WSW as part of the refurbishment works currently ongoing, as detailed in Section 3.1.5.3. The CeraMac plant asset will be shared between the SRO and other flows and will be constructed outside of the WfLH programme. To enable comparison with the Desalination options, it is assumed that the SRO option will drive half of the CeraMac flow. This would add £78.5m to CAPEX stated above, with NPV of £107.5 and AIC of £0.17/m3. Further details of the CeraMac cost breakdown are provided in Section 2.10.3 of Annex 3, Havant Thicket Technical. For comparison purposes, the Multi Criteria Decision Analysis (MCDA) built these costs into the CAPEX assumptions (further detail can be found within Section 5 of the Options Appraisal Process Annex 5).

3.8.2 Detail of expenditure

An overview of the CAPEX expenditure is detailed in Table 11. Further breakdown and the process undertaken to prepare CAPEX estimates is set out in section 2.10.4 of Annex 3, Havant Thicket Technical.

Table 11 - CAPEX summary: Havant Thicket options without CeraMac

Cost item	Option B.4 (£m)	Option D.2 (£m)
Infrastructure component total	100.2	90.7
Non-infrastructure component total	49.3	8.2
Net direct costs (including uncertainty)	157.0	103.9
SW Contractor Indirect Costs	51.6	32.4
Contractor Total (Excluding risk)	208.6	136.4
Additional Project Costs	37.2	17.9
SW Client Indirect Costs	25.9	16.9
CAPEX Sub total	**271.7**	**171.1**
Risk (from developed risk registers)	129.9	65.3
Optimism Bias	89.4	47.4
Option Project Cost (Subject to ACCE range)	**490.5**	**283.8**

Cost item	Option B.4 (£m)	Option D.2 (£m)
Indexation to 17/18 using RPI @ -8.804%	451.3	260.9

The process undertaken to prepare OPEX estimates is set out in Section 2.10.4 of Havant Thicket Technical Annex 3. As detailed in Figure 10 above, OPEX estimated have been produce for three operating regimes. These operating regimes are consistent with those detailed in Section 2.2, Engineering Technical Design.

Annual operational maintenance costs have been estimated based on a percentage of the initial capital costs at the option level. These percentages are based on common assumptions used in the water sector for such infrastructure. Civil maintenance was calculated as 0.5% of the Infra and Non-Infra civil costs whilst M&E maintenance was calculated as 2.5% of Infra and Non-Infra M&E costs which aligns to the approach taken within the WRMP24 exercise. The methodology used to prepare the capital maintenance estimates is as follows:

- CAPEX estimates have been split by asset type and each asset type has been assigned an asset life from 4 to 100 years (detail in Section 2.10.3 Havant Thicket Technical Annex 3).
- This allocation has then been used to allocate future capital maintenance/renewal costs for each asset type over the 100-year operation duration used in the NPV and AIC analysis. The capital maintenance cycles used in the NPV calculations follow the All Company Working Group (ACWG) guidance and start in the first operating year.

3.8.3 Optimism Bias

In estimating the Optimism Bias (OB), SW followed the HM Treasury Green Book Supplementary Guidance: Optimism Bias as well as updated guidance from the ACWG. Optimism Bias has been applied once to each Option, rather than being applied at a more granular level within each Option. Section 2.10.7 in the Havant Thicket Technical Annex 3 provides further detail on the Project Type and Optimism Bias percentages selected. The changes in Optimism Bias from Gate 1 are detailed in Table 12.

Table 12 - Optimism bias at Gate 1 (Q3 2020 values) versus Gate 2 (Q2 2021 values)

Option	Gate 1 OB Percentage	Gate 1 OB Value	Gate 2 Risk Adjusted OB Percentage (Stage 3)	Gate 2 Risk Adjusted OB Value
B.4	39.8%	£127 m	32.9%	£89 m
D.2	25.3%	£23 m	27.7%	£47 m

Optimism Bias accounts for 32.9% of the total CAPEX cost for option B.4 and 27.7% of the total CAPEX for option D.2. This represents a reduction from the position at Gate 1. This is owing to a shift of value from Optimism Bias into the quantified risk register, as well as increasing levels of information improving confidence in delivery. Whilst the Green Book recommends applying optimism bias to operating costs and benefits as well as to CAPEX, the Supplementary Guidance does not provide recommended upper and lower bound adjustment factors for OPEX as there was insufficient data to do so. In the absence of other data to inform what the optimism bias adjustments for OPEX should be, the Supplementary Green Book Guidance recommends using sensitivity analysis to test the materiality of OPEX assumptions for investment decisions. Hence, the OPEX values in this report do not include optimism bias.

3.8.4 Assumptions and Exclusions

Key assumptions and exclusions in deriving estimated costs is detailed in sections 3.8.1 and 3.8.2, include:

- The estimates of cost, NPV and AIC were prepared in line with relevant guidance requirements and methodologies, including WRSE guidance where appropriate;
- As the solution design underpinning the estimates remains at an early level of maturity, the estimates are deemed to be of AACE Class 4 accuracy (+30% / -5%);
- For consistency with the PR19 submission all costs have been indexed to average 2017/18 in line with the approach taken at Gate 1. The price base is the average of 12 months of index, with a mid-point of end September. The factors for each year are April – March averages. Ofwat changed the basis of indexation in April 2020 to CPIH. Hence, the index up to and including March 2020 is based on monthly outturn RPI, converted to April to March annual averages. This provides an indexation from current Q2'2021 back to 2017/18 of –8.084%; and
- Material prices are based on current 2021 market rates adjusted to PR19 17/18 utilising RPI data and CPIH data and while current price volitivity is included within risk allowances no allowance has been made for future fluctuations in supply costs.

3.8.5 Comparison of Solution Costs and Benefits

A detailed economic analysis, comprising of Multi-Criteria Decision Analysis (MCDA) and Cost Benefit Analysis (CBA), where criteria could be valued quantitatively, was undertaken to determine and assess the costs and benefits of each option. This analysis considered 23 criteria across Net Social Impact and Cost categories. The criteria structure utilised is detailed in Table 13.

Table 13 - Economic appraisal criteria categorisation

Economic Appraisal Category	Sub-category	No. of criteria
Net Social Impact	Customer	2
	Environment	15
	Society	3
	Deliverability	1
Cost	Affordability	2

Each of these criteria were assessed on a normalised score basis, scoring each option against each criteria from 100 – best performing, to 0 – worst performing, during both 'business as usual' (BAU) (i.e. non-stressed) and drought (i.e. stressed) scenarios. The average score for each option, from a Net Social Impact and Cost perspective for both operating scenarios was calculated and compared against each of the other options considered at Gate 2. The scopes for the two Havant Thicket options are detailed in Table 14, with further detail on the approach utilised, criteria assessed, and the results of the Economic Appraisal included throughout Annex 5, Options Appraisal Process.

Table 14 - Economic Appraisal - costs and benefits results

Operating Scenario	Economic Appraisal Category	Average Economic Appraisal – Normalised Score (for each option)					
		A.1	A.2	B.2	B.4	B.5	D.2
BAU	Net Social Impact	40	40	45	48	54	61
	Cost	0	0	45	55	38	100
Drought	Net Social Impact	40	38	44	46	53	61
	Cost	0	0	45	55	38	100

Option D.2 was typically the best performing relative to the other options. Option B.4 is relatively high performing, placing third regarding net social impact, while placing second when considering costs, based upon the assessment completed by Economic Appraisal participants. The Economic Appraisal undertaken was a key technical input to the overall Options Appraisal and Decision-Making process. The process and results are detailed in Annex 5, Options Appraisal Process and have informed the overall recommendation regarding steps for further option development post Gate 2, detailed in Section 9.1.

The interaction of this solution with other proposed water resources solutions would be considered through WRSE and WRMP24 modelling. However, as this solution is operating through the RAPID accelerated gate process, and the other solutions are not, there is limited information on the interactions between solutions at this stage. WRSE are currently developing their model and have provided some initial results. SW will continue to engage with WRSE throughout the process. Analysis was completed in-line with industry accepted practice, as detailed in Annex 5, Options Appraisal Process, although have not been reported in profiles consistent with WRMP24 requirements.

4 Programme and Planning

4.1 Project Plan

4.1.1 Delivery Schedule and Milestones

The s.20 agreement with the EA requires that SW uses all best endeavours to deliver the preferred SRO to support the WfLH programme providing sufficient water supplies during a severe drought event by 2027. For the Havant Thicket-based options, the overview delivery schedule is illustrated in Figure 8, which includes the phasing of key activities (both pre-construction and construction) and decision points, high-level dependencies and a summary of the activities to be completed in delivering the project. A detailed schedule is included in Section 2.9 of Annex 3, Havant Thicket Technical.

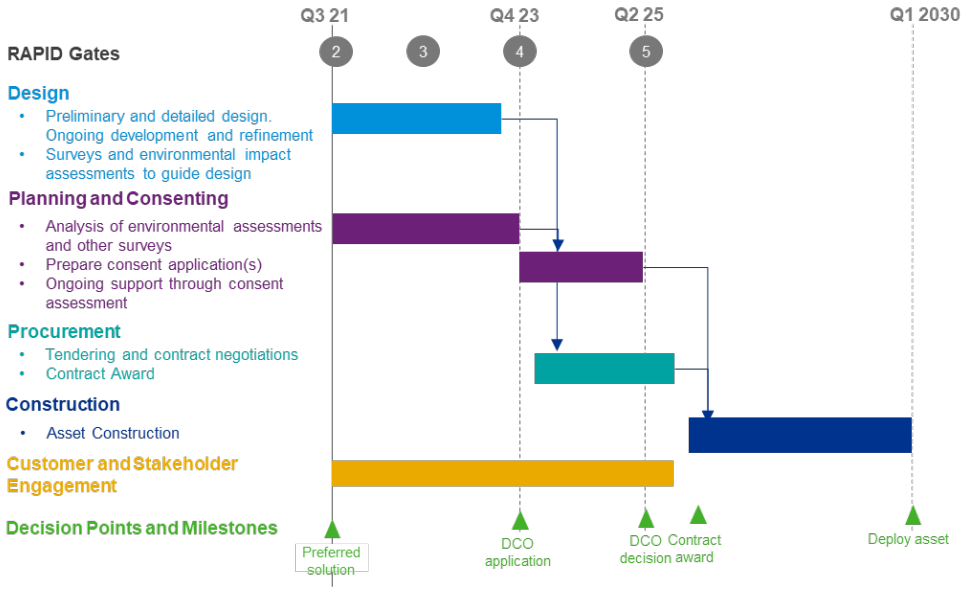

Figure 8 - High-level delivery schedule - Havant Thicket

Key milestones of the project, for options B.4 and D.2 are detailed in Table 15, with key regulatory milestones, including Ofwat's DPC control points and upcoming RAPID gates detailed in Table 16.

Table 15 - Delivery milestones

Milestone	A.1 & A.2	B.2 & B.5	B.4	D.2
Design completion	Q3 2023	Q3 2023	Q3 2023	Q3 2023
Consent application submission	Q4 2023	Q4 2023	Q4 2023	Q4 2023
Expected consent decision	Q2 2025	Q2 2025	Q2 2025	Q2 2025
Procurement (tender) commencement	Q1 2024	Q1 2024	Q1 2024	Q1 2024
Contract award	Q4 2025	Q3 2025	Q3 2025	Q3 2025
Construction start	Q4 2026	Q4 2025	Q1 2026	Q4 2025
Construction completion	Q2 2029	Q2 2030	Q2 2029	Q2 2029
Asset operational	Q4 2030	Q4 2030	Q1 2030	Q1 2030

Table 16 - Regulatory Milestones

Ofwat Control Points	Submission	Decision	RAPID Gates	Submission	Determination
A	Q1 22	With control point B	Gate 1	Complete	Complete
B	Q1 22	Q1 22	Gate 2	6 Dec 21	Q1 22
C	Q4 22	Q4 22	Gate 3	Q4 22	Q1 23
D	Q1 23	Q1 23	Gate 4	Q4 23	Q1 24
E	Q3 23	Q3 23	Gate 5	Q2 25	Q3 25
F	Q2 25	Q2 25			

Although the timeline is on ABE basis, completion and asset operation will commence after the 2027 s.20 deadline, in Q1 2030. As previously communicated to RAPID in the Strategic Solution Gate 1 Submission: Remediation Action Plan, dated 31 March 2021 and the Gate 1 submission, the timeline for delivery set out in s20 is challenging and estimates predict completion to be post the deadline. SW is actively looking at measures to limit the delay in project delivery post the s20 deadline. These include, investigating the use of Project Speed, procurement delivery models (refer to Section 5) and detailed review of regulatory timeframes and construction and commissioning schedules to identify opportunities for earlier delivery, so that SW is meeting its ABE obligation. Following Gate 2, SW will continue to explore possibilities to bring the anticipated project completion date closer to the s20 deadline of 2027.

SW will work with the EA and NE on the s20 agreement commitment, and the consequences of the Selected Option and Selected Back Up Option being unable to meet the 2027 deadline. This will include discussion of changes in the s20 agreement regarding timelines as well as active engagement on operational and environmental mitigation measures to be undertaken for the period between 2027 and the

anticipated date the asset will be operational (Q1 2030 for Options D.2 and B.4). This will be progressed in alignment with the RAPID gated process. Analysis completed was in-line with industry accepted practice, as detailed in Annex 5, Options Appraisal Process, although have not been reported in profiles consistent with WRMP24 requirements.

4.1.2 Assumptions and Dependencies

The key assumptions underpinning the schedule are summarised below, with a more comprehensive list of assumptions included and a description of their impact on delivery in Section 2.9 of Annex 3, Havant Thicket Technical. The key assumptions and dependencies are:

- PW's delivery of the Reservoir Project does not delay the delivery of either option, nor is the Reservoir Project delayed by the delivery of either option. This includes the filling of the HTR following construction, which is currently expected to be completed by November 2029. Delay in either the construction or the filling of the reservoir will delay the delivery and commencement of operations for either option;
- Any necessary revision to SW's WRMP19 to account for new options B.4 and D.2 can run in parallel to project delivery. If this activity is not able to be completed in parallel then this will cause delays to the delivery of either option and, at which point the options can commence operations;
- Either option is delivered through a Development Consent Order (DCO) consenting route rather than Town and Country Planning. The critical path mostly comprises activities required for the DCO submission;
- DCO consent is provided before Contract award;
- DPC is the preferred procurement route and one DPC contract is issued containing all elements of work
- Landowners give SW timely access for surveys; and
- Feasibility design for non-statutory consultation is of sufficient quality and depth to meet Ofwat's Control Point E requirements.

4.1.3 Missing Information

At this stage, project schedule development has concentrated on pre-construction activities, such as design, site and environmental surveys, consenting, procurement and stakeholder engagement. The construction schedule will be developed in consultation with the CAP, once further detail on project delivery is available, considering items such as costs, design and consent conditions. There is no outstanding information that would be expected at the strategic outline case of a major project's development.

4.2 Planning Route

4.2.1 Preferred Planning Route

A DCO, under the Planning Act 2008, or planning consent under the Town and Country Planning Act 1990 (TCPA) are the consent and planning regime options available.

A DCO is the preferred consenting strategy for all Havant Thicket-based Options, based on multiple factors, including the greater certainty of timescales for consenting the Selected Option (in-line with SW's s20 obligation to utilise ABE in project delivery), the scale and significance of the scheme, the ability to include multiple consents and powers required for delivery, and because of the likely significant impacts across a 'larger than local' area. Only projects within section 14 of the Planning Act 2008 automatically qualify as a National Significant Infrastructure Projects (NSIP) that must be consented under the DCO regime. The water recycling options do not meet the NSIP threshold criteria so do not automatically qualify as a NSIP under the Planning Act 2008. Therefore, to be consented under the DCO regime, a s35 direction from the Secretary of State is required. The key steps in the DCO planning approach process, including the request for a s35 Direction, are set out in Section 2.6 within Annex 3, Havant Thicket Technical.

The use of TCPA consenting is expected to increase the time required to obtain the necessary consents (the exact time implication is not known at this time), as although a 'simple TCPA application' may be quicker, there is a significant risk that this may take longer than a DCO due to the need to coordinate multiple TCPA applications, plus other applications for consents, licences and possibly a separate Compulsory Purchase Order. Using the DCO consenting route is expected to give more certainty of timings for the consenting process, and consequently the overall project, in-line with SW's s20 obligation, as highlighted in Section 4.2.3. SW has engaged with Defra on the scope of a section 35 request and anticipates making an application to Defra as soon as practicable on confirmation of the Selected Option.

4.2.2 Pre-planning Application Activity Plan

If a s35 Direction is given, SW proposes two additional stages of pre-application consultations, both statutory and non-statutory, prior to submitting its application for a DCO.

Land referencing and surveys - SW has referenced all potential main sites and pipeline routes so that landowners can be identified and, in some cases, they have already been contacted. Where land is unregistered, site notices are being posted requesting those with land interests to make contact and Crown land and 'special' categories of land under the Planning Act 2008 are being identified. In the period to Gate 3, SW will continue land referencing as the pipeline route selection process continues and continue engaging with landowners to secure access and interests in land, where required.

Environment - As part of the DCO process, SW will undertake an Environmental Impact Assessment (EIA) and submit an Environment Statement. The EIA will be supported by other environmental assessments (e.g. Habitats Regulations Assessment, Water Framework Directive compliance assessment). Further detail is provided in the Section 2.5 of Annex 3, Havant Thicket Technical.

SW will also obtain the relevant environmental permits for the activities relating to the water recycling solutions, for example any new water discharges or for treatment or storage of waste. Annex 3, Havant Thicket Technical, section 2.6.7 lists the possible secondary licences and consents, with associated timescales and consenting bodies to ensure timely application.

Stakeholder and consultee engagement – SW will continue to engage with planning consultees on the scheme development and information from its various assessments and appraisal undertaken as part of the as part of preparing its application for consent. This will include future public consultation events.

4.2.3 Key Planning Steps and Risks

The key planning steps to be managed and mitigated delivery any option following Gate 2 include:

- Submitting s.35 request to Defra
- Submitting a Scoping Request to the Planning Inspectorate following s35 Direction from the Secretary of State
- Commencing early environmental and other impact assessment activities
- Preparing for further public consultation; and
- Stakeholder, community and landowner engagement.

Further detail of the consenting risks identified, and associated mitigations and management processes proposed are detailed in Section 2.6.10 of Annex 3, Havant Thicket Technical. SW has also prepared a contingency programme for a Town & Country Planning Application consenting route should the DCO consenting regime not be available.

4.3 Key Risks and Mitigations Measures

SW has used a consistent approach for identifying and managing assumptions, risks and opportunities across all options[4], as detailed in Annex 14 of SW's Gate 1 submission. The WfLH Programme Risk Management Strategy has been designed to incorporate all aspects of risk management, and demonstrates a commitment to managing assumptions, risks and issues proactively and comprehensively throughout the lifecycle of the WfLH Programme. WfLH programme assumption, risk and opportunity registers initially developed prior to Gate 1 have been continued into Gate 2 and provide the underpinning information for risk and assumption information included within SW's Gate 2 submission. Further detail of the risk, assumption and opportunities are included in Section 2.7 of Annex 3, Havant Thicket Technical.

A summary of the risks rated as either 'Very High' (VH) or 'High' (H), based upon the risk scoring classification detailed in Figure 9 is included in Table 17. Risks specifically noted within Table 17 have been scored to have a residual risk (post mitigation) score either equal to, or greater than, 19 (out of a maximum score of 25). No assumptions were rated in this area. As a result, no assumptions have been included specifically in this document, although assumptions are included in Section 2.7 of Annex 3, Havant Thicket.

Probability	**VH** (5)	11	16	20	23	25
	H (4)	7	12	17	21	24
	M (3)	4	8	13	19	22
	L (2)	2	5	9	14	18
	VL (1)	1	3	6	10	15
		VL (1)	**L** (2)	**M** (3)	**H** (4)	**VH** (5)
		Impact				

[4] Approach and outputs consistent with quarterly dashboards.

Figure 9 – WfLH Programme Probability Impact Diagram

It should be noted that the proposed mitigation actions at this stage primarily relate to the near-term tangible and practical so a realistic approach that can be taken (rather than a long-term aspirational approach to managing risk, so that mitigations more suited to the current or near-term activities of the project can be applied).

Table 17 - Key risks [5]

Risk ID	Risk Description	Risk Category	Current Score	Mitigation Strategy	Residual Score
Costs and benefits					
710064-048	Owing to a number of global factors including shipping costs, import tariffs, the coronavirus pandemic, and other supply/demand volatility, projections are indicating significant increases in costs associated with Steel and Timber. Therefore, there is a risk that the costs associated with these items are significantly higher than assumed within the cost estimate rates, leading to an increase in the cost of the Non-Infrastructure element of the cost estimate (cost increases around pipe materials previously accounted for).	Budget	25	Continue to monitor material volatility as the estimate is revised throughout the lifecycle. Adjust the base estimate and risk profile accordingly as further information is received. Ensure that contractors, as part of the design process, have started to look at scalability testing and raw water/treated water profiles to determine the most appropriate pipe to use, as this may be informed by cost. Explore alternative procurement approaches to procure materials in advance of contract award and free issue to mitigate against rising costs.	24
710064-050	Owing to environmental and spatial constraints adjacent to environmental crossings, there is a risk that significant amendments are required to the location and extent of the reception and launch pits, leading to additional requirements and increased costs.	Environment	20	Undertake a feasibility study on this route and the alternative options, including examination of further utility information and discussions with local highways teams. In conjunction with the Planning & Consents team, prepare an appropriate methodology to enable the route to be correctly defined. Look at topics such as traffic, air quality, etc. to help determine the most appropriate route.	20
710064-051	Risk that the lengths and techniques assumed in the base design in relation to the A3(M) crossing are incorrect, resulting in a change in methodology and increased costs.	Other	22	Undertake a feasibility study on this route and the alternative options, including examination of further utility information and discussions with local highways teams. In conjunction prepare an appropriate methodology to enable the route to be correctly defined. Look at topics such as traffic, air quality, etc. to help determine the most appropriate route	22
710064-140	There is a risk that the funding required to undertake construction of the SW recycled water assets that interface with the HT reservoir is not in place in order to allow early alignment of the SW and PW construction schedules, leading to significant delay, increased cost and reputational damage in the event of retrofitting the assets into the operational reservoir	Budget	24	Complete the alignment review in order to better define the scope which needs to be accelerated in order to mitigate against the risk. Utilise the early fill deliverables in order to reduce the filling period timescales and therefore mitigate any delay to the fill completion date. Utilise RAPID engagement to assist in developing a mutually agreeable solution for both PW and SW.	22
710064-046	Owing to the significant number of unknowns in relation to the any mitigated habitat requirements, there is a risk that the level of the mitigations assumed to be required from the HRA / SEA is not sufficient, resulting in increased costs and potential delays depending on the habitat required.	Environment	21	Continue to develop HRA Assessments with a specialist consultant to understand the extent to which habitat mitigation will be required and factor into cost estimate.	19
Dependencies					

[5] This table sets out project specific risks and is distinct from engineering risks which are captured separately.

Risk ID	Risk Description	Risk Category	Current Score	Mitigation Strategy	Residual Score
Prog-R96	Owing to the current EPO involving agreement and collaboration with an external party (PW), there is a risk that a Collaborative Strategy and Agreement on the delivery approach is not secured, leading to the EPO not being able to be delivered	Other	24	Continue to develop the EBO at pace in order that this scheme can be utilised as the EPO, if required. Raise risk with RAPID to ensure that they are aware of potential collaboration issues and that their assistance will be required to manage the relationship and process. Utilise RAPID engagement to assist in developing a mutually agreeable solution for both PW and SW	22
710064-141	At present, the assumption within the SW delivery schedule is that SW will undertake construction within the HT reservoir whilst the filling programme is ongoing. There is a risk that this parallel working is not achievable leading to a significant delay to the HT filling programme (if acceptable) leading to a delay to the operation of the reservoir to provide SW with water to Otterbourne.	Stakeholder	24	Complete the alignment review in order to better define the scope which needs to be accelerated in order to mitigate against the risk. Utilise the early fill deliverables in order to reduce the filling period timescales and therefore mitigate any delay to the fill completion date. Utilise RAPID engagement to assist in developing a mutually agreeable solution for both PW and SW.	19
Planned progress					
Prog-R56	Owing to a number of currently identified risk events, there is a risk that delivery of the chosen SRO is not achieved in accordance with the obligations under the Section 20 agreement, including timescales, leading to potential legal enforcement and significant reputational damage..	Timetable	25	Following finalisation of the schedule, continue to look at opportunities within the logic and mitigations to schedule pressures to improve the forecast completion date where possible. Undertake risk-based approach to examining the assumptions throughout the schedule in order to understand risk assessed timescales.	24
710060-001	Owing to the Pilot being a complex and time critical process, and in light of the extraordinary circumstances around COVID-19, there is a risk that there is insufficient data generated to support further assessments in relation to water recycling, which could lead to delays in finalising a suitable design.	Water Quality	24	Obtain agreement with [redacted] over NDA and the ability to examine their data for comparison with our own. Ongoing monitoring of the [redacted] operation to understand any data gaps that may occur. Ensure that investigation is undertaken into reasons for [redacted] being offline in order that any corrective measures can be incorporated as part of the [redacted] trial.	22
710064-058	Owing to the relatively novel technique of Water Recycling and the fact that this water will be placed in a reservoir previously fed by a natural source, there is a risk that public perception is negatively skewed against Water Recycling, leading to delays to during the planning process as the DWI expects public concerns are addressed, as well as reputational impact on PW and SW. (Perception driven by source, odour, hygiene, etc.).	Water Quality	24	Create joint SW-PW stakeholder strategy an[redacted] continue to undertake purposeful customer consultation to build an informed picture of current perception, including focus on wastewater treatment Details to include CAG, YPM, Surveys, Analysis, etc. Complete the [redacted] to assist in changing perception as required. Undertake necessary activities and obtain necessary approvals / funding in order to relocate the [redacted] from Peel Common to [redacted] in order to provide an end-to-end stakeholder experience for recycled water.	22
Prog-R98	Owing to the Selected Option at Gate 2 being shift away from the 'Base Case' included within WRMP19 (desalination at Fawley), in order to support our future planning application, this needs to be reflected in an update of WRMP19 and consultation on our Selected Option is also required	Regulatory	24	Prepare a letter to the EA expressing SW concerns over the expedited WRMP24 timeline and the impact that this may have on submission quality. Within the letter to the EA, seek support in the form of additional resource in order to assist in the preparation of WRMP24.	22
Prog-R99	Owing to the Selected Option at Gate 2 being shift away from the 'Base Case' included within WRMP19 (desalination at Fawley), in order to support our future planning application, this needs to be reflected in an update of WRMP19 and consultation on our Selected Option is also required.	Regulatory	24	Prepare a letter to the EA expressing SW concerns over the expedited WRMP24 timeline and the impact that this may have on SW ability to align WRMP24 with the final outputs of the WRSE modelling and regional planning process.	22

5 Procurement, ownership, and operation

5.1 Procurement strategy

Since Gate 1, SW has continued to refine the procurement and commercial strategy for the delivery of the SRO, including both Havant Thicket options, options D.2 and B.4. This includes further consideration of the procurement activities and implications associated in the event that either of these options are delivered. Since Gate 1 submission, the WfLH programme team have further developed the DPC eligibility assessment, tender model and commercial model. The outline DPC procurement timeline is set out in Figure 10, at the time of analysis preparation.

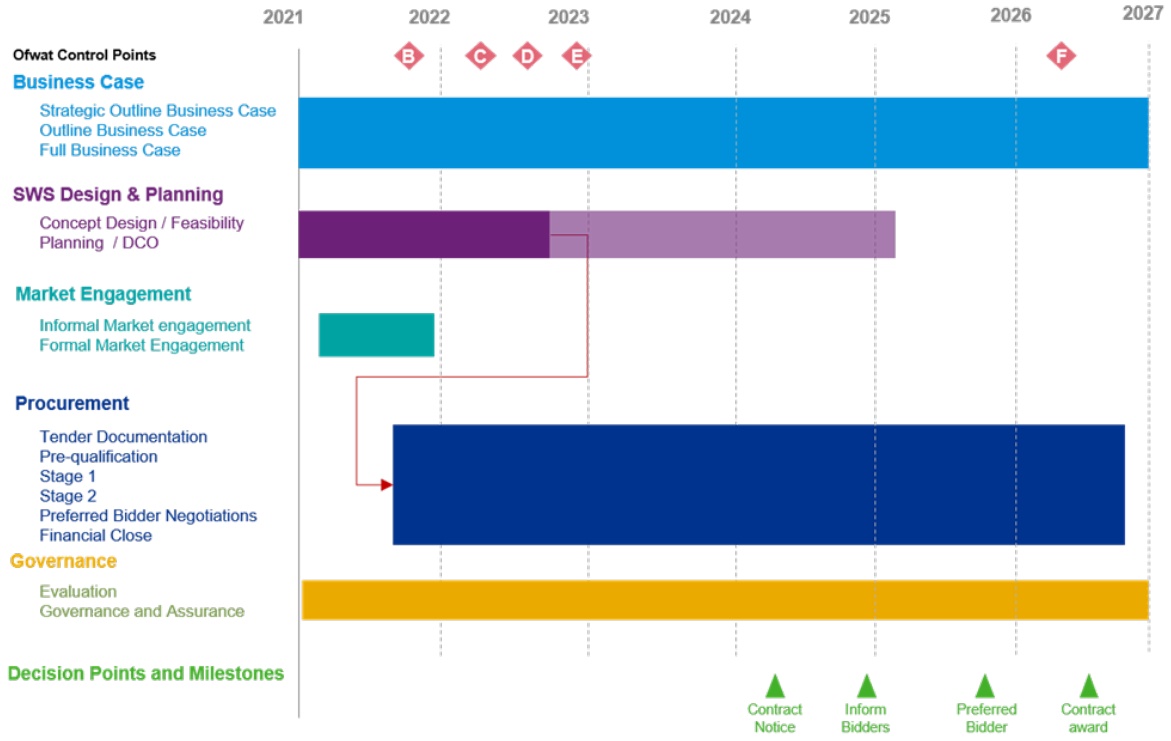

Figure 10 - DPC procurement timeline

5.1.1 DPC Eligibility Assessment

The latest assessment is that the solution is somewhat suitable for delivery under a DPC model. This is consistent with the findings from Gate 1. SW followed Ofwat's three-step DPC process guidance[6], taking into account project scope developments and feedback from market engagement earlier this year. The full findings from the size test, discreteness test, Value for Money (VfM) analysis and a summary of market engagement are provided in Section 2.11 of Annex 3, Havant Thicket Technical.

SW will continue to test and validate the assumptions that underlie this submission following further development of the project specification, updated risk mitigation plans as feasibility information matures and additional market engagement. As such the analysis should be considered indicative rather than an endorsement of the DPC approach for these options. SW will determine the solution's suitability for DPC as part of the Gate 3 submission.

SW has identified a range of project-specific considerations which may present constraints to delivery via the DPC route, which will continue to be explored beyond Gate 2. These include, but are not limited to, the following:

[6] Ofwat (February 2020) Appendix 2: Direct Procurement for Customers; Briefing Note on the Procurement Process for 2020-2025.

- **Discreetness criteria.** Gate 2 assessment considered four areas regarding the DPC eligibility for both options B.4 and D.2. Two areas, specifically, stakeholder interactions and interoperability considerations, DPC was found to be somewhat less suitable, although DPC was found to be somewhat more suitable considering output type and asset and operational service failures;
- **VfM:** The current VfM assessment is based on Ofwat's standard assumptions set out in the 2017 guidance. The cost to customers in NPV terms of Option D.2 under the factual scenario (DPC) is £134m compared with £160m under the counterfactual (PR19). The difference in the costs to customers is £25.4m which is equivalent to c.19% of the PR19 revenues. The cost to customers in NPV terms of Option B.4 under the factual scenario (DPC) is £243m compared with £289m under the counterfactual (PR19). The difference in the costs to customers is £45.5m which is equivalent to c.19% of the PR19 revenues. The key value drivers under the DPC model are the benefits from cheaper financing costs (£13m) and the benefits from CAPEX efficiency (£19m). The VfM may change once the solution is developed further, and project-specific inputs are used including, but not limited to, market views on key financing issues such as debt terms and gearing, and a more detailed commercial model and risk allocation;
- **Licencing and DCO uncertainty:** While SW aims to conclude the licencing and achieve DCO approval prior to contract award, the combination of these factors may adversely affect investor appetite and push up financing costs, with a potential knock-on effect on the VfM assessment. More market testing is needed to better understand this risk; and
- **Treatment technology**. For Option B.4 only, SW recognises that water recycling is not an established treatment process within the UK at this scale. It is important for SW to be able to provide confidence in the viability of such an option to the market and on successful implementation for customers. It is important to be able to convey confidence to the market that such an option will progress successfully.

5.1.2 Constraints on DPC process

The interactions with Portsmouth Water for the Havant Thicket options will add complexity and risk of timetable constraints to the DPC process. SW has been mitigating the risk through early discussions and it will hold procurement workshops with Portsmouth Water following the Gate 2 submission.

5.1.3 Interaction with Portsmouth Water

PW are developing the Havant Thicket reservoir and associated infrastructure under a separate arrangement; however, this asset will form the source of supply for the raw water direct transfer asset. SW is also working in conjunction with PW in respect of the proposed solution, and as such this submission is made jointly between both companies.

5.1.4 Tender Model

Four tender DPC models were identified for further progression at Gate 1: a) late with early design, b) late with early market engagement, c) late with novation of early designer or d) late, with split Design and Build from Finance.

The late tender model with early market engagement has been selected as the preferred model, based on a combination of internal assessment and informal market engagement[7]. Further detail on tender selection and proposed tender process is in Section 2.11 of Annex 3, Havant Thicket Technical. Key justifications for the selection of late model with early market engagement are:

- Simplicity, which helps with timeline constraints
- Likelihood of keen design and build competition from international contractors
- Transparency of risk allocation between CAP and SW with fewer interfaces between them; and
- Preference expressed by potential bidders in the early market engagement.

5.1.5 Assessment of Alternative Procurement Options

Further consideration has been given to procurement routes beyond DPC. Major infrastructure schemes such as this are predominantly delivered through design and build (D&B) contracting. D&B contracting is utilised extensively to deliver

[7] Internal assessment narrowed down the choice to two options - the late tender model with early market engagement, and the late tender model with split D&B from finance – which were presented at market engagement.

infrastructure projects of various sizes, ranging from small and regularly delivered projects to major 'one-off' type projects across numerous infrastructure sectors, including the water sector.

A high-level consideration of D&B delivery model, as an alternative to DPC, the preferred route (identified in Section 5.1.1) was conducted based upon the information currently available at this time. D&B was utilised as a test as it aligns with SW's previous experience and regularly used industry methods. Considering the project scope, size, use of novel technology, plus SW's previous experience with delivering projects like options B.4 and D.2. SW's current framework agreements are not designed for this scale of capital expenditure. Alongside the specialist technical nature of this scheme, it dictates that a new published procurement would be required. It is also the case that large-scale design and build procurement models predominantly include Early Contractor Involvement (ECI) to safeguard solution design as well as optimise risk balance: providing more cost efficient and predictable contract values and delivery timescales. The nature of risks identified for this scheme further assert the benefit of ECI. However, the nature of ECI means it can compromise competitive tension. Following research in recent major capital schemes, infrastructure clients have deployed competitive ECI successfully whereby two design and build contractors are engaged with capped reimbursement for both.

This procurement would follow a pre-qualification process followed by a tender period to award contracts to two design and build suppliers. These contracts would be divided into initial ECI phase and construction phase. The ECI phase would involve suppliers working in parallel, competing for a single award for the construction period. A set contribution would be provided for the ECI phase with SW specifying the maximum price, ensuring market interest while also stimulating competition leading to successful award. Contracting with two suppliers for the ECI phase safeguards against either supplier withdrawing before final construction price agreement, in addition to maintaining competitive tension. During the ECI period, SW would engage with both contractors to understand progress, provide constructive challenge, source information and provide feedback on innovation. A desired benefit from the ECI phase is that collaborative team culture can be fostered. Given this option would be directly funded, the construction contract could be agreed prior to securing DCO planning approval and RO membrane licencing.

The suitability of DPC procurement, and other possible alternatives, will continue to be considered through the Ofwat Control Point process. Proposed dates for each Control Point are detailed in Section 2.9 of the Havant Thicket Technical Annex. Confirmation of the procurement method to be utilised will to be confirmed with Ofwat at the relevant stage in the overall project lifecycle, where there is sufficient knowledge and confidence in technical information that underpins procurement method decision making.

5.2 Ownership and Operational Model

5.2.1 Asset Utilisation

During normal daily operation the transfer from Havant thicket to Otterbourne will be 5 Ml/d. As drought severity increases the asset will be called upon to transfer increased volumes, starting to operate above its minimum flow during a drought with return period of around 50 years. During a drought with a return period of 100 years the transfer will operate above minimum flow for 51 days in a 365-day period, and in a 1-in--200-year drought the transfer will be operating above minimum flow for 100 days in a 365-day period. The plant will need to be available with reasonable response time in the event of an incident or if required for emergency use, i.e. other supply sources are temporarily not operational during non-drought scenarios – with the balance of supply, up to the maximum deployable output of the option, contributing the balance of supply to meet customer needs. The continual use of Selected Option, using the "sweetening flow" provides greater flexibility in supply rates, making it less power intensive and time consuming to increase supply rates – ultimate supply quicker and more agile response in events where the Selected Option is required to operate during emergency situations.

The forecast production requirements of the Havant Thicket option D.2, in terms of days and total water volume expected to be transferred in various drought scenarios, is detailed in Table 18.

Table 18 - Asset utilisation, option D.2 and B.4 – developed to a maximum of a 1-in-200-year drought scenario only

Drought Return Period (years)	Maximum Daily Supply (Ml/d)		Annual Days Operation (above sweetening flow)	Annual Volume Transferred (ML)	
	Inc. 21 Ml/d potable transfer	Exc. 21 Ml/d potable transfer		Inc. 21 Ml/d potable transfer	Exc. 21 Ml/d potable transfer
1	*5*	5	0	*1715*	1715
2	*5*	5	0	*1715*	1715

Drought Return Period (years)	Maximum Daily Supply (Ml/d)		Annual Days Operation (above sweetening flow)	Annual Volume Transferred (ML)	
	Inc. 21 Ml/d potable transfer	Exc. 21 Ml/d potable transfer		Inc. 21 Ml/d potable transfer	Exc. 21 Ml/d potable transfer
5	*5*	5	0	*1720*	1720
10	*5*	5	0	*1720*	1720
20	*5*	5	0	*1720*	1720
50	*32*	11	27	*1993*	1144
100	*48*	27	52	*2574*	1271
200	*72*	48[8]	100	*4860*	2844

For options D.2 and B.4 the total output from Havant Thicket reservoir was modelled as a single raw water transfer from the reservoir to Otterbourne WSW, including the 21 Ml/d potable transfer that is modelled separately for options A.1 and B.5. To make a direct comparison with options A.1 and B.5, please refer to the values entitled "Exc. 21 Ml/d potable transfer".

5.2.2 Commercial Model

The commercial model builds on the work carried out as part of the Gate 1 submission. Key items included in the current model include contractual principles and main categories of risk allocation, both of which have been tested with potential DPC market participants, through a market engagement process. Possible market participants were engaged on multiple items that influence the commercial model, including the nature of the options under consideration, the indicative tender timeline, indicative tender model and key contractual terms within the commercial model. The results of this informal engagement indicated that there is significant appetite within the market to compete for a solution of this nature.

At this stage it is assumed that the asset will be owned and operated by the CAP. This is typically an ownership and operation arrangement for the projects delivered by DPC procurement. Ownership and operation models will be considered in greater detail following Gate 2, once further technical detail, related to design and operating regimes is available. This underpinning information is required before the ownership and operating models for the asset can be confirmed.

There is additional commercial complexity for the Havant Thicket options arising from the asset ownership relationship with PW. The reservoir itself is a PW asset, so any reliance and utilisation of a shared asset from SW will need to be detailed and considered. The intention is to investigate and resolve this commercial relationship post Gate 2, as part of wider reaching for formalised engagement approach between SW and PW. An example of the recently initiated actions is the Design Alignment Review, a detailed review of the interfaces between SW and PW infrastructure components, which will inform the planning and preparation of the commercial model, which will be developed further post Gate 2.

A high-level overview of the proposed commercial approach, based upon the analysis completed to date, including outcomes from the market engagement exercise has been included in Table 19, with further detail provided in Section 2.11 of Annex 3, Havant Thicket Technical.

Table 19 - Overview of proposed commercial model

Area	Proposed approach
Contract length	• The recommended contract length is 20 years for operation • The contract will also cover a design period of 1 year and the construction period of 4 years
End of contract asset treatment	• A 'bullet' payment will be made to the CAP based on the end of contract asset value • At the end of the contract, the asset will either be retendered by SW or transferred to SW's control and an amount equivalent to the end of contract asset value added to SW's RCV
Termination and payments	• Contract terms should include termination rights, allowing SW or CAP to terminate the contact based on pre-defined scenarios or targets, such as default scenarios, force majeure, or non-payment by SW.
Payment mechanism	• Payment to CAP will start post commissioning • Hybrid model primarily based on availability charge combined with a volumetric element to cover variable OPEX linked to asset utilisation • Fixed price contract • Refinancing gains to be shared 50:50 between the CAP and the customers • Performance targets with associated incentives/penalties

[8] 48 Ml/d rather than 51 Ml/d deficit otherwise quoted due to technical modelling outputs vs. static projections.

Area	Proposed approach
Acceptance and late service commencement	• Liquidated damages for late service commencement • Financial incentive for timely asset delivery • Clearly defined criteria and process for acceptance
Operational performance	• Most risks are expected to be transferred to the CAP, e.g. EA water quality risk, process risk, leakage, response time and critical spares • Some will be shared between the parties (e.g. DWI water quality risk, volume uncertainty)

6 Costs to Gate 2 and Forecast

6.1 Breakdown of Gate 2 Costs

Costs incurred during Gate 2 to further progress and develop the Havant Thicket-based options include those related to be completed in Gate 2, plus "early-start Gate 3" activities. "Early-start Gate 3 activities" are activities which were initially expected to be completed during the period between gates 2 and 3, as included in PR19, yet in order to progress the project in line with SW's s20 obligation, all best endeavours are being utilised to deliver the project. Commencing these activities ahead of Gate 2 was previously agreed with RAPID, which included that any costs incurred delivering "early-start Gate 3 activities" be netted from the Gate 3 funding allocation. A breakdown of the costs incurred between Gates 1 and 2 to progress and develop the Havant Thicket-based options is detailed in Table 20.

Table 20 - Gate 2 and accelerated Gate 3 costs – Havant Thicket alternatives, 17/18 prices

Activity	Description	Gate 2 (£k)	Early Gate 3 (£k)	Total (£k)	Total (£k, 17/18)
Ceramic membrane pilot trial - Otterbourne WSW	The ceramic membrane pilot trial is designed to inform the design and delivery of the pre-disinfection plant at Otterbourne.	0	646	646	609
Portsmouth Water costs	Following the agreed governance model between SW and PW to G2 delivery, PW have engaged and provided support throughout the G2 period.	40	8	48	45
Design Development	Activities for G2 largely centre around the development of concept design to inform the CAPEX estimate and environmental assessments.	115	448	563	531
Planning and Environmental works	The principal focus for the planning activities in G2 was the first non-statutory engagement and refining the activities to support a DCO process.	75	22	97	92
Site surveys	N/a	0	88	88	83
Project management	Project Management costs include dedicated full-time resource for budget management, resourcing, procurement, project planning, risk management, schedule management and project governance.	119	0	119	113
Sub-controls		350	1,212	1,561	1,473

Further detail of the costs incurred delivering activities specifically focused to the Havant Thicket-based options is provided in Section 1.2 of Annex 6, Efficiency of Expenditure. Further to the activities and cost incurred detailed in Table 21 a series of common activities which cannot be directly attributable to a specific solution-type or option. These activities include programme and project management, legal advice, stakeholder and customer engagement and commercial analysis. For illustrative purposes, we have allocated our common costs to SROs, an even proportioning of costs incurred by each solution type, summarised in Table 21, and detailed further in Section 1.2 of Annex 6, Efficiency of Expenditure.

Table 21 - Gate 2 and accelerated Gate 3 costs – total summary (using multiple proportioning methods for common activities)

Description	Gate 2 (£k)	Early Gate 3 (£k)	Total (£k)
Desalination	5,566	1,248	6,814
Water recycling	5,052	3,228	8,281
Havant Thicket alternatives	2,894	1,791	4,685

6.2 Evidence of Efficient Expenditure

An overall summary of the programme wide spend in the Gate 1 to Gate 2 period, relative to the Gate 2 allowance is detailed in Table 22. Further detail on the total spend and the contributing activities to this spend is detailed throughout Annex 6, Efficiency of Expenditure.

Table 22 - Gate 2 and accelerated Gate 3 costs

Solution Type	Final determination cost allowance (as of 2019), (£k)		Actual, accrued and forecast costs to 6 December 2021 (£k, today prices)			Actual, accrued and forecast costs to 6 December 2021 (£k, 2017/18) prices			
	Gate 2	Gate 3	Gate 2	Gate 3	Total	Total (2017/18 prices)	Gate 2	Gate 3	Variance (£k)
Desalination	Total allowance below	Total allowance below	3,022	668	3,690		n/a on a 'per solution' basis	n/a on a 'per solution' basis	n/a on a 'per solution' basis
Water Recycling			2,508	2,649	5,157				
Havant Thicket			350	1,212	1,561				
Common Costs			7,633	1,739	9,372				
Total	**12,108**	**27,500**	**13,515**	**6,268**	**19,780**	**18,661**	**12,748**	**5,913**	**640**

The primary driver for the overspend against the Gate 2 allowance is that the SROs considered and developed prior to Gate 2 are technically complex in line with SW's s20 obligations, these options are being progressed at pace. As a result, the required involvement of technical specialists across a wide range of expertise is required to ensure the programme is appropriately resourced. In addition, SW are in effect 'pathfinders' of the accelerated RAPID process as SW are progressing through the process faster than other companies and SW is the first company to encounter many of the challenges and complexities of the accelerated RAPID process.

Following our Gate 1 submission, Ofwat challenged aspects of our costs, including the lack of benchmarking that had been included. In terms of project costs management, there are a number of benchmarking, knowledge-based elements and cost control mechanisms which are used. These include;

- A framework process, built on competitive tendering and benchmarking;
- An approval and sign-off process to the point of commitment of expenditure, controlled by defined delegations of authority. The levels are set by value and challenge is applied at each level of seniority before approval. This authority runs from project manager to executive management; and
- A full tender process.

There is extremely limited opportunity to externally benchmark steps in the project development process for highly idiosyncratic water infrastructure projects – with severely limited benchmarking information available. In response the programme team contacted [redacted] requesting support on benchmarking the options considered, using relevant comparable projects, which indicated there were no suitably comparable projects which could be used as benchmarks. Following this, the programme team commissioned [redacted]) to assess the scope for benchmarking at Gates 1 and 2. [redacted] found no representative benchmarking data for water projects at this early and specific project stage.

As a result, SW has focused on ensuring robust processes are in place to ensure efficient costs. Details of the procurement and management approaches are detailed in Annex 6, Efficiency of Expenditure. We will keep this under review for future gates and will continue to reach out to our supply chain to determine whether any useful benchmarks become available in the future.

For context, it should be noted that the programme cost allowances capped development costs at 6% of total solutions costs. At the time, this was based on a limited number of comparisons, with at least one benchmark (the Thames Tideway Tunnel) having a much higher proportion of development costs (10%). In its determination, Ofwat stated that the '6% also assumes that costs for some components of complex solutions requiring development consent orders are more likely to happen beyond 2025'[9]. This assumption does not appear appropriate for SW, as we need to apply for development consent before 2025.

[9] Ofwat (2019) 'PR19 draft determinations: Strategic regional water resource solutions', page 13

6.3 Forecast of Expenditure to Gate 3

Option B.4 has been identified as the Selected Option. As a result, activities in the period from Gate 2 to Gate 3 will be dominated by progressing Option B.4, with other costs incurred related to progression of the Selected Back Up Option. A breakdown of the expected expenditure to Gate 3 for progressing the Selected Option is detailed in Table 23.

Table 23 - Gate 3 expenditure forecast across each option (17/18 price base, £k)

Description	Early Gate 3 expenditure	Gate 3 expenditure post Gate 2	Total Gate 3 expenditure	Gate 3 funding allowance	Delta to allowance	Forecast costs to Nov22
Selected Option	3,257	15,611	18,868	14,389	+6,630 (+46%)	9,863
Water recycling back up	1,538	613	2,151			461
Desalination	1,207	-	1,207	13,090	-11,883 (-91%)	-
Total	6,002	16,225	22,226	27,479	-5,253 (-19%)	10,324

Further detail on the cost forecast to Gate 3 is detailed in Section 9.1 of this document and Section 1.3 of Annex 6, Efficiency of Expenditure.

7 Stakeholder Engagement

7.1 Overview of Engagement and Key Findings

Engaging proactively and openly with regulators, stakeholders and customers and stakeholders is essential to the successful consenting, delivery and operation the WfLH programme. SW and PW are engaging with a broad range of groups across the WfLH programme, including harder to reach customers. This is to ensure a wide range of stakeholder and customer views are understood and had regard to as Options are developed. A snapshot of some of these groups is shown in Table 24. More information on the specific engagement activities undertaken since Gate 1 is provided in Annex 9, Stakeholder and Customer Methodology.

Table 24 - Overview of customer, stakeholder, regulator and consultee engagement

Customers	Stakeholders	Regulators	Planning Consultees
Non-statutory consultation			
Customer Action Group	Water for Life – Hampshire Stakeholder Group meetings	1-1 briefings and discussions	Briefing and engagement with Local Planning Authorities
Ongoing Customer Insight	1-1 briefings and discussions	Senior Stakeholder Group meetings	Briefing and engagement with statutory bodies
Industry-wide engagement		Practitioner Workshops	Communications with landowners for the Base Case

7.1.1 Overview of Engagement Undertaken, Key Findings and Resulting Action

As the 75 Ml/d desalination plant at Fawley is the Base Case, SW has carried out more detailed engagement and consultation on this option; however, there has been joint engagement with PW on the alternative options that interface with Havant Thicket Reservoir (Option B.4 and Option D.2). Regulators and other statutory bodies have been engaged on an ongoing basis, including on the development of the different stages of the OAP, namely the site and route selection methodology, the Consenting Evaluation and the MCDA appraisal methodology, and also on the emerging results.

SW is working with PW to develop joint communications and engagement on developing Option B.4 and Option D.2. Due to the early stages of development that these options are at, this has focused on explaining the partnership between the two companies and on the need for, and the benefits of, a joined-up approach to developing strategic regional water resources.

The most comprehensive engagement activity was the non-statutory consultation from February 8 to April 16 2021, where planning consultees, including regulators, local communities and landowners, and stakeholder groups were consulted. This was run as a virtual consultation due to Covid-19 restrictions and it consulted on elements of the desalination Base Case and introduced the back-up alternatives, including option B.4 and option D.2. Whilst the non-statutory consultation did not ask consultees to rank their preference for each of the

Options presented, as it was not a general 'options' consultation where consultees were asked to choose an option, it did ask for consultees' views on whether the water recycling alternatives (including Option B.4) and water transfer alternatives (including Option D.2) would be acceptable solutions to meet the need should the Base Case be undeliverable.

A significant proportion of respondents (60%) agreed that water recycling alternatives (including Option B.4) would be an acceptable alternative solution to address potential water resource challenges in Hampshire should the Base Case not be delivered, with only 12% indicating disagreement, and 28% in total responding, 'don't know' or 'neither agree or disagree'. A large proportion (45%) of respondents agreed that water transfer alternatives (including Option D.2) would be an acceptable alternative solution, with only 18% responding that they 'disagree or strongly disagree'.

However, it is important to note when considering the responses to the consultation that a total of 67% of respondents to the question 'which of the following best describe your interest in the WfLH programme' stated that they lived within the local area of the Programme, whilst 38% stated that they lived close to the proposed Base Case option. As a result, we can expect the issues and preferences of those local to the Base Case to be better represented in the consultation feedback. We have published a report on this feedback and are in the process of analysing and having regard to it as part of the ongoing option scheme development process.

As well as the non-statutory consultation, we have carried out in-depth engagement with customers through the Customer Action Group, and other customer forums, as well as conducting targeted customer surveys – this included engaging more than 240 Informed Customers through deliberative approaches and more than 1,950 in quantitative surveys. Table 25 provides some insights from the customer and stakeholder engagement. We have already had regard to some of this feedback in the work undertaken to Gate 2 and will continue to as we progress into the consenting process. Further detail on this is provided in Section 2.8 of Annex 3, Havant Thicket Technical.

Table 25 - Key customer, stakeholder and regulatory insights on water transfer (Option D.2) and associated actions. Insights relating to water recycling options (including Option B.4)

Stakeholder group	Key insights and feedback	Associated actions completed prior to Gate 2 and future activities
Customers	Limited understanding of water scarcity and the need for water transfers	Developing a much stronger understanding of the rationale for bulk transfers through engagement on water scarcity, and in particular the protection of chalk streams and the environment
	Concerns about the reliability of transfers and impact on supply	Tailor stakeholder communication to address this concern
Regulators	DWI broadly content with how SW is progressing the water quality concerns, including raw water quality	Extensive water quality sampling of [redacted] has been undertaken as part of the development of the HT reservoir scheme SW held several meetings with DWI since Gate 1, and will continue to engage closely
Planning authorities	Planning authorities have raised concerns around the current planning consent for the Havant Thicket reservoir, given integrating Option B.4 would require a change to the use of the reservoir	Dialogue with Portsmouth Water has commenced to consider the likely consenting and delivery interfaces between the proposed reservoir and Southern Water's water transfer and water recycling options. Should either of these options be confirmed at Gate 2 as Southern Water's Selected Option for delivery, further engagement will be required with key stakeholders to ensure that these interfaces are effectively communicated and managed to facilitate the timely delivery of both schemes.
Environmental Groups	Further information and detailed required to provide a full and comprehensive view on the potential environmental impact	Options were assessed against environmental criteria as part of the Options Appraisal, including the Consenting Evaluation and MCDA appraisal. Environmental regulators, the EA and NE, have been engaged throughout the process and their feedback has been considered as we designed the options appraisal process and also prepared the Gate 2 submission. As we progress into the consenting process, there will be a full assessment of environmental impacts for the Selected Option and information will be shared for consultees' views, including environmental groups, at the upcoming consultations. Proposals for avoiding, reducing and mitigating environmental impacts will be developed as the scheme development process progresses.
Landowners	There has been some very early initial landowner engagement on survey access for some sites, but as these options have been back up alternatives to the Base Case this has been limited.	Landowners have been identified and contact made in some cases. Engagement on survey access and potential property negotiations will continue after Gate 2 for the Selected Option and Back-up Option, where appropriate.
Other water companies	Portsmouth Water (PW) is a key stakeholder and partner for the delivery of Option D.2 and Option B.4.	Dialogue with Portsmouth Water is ongoing to consider the likely consenting and delivery interfaces between the consented reservoir and Southern Water's options that interface with it. Should either of these options be confirmed at Gate 2 as Southern Water's Selected Option, further regular engagement and collaboration will be required with PW on an ongoing basis to ensure that these

Stakeholder group	Key insights and feedback	Associated actions completed prior to Gate 2 and future activities
		interfaces are effectively communicated and managed to facilitate the timely delivery of both.

Insights from the customer engagement work were used to inform parts of the MCDA appraisal section of the OAP, as set out below. Further information is detailed in Section 3 of the Options Appraisal Process Annex 5:

1) The views of members of the SW customer panel informed the weighting scenario applied to the MCDA appraisal ranking and
2) The criteria for the MCDA appraisal were originally informed by customer insight work, undertaken by SW and WRSE, so that the factors that were of most interest to customers could be considered when designing the assessment.

Customer views and engagement outcomes, as detailed in Table 25, were include in the options appraisal process, via the MCDA. Further detail of the MCDA and options appraisal process is included in Section 3.8.5 and Annex 5, Option Appraisal Process.

As detailed in sections 3.7.2 and 3.8.5, two customer specific criteria were considered – tap water quality and resilience of supply. Due to the importance of considering customer views, these two criteria equated to 13% weighting across all 23 MCDA criteria. Multiple sensitivity analysis scenarios were considered, each of which further increased the weighting towards customer related criteria in the MCDA, relative to other criteria which include environment, society, deliverability and cost. Further details in the sensitivities considered are included in Annex 5, Option Appraisal Process. The normalised customer criteria scores for each of the options considered in the Options Appraisal Process are detailed in Table 26.

Table 26 - MCDA scores per option: Customer criteria only

Scenario	MCDA Customer Criteria scores – Normalised					
	A.1	A.2	B.2	B.4	B.5	D.2
BAU Scenario	50	38	25	75	38	75
Drought Scenario	50	38	25	75	25	75

The customer specific MCDA scores detailed in Table 26 broadly align with the full MCDA and overall options appraisal results, which are detailed in Section 3.8.5. This supports ensuring that customer views are reflected in the work undertaken as they both informed the recommendations and conclusions detailed in Section 10.

7.2 Future Engagement Activities Planned

Customers and stakeholders will continue to be engaged and consulted on the Selected Option and Selected Back Up Option, by SW and PW collaboratively, including activities that relate specifically to the SROs and the wider WfLH programme. This includes (but is not limited to):

- **Water Futures 2030** – is SW's continuous consumer group which will take over from the Water for Life – Hampshire CAG to provide a central hub for insight. We will invite a number of members of the CAG to join and continue to use the group to drive relevant decisions, develop engagement materials and test options within the WfLH programme;
- **Water Futures 2050** – is our young person's group which has provided insight for Water for Life – Hampshire from future customers. The group will continue to support the programme through its next stages;
- **Sharing of key insight** – as we are progressing through an accelerated process we have been at the forefront with much of our insight. All the key insight is being shared across the industry and we are developing a range of materials (e.g. reports, videos, recorded podcast debriefs and infographics) to make this information accessible;
- **Stakeholder groups** - continuation of strategic engagement at various levels within organisations, such as regulators and other statutory bodies and the Water for Life – Hampshire Stakeholder Group meetings; and
- **Wider stakeholder engagement activities** - continue to progress ongoing engagement with stakeholders and consultees, and also undertake consultation at the appropriate points of the pre-application schedule, with associated structure and resource to deliver the consultations activities.

8 Board Statement and Assurance

The Board has reviewed and discussed the overall strategy for the approach to the accelerated Gate 2 RAPID submission and is satisfied that both the submission and data assurance are appropriate.

SW confirms that:

- All the elements add up to an accelerated Gate 2 submission that is high quality and meets the requirements as set out in the Price Review (2019) PR19 Final Determination and subsequent guidance from RAPID;
- SW has put in place an assurance process to support improvement of the accuracy and robustness of the data and estimates used to develop the Gate 2 submission;
- Expenditure has been incurred on activities that are appropriate for accelerated Gate 2 and activities brought forward for accelerated Gate 3 (as discussed with RAPID) and is efficient;
- SW endorses Option B.4 as Selected Option and Option B.5 as Back-Up Option being put forward at Gate 2, for continuation to the next stage of the RAPID process;
- SW is satisfied that progress on the solution(s) is in line with the solution being in place and operable by 2030; and
- SW is committed to transparent reporting of high-quality data that can be trusted.

The Board supports the continued joint working groups with PW on the Havant Thicket SRO and continues to work closely with PW Board to satisfy both parties that an appropriate strategy has been implemented to assure the submission approach and data verification. PW supported the creation of the Havant Thicket SRO documentation and co-reviewed the documents during the assurance process prior to submission approval from the PW Board on the 3rd December 2021.

How the Board has reached its conclusion:

- The SW Audit committee is responsible for the WfLH assurance approach and responded to external assurance findings;
- [redacted] provided technical assurance, focussing on reliability, consistency and quality of data, and efficient cost expenditure;
- SW established a Board working group which met regularly to discuss progress, approve key decisions to meet programme milestones and reviewed key areas of the submission;
- The joint executive team working group with PW has confirmed it is satisfied with the Havant Thicket element of the submission; and
- Final assurance reports were provided to the WfLH Executive Programme Board and the SW Board working group for consideration in approving the submission.

Further evidence

- Active Board engagement with the submission team through the Board working group; and
- The WfLH Executive Programme Board challenged key areas of the plan, advising the Board working group.

Future Plans for Board Engagement

Both the SW Board and PW Board will continue to be actively engaged on the RAPID solution(s) as the solutions progresses towards accelerated Gate 3. The current governance process, driven up from the WfLH Steering Group, WfLH Executive Programme Board into the Board working group and full SW Board, will continue to meet on a regular basis to share progress and make key decisions to manage or mitigate risks identified by the delivery of the solution to meet the 2030 delivery date.

The Board will oversee the obtaining of the agreed amendment in writing from the EA to the s20 delivery dates from 2027 to 2030 and a workstream ensuring sufficient interim supply for the period.

SW and PW are in discussion with Ofwat and RAPID on Direct Procurement for Customers (DPC) and Gated Process timings. These timings will drive the schedule of activity and determine the Board level engagement topics to support decision making and regulatory engagement.

Annex 10 Gate 3 activity plan contains milestones from Gate 2 to Gate 3. Board engagement for SW and PW on key topics leading up to accelerated Gate 3 should include:

- Network interface between PW and SW;
- Potential regulatory barriers, guidance or changes required;
- Accelerated Gate 2 determination feedback;

- DPC (DPC and Control Point timetable with Ofwat);
- Review of efficient cost expenditure;
- Interface between the Gated Process and WRMP, and Water Resource South East (WRSE) plans; and
- Assurance findings and Board statement for accelerated Gate 3.

9 Proposed Gate 3 Activities and Outcomes

9.1 Proposed Gate 3 activities

As detailed in sections 1 and 4, SW is committed to delivering the Selected Option using ABE, in-line with the s20 obligations. As detailed in Section 10 and throughout Annex 5, Options Appraisal, Option B.4 is the Selected Option for delivery. Activities to deliver the Selected Option will be prioritised. This is also reflected in the forecast spend to Gate 3, detailed in Section 6.3, where the total expected Gate 3 expenditure for Water Recycling and Havant Thicket is £18.6m, as opposed to £2.1m for Water Recycling.

A high-level summary of the key activities for progressing the Selected Option to Gate 3, with the associated outcomes or deliverables, is included in Table 27. Further detail included throughout Section 3 of Annex 10, Activity Plan to Gate 3.

Table 27 - Summary of proposed activities to Gate 3 and associated outcomes for progressing the Selected Option

Category	Activities	Outcomes or Deliverables (for Gate 3)
Design and feasibility	Continue to develop the solution design, to a maturity appropriate for the consenting and procurement strategies	Progress of design and feasibility development Gate 3 Developed Design Snapshot Report.
Costs and benefits – comparison	Further refine position of Selected Option costs and benefits	Refined and further developed summary of the costs and benefits of the Selected Option – in line with WRMP24 requirements
External Assurance	Ensure the Gate 3 submission is thoroughly assured	Assurance Annex including associated Board Statements
Procurement	Propose alignment between RAPID Gate 3 and the DPC Control Point C milestone	Selected Option Procurement Strategy and Update on Outline Business Case
Pre-planning applications	Request and secure the S35 Direction and start developing key DCO documents	Consenting and Consultation Update Report
Consent orders	Commence the required surveys for consent applications	Progress of consent order development in Gate 3 Developed Design Snapshot Report
Planning permission stakeholder engagement	SW will undertake both informal and formal non-statutory consultation	Update of Customer and Stakeholder engagement completed and associated results in Gate 3 Developed Design Snapshot Report
Supply-demand balance	Update position of the supply-demand balance	Update of Supply Demand Balance
Solution partner or solution substitutions	Validate the role and possible interaction with partners to deliver the Selected Option	Summary statement of solution partnering
Programme plan	Update the detailed schedule for the Selected Option delivery – and plan Gate 4	Updated detailed schedule
Gate 4 activity planning		Gate 4 Activity Plan
Efficiency of spend	Prepare Gate 3 Efficiency Report in accordance with PR19 requirements	Gate 3 Efficiency of Expenditure Report.

9.2 Proposed Gate 3 Outcomes, Penalty Assessment Criteria and Incentives

The proposed outcomes for Gate 3 are summarised in Section 9.1, with further detail provided through Section 3 of Annex 10, Activity Plan to Gate 3. Ahead of Gate 2, SW has brought forward activities, intended for delivery between Gates 2 and 3, into the Gate 2 Activity schedule, in-line with SW's obligation to deliver the SRO asset, using all best endeavours.

SW is proposing an alternative delivery incentive mechanism for Gate 3 that will move the focus to incentivising delivery of the Preferred Option, rather than as now on the SRO gate submission. A proportion of the incentive would be based around key project milestones rather than Gate 23 itself. A summary of the proposal is contained in Annex 6 and more detail will be provided.

10 Conclusion and Recommendations

Based upon the technical analysis completed regarding the feasibility and viability of the Havant Thicket-based options, options D.2 and B.4, up to Gate 2, it is recommended that Option B.4 is progressed post Gate 2 as the Selected Option. For clarity, the Selected Option will continue to be developed within the WfLH programme and RAPID process, while development of Option D.2 will be stopped and not continued post Gate 2. Further detail of the options appraisal process utilised and the outcome of this process is included throughout Annex 5, Options Appraisal Process. Option B.4 will need to be evolved as set out in Annex 13 to achieve the revised residual deficit (87-95 Ml/d) as per Annex 12, which will be developed post-Gate 2.

11 Supporting Documentation

Responses to the actions and recommendations made in the Gate 1 final determination are included throughout SW's Gate 2 submission. References to the location of where technical detail is provided in response to the Gate 1 final determination actions and recommendations are provided in Table 28. For further information on Gate 2 submission structure and annex descriptions, refer to the Gate 2 Navigation and Glossary (Appendix 1, Submission Summary).

Table 28 - Gate 1 Actions and Recommendations – location within Gate 2 submission

No	Actions – From Gate 1 Final Determination	Location
1	Provide a 'conceptual design report' developed in consultation with all regulators, to meet gate two requirements and timescales. Include a recommendation for which solution should progress beyond gate two, based on the outcome of the assessments completed by that stage.	Full Annex 3 Havant Thicket Technical,
2	Undertake site selection process for the preferred pipeline configuration as detailed in Annex 9.1 and 9.2 in consultation with the Environment Agency and Natural England, to meet gate two requirements and timescales.	Annex 3 Havant Thicket Technical, Section 2.4
3	Agree the results of collaborative water resources modelling that indicates the alternative raw water proposal for Havant Thicket will be able to support the 61Ml/d drought requirements in addition to the 21Ml/d supply currently included in WRMP19 with the Environment Agency. This should include consideration of a 1 in 200 and 500 year drought. Confirm how this option will operate during different drought scenarios, alongside the 21 Ml/d WRMP19 solution and any operational requirements.	Annex 4 Water Resource Management, Section 3.6 of this document and Submission Summary
4	Provide summaries of the further development of Strategic Environmental Assessment, Habitats Regulations Assessment, Water Framework Directive assessment, Natural Capital Assessment, Environmental Social and Economic Valuation and Environmental Net Gain, that have been discussed and agreed with the Environment Agency and Natural England, to meet gate two requirements and timescales.	Annex 3 Havant Thicket Technical, Section 2.5
5	Explain how this proposed alternative raw water transfer option can support delivery of alternative water resource by the end of 2027. This should include exploring the abstraction implications of different options, including comparisons of environmental impacts of an interim solution that uses the pipeline and pumping infrastructure with those of desalination and recycling. Provide further detail on pre-construction activities required, highlighting critical paths and demonstrating greater focus on the potential constraints that environmental designations could bring to the pipeline corridors.	Annex 3 Havant Thicket Technical, Sections 2.1 and 2.5
6	Consider whether your WRMP19 needs amending and if so how. Explain the reasoning for this in light of potential changes to your Best Value plan, delivery times and costs.	Annex 8 Regulatory Management
7	Provide a summary of the potential impact that the solution could have on Southern Water and Portsmouth Water's supply-demand balances. This should also include the impact on any current options or programmes within the WRMP19 or AMP7.	Annex 4 Water Resource Management Technical
8	Clarify plans for the regulation 15 assessment of raw water quality, and therefore appropriate treatment processes for this water.	Annex 3 Havant Thicket Technical, Section 2.2.9
9	Otterbourne WSW site is currently the subject of a legal instrument to carry out significant refurbishment works. The DWI has already amended the legal instrument, delaying some of the work, to take account of the strategic resource options at this site. Implications of this solution on the ongoing refurbishment at Otterbourne WSW should be identified and discussed with the Inspectorate.	Annex 3 Havant Thicket Technical, Section 2.2.6
10	Provide details of an 'Evidence Planning Strategy', which has been discussed and agreed with the Environment Agency and Natural England, to meet gate two requirements and timescales. Baseline methodologies and scopes to inform survey work needs to be agreed as a priority.	Annex 3 Havant Thicket Technical, Section 2.5.2.1
11	Undertake a procurement strategy assessment including DPC eligibility assessment. Include in assumptions with respect to who would operate the solution under both the DPC and traditional delivery model.	Annex 3 Havant Thicket Technical, Section 2.11

No	Actions – From Gate 1 Final Determination	Location
12	Provide more information about stakeholder engagement and the understanding of customer acceptability including: ·for individual solutions and options; ·on issues that could cause delay; and ·how the views of vulnerable or harder to reach stakeholders and customers will be sought.	Annex 3 Havant Thicket Technical, Section 2.8
13	Develop a fuller risk assessment that explores the areas of uncertainty associated with this solution. This should include: • A clearer relationship between mitigation measures and residual risks; • Greater clarity on the scoring criteria applied; and • Direct read-across to the dashboard risks	Annex 3 Havant Thicket Technical, Section 2.7
14	Future plans for Southern Water's board engagement must provide for effective oversight of Southern Water's obligations under the section 20 agreement and to ensure that one or more solutions are in place and operating by the end of 2027. We expect Southern Water's Board assurance for gate two to include a statement that the Board is satisfied that progress on solutions is commensurate with solutions being in place and operating by the end of 2027.	Havant Thicket Concept Design Report, Section 2.8
15	Provide total gate expenditure and activity breakdown costs in a common cost base. These costs should be presented in 2017-18 prices.	Annex 6, Efficiency of Expenditure
No	**Recommendations – From Gate 1 Final Determination**	**Location**
1	Provide further information about how this solution will meet the National Framework and WRSE requirements and explore the wider resilience benefits this solution could bring.	Annex 4 Water Resources Planning & Annex 12 Outline Option Evolution Plan
2	Please clarify what factors are included in the final out-turn cost adjustment included in the indirect CAPEX estimates and whether there is any double counting of allowance for cost uncertainty included under the risk assessment and optimism bias assessment.	Annex 3 Havant Thicket Technical, Section 2.10
3	Correct the inconsistency confirmed in clarification response (SRN020 Western Grid Minimum Flows) to demonstrate that option operating costs are calculated correctly for different operating scenarios and therefore options are being compared consistently.	Annex 3 Havant Thicket Technical, Section 2.10.4
4	To aid comparison with other WRMP options provide the Average Incremental Costs (AIC). Please clarify why 60 years has been used for OPEX and whole life cost calculations. It is noted that the Water Resources Planning Guideline (WRPG) recommends that costs are profiled over at least the next 80 years.	Annex 3 Havant Thicket Technical, Section 2.10.5
5	Provide both operational carbon emissions and carbon intensity using the same throughputs as used for the OPEX and whole life cost per m3 presented in Annex 12 (i.e. as a whole life carbon per m3 or Ml using the expected flows over 60 years). The expected flows used in both cost and carbon analysis should be consistent with the flows stated in Annex 7. Include a clarification of whether operational carbon emissions calculations take into account the future decarbonisation of the power grid.	Annex 3 Havant Thicket Technical, Section 2.10.6
6	Provide further detail on the planning risks and the planned mitigation measures.	Annex 3 Havant Thicket Technical, Section 2.6.11
7	External reviews appear focused on working versions rather than final versions. A challenge log or compiled assurance findings could clarify what issues the external assurance providers flagged and how they were resolved. Information on future plans for board engagement and a compiled summary/log of assurance findings with actions taken to address would also improve future submissions.	Annex 7, Assurance
8	Provide information on future plans for board engagement and a compiled summary/log of assurance findings with actions take	
9	Provide a breakdown of costs to gate two that is consistent with the scheduled activities for gate two, demonstrating the efficiency of expenditure	Annex 6, Efficiency of Expenditure

Data tables including cost and benefit profiles consistent with WRMP24 reporting requirements have not been included within this submission due to availability. We are expecting our submission date for WRMP24 to be brought forward to 13 June 2022, with a direction confirmed in January. We will therefore be populating these tables closer to the deadline.