STRATEGIC REGIONAL WATER RESOURCE SOLUTIONS

Gate two submission

Mendip quarries

July 2023

Submitted to:

RAPID

Submitted by:

South West Water

Wessex Water
YTL GROUP

Contents

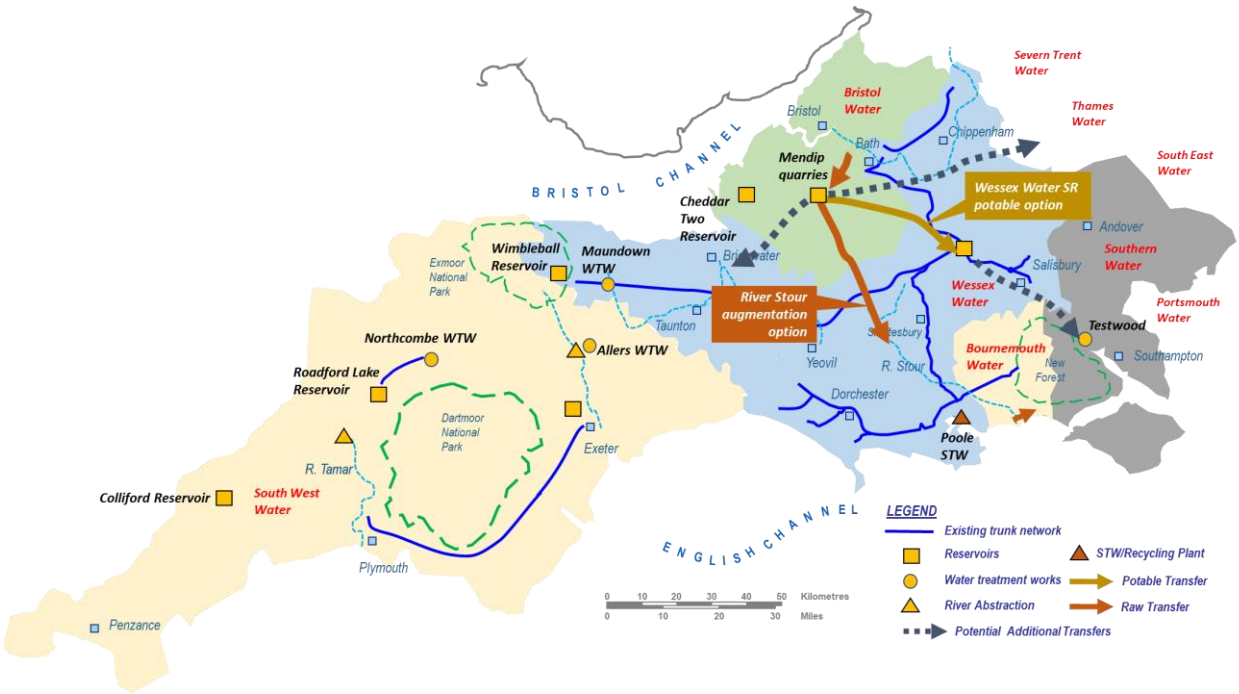
1. Executive summary

This section provides an overview the scheme's history in the Regulators' Alliance for Progressing Infrastructure Development (RAPID) gated process and summarises the approach taken to deliver the scheme at gate two. The key facts and risks of the solution are outlined alongside the gate two conclusions and recommendations.

1.1 Overview

There are three strategic water resource option (SRO) projects in the West Country Water Resources Group (WCWRG) region that are following the gated process overseen by RAPID. All three projects have successfully passed through gate one. The gate two submissions for the Poole Water Recycling and Cheddar Two reservoir projects were made in November 2022. The third project, Mendip Quarries, is following a later timeline[1] and this report and its annexes comprise the gate two submission, due by 17 July 2023. The Mendip Quarries scheme involves repurposing a quarry in the Mendip Hills, after quarrying operations have been completed, and using the site to provide raw water storage, augmented by water abstracted from the River Avon. The scheme partners are Wessex Water (WW) and Bournemouth Water (BW), a subsidiary of South West Water (SWW), who would benefit from the resource, although there are also opportunities for the scheme to be expanded to provide resources to other areas. ***Annex H – Gate Two Guidance Signposting*** provides a summary of how each of the requirements outlined in the RAPID gate two guidance[2] have been addressed with reference to the relevant annexes, including this report.

Figure 1.1: Scheme overview

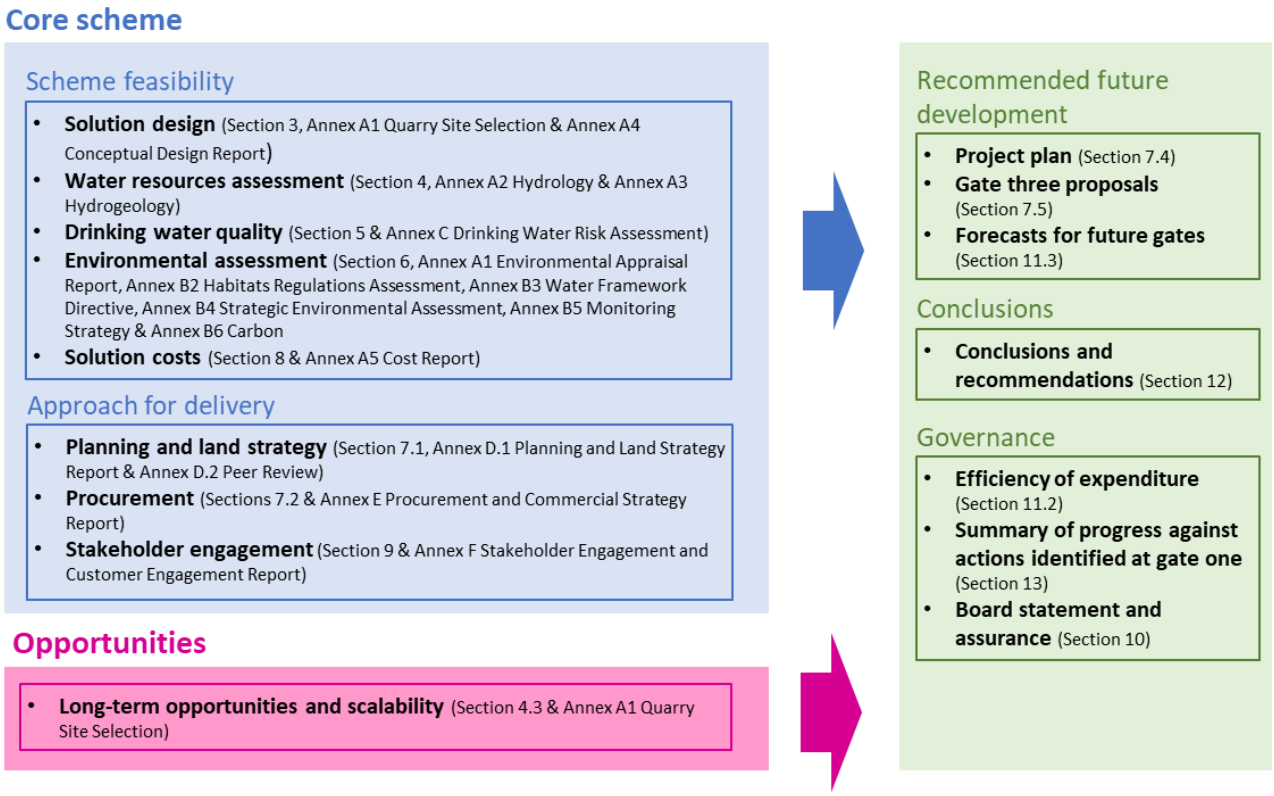


[1] The Mendip Quarries SRO was not included in the list of SROs identified by Ofwat in the 2019 Final Determination, but was highlighted by the WCWRG programme director and included in a subsequent gap analysis undertaken for RAPID. The scheme was developed through to gate one by West Country Water Resource Group (WCWRG), was admitted by RAPID to the gated process in May 2022 and has since been developed through to gate two.

[2] RAPID, *Strategic regional water resource solutions guidance for gate two* (April 2022). Available online: https://www.ofwat.gov.uk/wp-content/uploads/2022/02/Strategic-regional-water-resource-solutions-guidance-for-gate-two_RAPID.pdf [Accessed 06/07/2023].

1.2 Methodology and objectives

Figure 1.2: Overview of gate two document structure



A summary of the contents of this gate two report and associated supporting information can be found in Figure 1.2. A full list of supporting annexes is also provided in, Table 13.1. Table 13.2 provides a summary of responses to the gate one draft decision actions and recommendations.

The gate two work has focused primarily upon determining the feasibility of a 'core scheme' that is based upon using the volume of storage made available by quarrying activities at the preferred site (Torr Quarry) to date and the two transfers to WW and BW that this can support. This report sets out the hydrological, hydrogeological, environmental and engineering investigations conducted to determine the feasibility of the core scheme. The report also sets out initial proposals for the planning and land strategy and procurement strategy, as well as summarising stakeholder engagement to date.

Opportunities to expand the scheme, by using additional storage (at Torr Quarry and other quarries) and through additional abstraction are described in this report, but are proposed for more detailed development in gate three, prior to regional modelling for the 2029 Regional Plan. Activities are included in the recommended future project plan and gate three proposals.

1.3 Key facts

Table 1.1 summarises key information about the gate two core scheme for Mendip Quarries SRO.

Table 1.1: Mendip Quarries SRO key information

Item	Details
Scheme type	Reservoir and transfers
Key Assets	Torr Reservoir Resource
	• **River Avon intake**: 163Ml/d abstraction capacity with a low lift pumping station at site

<table>
<tr><td>Item</td><td colspan="3">Details</td></tr>
<tr><td></td><td colspan="3">

River Avon Water Treatment Works (WTW): 163Ml/d capacity works with a high lift pumping station at site for treatment to remove invasive non-native species (INNS) and conveyance of raw water to Torr Reservoir
Torr Reservoir: Torr Works quarry repurposed as a surface water reservoir with 28.5MCM of useable storage
Torr Reservoir WTW (Non-potable process): 110Ml/d treatment capacity to provide initial treatment sufficient to remove INNS and to meet WFD requirements for discharges to the River Stour

</td></tr>
<tr><td></td><td>Transfer to Wessex Water</td><td colspan="2">Transfer Bournemouth Water</td></tr>
<tr><td></td><td>

Torr Reservoir WTW (Potable process): 50Ml/d potable treatment capacity process stream to further treat flows for potable transfer
Torr Reservoir WTW to Wessex Water service reservoir: 50Ml/d capacity, 23.4km potable water pipeline

</td><td colspan="2">

Pipeline - Torr Reservoir WTW to the River Stour: 62.5Ml/d capacity, 31.8km non-potable gravity main
River Stour discharge: Structure to discharge up to 62.5Ml/d
River Stour intake: 50Ml/d capacity abstraction near Longham Lakes with a pumping station at site
Matchams pumping station: 50Ml/d capacity station at the existing Matchams water abstraction site for pumped transfer to Knapp Mill WTW
Pipeline - Longham Lakes to Knapp Mill WTW via Matchams: Reuse of existing raw water transfer assets for a 50Ml/d capacity transfer

</td></tr>
<tr><td>1 in 500yr Deployable Output (DO)</td><td colspan="3">Torr Reservoir Resource</td></tr>
<tr><td></td><td colspan="3">46Ml/d Dry Year Annual Average (DYAA), 106Ml/d Dry Year Critical Period (DYCP)</td></tr>
<tr><td></td><td>Transfer to Wessex Water</td><td colspan="2">Transfer Bournemouth Water</td></tr>
<tr><td></td><td>15Ml/d DYAA, 50Ml/d DYCP</td><td colspan="2">16Ml/d DYAA, 50Ml/d DYCP</td></tr>
<tr><td>Requirements met by the scheme</td><td colspan="3">With the two outgoing transfers, the scheme would meet needs in the West Country, conveying water to Wessex Water and South West Water's Bournemouth area to help address deficits caused by abstraction licence reductions.</td></tr>
<tr><td>Plans in which the scheme features</td><td colspan="3">

West Country Water Resources Group - Regional water resources plan
South West Water (Bournemouth Water) - Draft Water Resources Management Plan (WRMP)
Wessex Water - Draft WRMP and proposed revisions for the statement of response

</td></tr>
<tr><td>Date by when the scheme is required</td><td colspan="3">The scheme is required by 2050 in three out of the five scenarios in the WCWRG's draft regional plan. SWW's dWRMP indicates that the scheme is required by 2043.</td></tr>
<tr><td>Year the scheme can be first operated</td><td colspan="3">The reservoir is expected to be operational from 2042, which is based upon a planned cease of quarry activities at Torr Quarry at the end of 2040.</td></tr>
<tr><td>Max utilisation AIC (with sensitivity test figures)</td><td colspan="3">Torr Reservoir Resource</td></tr>
<tr><td></td><td colspan="3">240p/m³ (177p/m³)</td></tr>
<tr><td></td><td>Transfer to Wessex Water</td><td colspan="2">Transfer Bournemouth Water</td></tr>
<tr><td></td><td>92p/m³ (87p/m³)</td><td colspan="2">132p/m³ (119p/m³)</td></tr>
<tr><td>Carbon impact</td><td colspan="3">The assessment of whole life carbon for an 80year timeframe is 302,700 tCO_2e with capital carbon in construction contributing approximately 60%.</td></tr>
<tr><td>Proposed gate three submission date</td><td colspan="3">The scheme should progress within the RAPID gated process based on the recommendation in the WCWRG's draft regional plan. The proposed gate three submission date is December 2028.</td></tr>
<tr><td>Key Project Risks</td><td colspan="3">Key risks and the pre and post-mitigation scores are detailed in section 7.3, Table 7.4, summarised below:</td></tr>
<tr><td></td><td>Risk Name</td><td>Post Mitigation Score</td><td>Gate Two Trend</td></tr>
<tr><td></td><td>Abstraction licence</td><td>Amber</td><td>Stable</td></tr>
<tr><td></td><td>Water quality – Treatment</td><td>Amber</td><td>Stable</td></tr>
<tr><td></td><td>INNS</td><td>Amber</td><td>Increasing</td></tr>
<tr><td></td><td>Torr Reservoir drawdown Impacts</td><td>Amber</td><td>Stable</td></tr>
<tr><td></td><td>River Stour transfer</td><td>Amber</td><td>Increasing</td></tr>
<tr><td></td><td>Reservoir leakage</td><td>Amber</td><td>Stable</td></tr>
<tr><td></td><td>Capacity of existing assets</td><td>Amber</td><td>Stable</td></tr>
</table>

Item	Details		
	River Avon stakeholders	Amber	Stable
	Crown Land	Amber	Stable
	Quarry purchase	Amber	Stable

1.4 Conclusions and recommendations

The purpose of gate two is to confirm the feasibility and deliverability of the scheme and to provide cost estimates and a project plan. In parallel the regional water resource planning and company Water Resource Management Plans provide support for the need for the scheme.

1.4.1 Conclusions

With regard to the feasibility and deliverability, we conclude that the core scheme:

- is technically feasible and deliverable
- has environmental impacts that can be satisfactorily mitigated given that one of the major components, the quarry storage, is already constructed
- would provide a drought and climate change resilient regional water resource with an average annual reservoir resource DO of 46Ml/d and a peak DO of 106Ml/d.
- can provide peak supplies comprising 50Ml/d to Wessex Water and 50Ml/d to South West Water's Bournemouth area, which will enable both reductions in groundwater abstraction from the upper Hampshire Avon and reductions in river abstraction from the lower Hampshire Avon respectively
- can be construction ready in the period 2030 to 2035 and on line by 2042, assuming quarrying ceases in 2040

One of the great advantages of the scheme is that the reservoir storage will have already been constructed thus avoiding the very significant environmental, social and carbon impact, as well as public relations challenges, of trying to construct a new dam and reservoir of an equivalent volume.

In addition to the core scheme we present a number of opportunities to scale up the scheme and provide further benefits, which will be investigated in gate three.

And with regard to demonstration of need, there is support for the need for the scheme through the following published plans and the statements of response to the consultations that will be issued in summer 2023:

- West Country Water Resources Group - Regional water resources plan
- South West Water (Bournemouth Water) - Draft WRMP
- Wessex Water - Draft WRMP and proposed revisions for the statement of response

1.4.2 Recommendations

Therefore, based on the conclusions regarding feasibility and the need for the scheme identified in the regional and company water resources plans, it is recommended that the scheme proceeds to gate three.

Gates three and four involve design development, pre-planning activities, procurement, planning applications, consents etc. such that by the end of gate four the scheme is 'construction ready'. An extended environmental baseline monitoring programme, including flow, water quality and ecological surveys, has already commenced in spring 2023.

2. Background and objectives

This section outlines the scheme requirements as set out by the National Framework, regional planning, and water company Water Resources Management Plans (WRMPs).

2.1 National Framework and regional planning

The Environment Agency's (EA) National Framework (meeting our Future Water Needs: A framework for Water Resources[3]) was published in March 2020. It explores England's strategic long-term water needs across all key sectors up to and beyond 2050, emphasising that if action is not taken many areas of England will face water shortages. The National Framework recognises that an increasing population, demand from agriculture and industry, environmental destination abstraction reductions and improving resilience to drought will all put significant pressures on our water resources, and that climate change will further increase these pressures.

The National Framework identified that, if no action was taken, the West Country may require an additional 227Ml/d by 2050 to meet future pressures on public water supply and that this could double by 2100.

Since 2020, the West Country Water Resources Group (WCWRG) has published emerging and draft regional water resources plans[4]. The purpose of the regional plan is:

- To set out the deficits the region faces across the range of forecast scenarios and explain that this will require supply side solutions in addition to ambitious demand reductions and leakage savings ie. demand reductions and leakage savings alone are insufficient to meet future needs
- Report on the outputs of the inter-regional reconciliation process, which concluded that transfers out of the region are not feasible in the short to medium-term
- To be a public document seeking views from the public and stakeholders
- To provide direction for the development of strategic regional resource options

The draft regional plan proposes that all the strategic resource options, including Mendip Quarries, continue to be developed so that they can be implemented when new water resources are required either as part of a preferred plan or as part of an adaptive plan should demand reductions not materialise or if environmental needs are greater than expected.

However, it is not possible to deliver the Mendip Quarries scheme until the early 2040s due to the existing planning permissions for its use as a quarry, unless quarrying activities end sooner than the planning permission end date (refer to section 7 below). It is therefore proposed that the solution is considered as part of plans for the current planning period to 2050 and/or as a long-term water resource to meet future needs in 2050 to 2080.

The draft plan also recognises the need for a regional water resources model to better understand the utilisation of solutions, intra-regional transfers and what a regional best value plan would look like. This work is scheduled to commence by September 2023 and be completed so that it can be used to prepare the next regional plan in 2027.

[3] Environment Agency, *Meeting our future water needs: a national framework for water resources* (2020). Available Online: https://www.gov.uk/government/publications/meeting-our-future-water-needs-a-national-framework-for-water-resources

[4] West Country Water Resources, *Draft Regional Water Resources Plan* (2023). Available Online: https://www.wcwrg.org/our-work/draft-regional-plan/

2.2 Water company plans

2.2.1 South West Water

Bournemouth Water (part of South West Water) is facing a major supply challenge in the Bournemouth area as a result of needing to reduce abstractions for environmental reasons from the lower reaches of the River Avon in Hampshire. South West Water's draft Water Resources Management Plan (dWRMP) was issued for consultation in February 2023[5]. Total demand in the Bournemouth area will remain relatively flat at 149Ml/d. However due to the impact of abstraction reductions and climate change the supply-demand balance position is forecast to shift to deficit from 2035 onwards and be up to 89Ml/d in deficit by 2050 without any interventions. The draft plan includes a comprehensive set of options and an adaptive plan based on demand reductions and supply-side options, including the Mendip Quarries SRO.

Following the consultation, SWW will prepare a statement of response for consideration by Department for Environment, Food and Rural Affairs (Defra) prior to publication of the final statutory WRMP.

2.2.2 Wessex Water

Wessex Water's dWRMP24 was issued for consultation in November 2022[6]. The most significant driver is the need to deliver further abstraction licence reductions to help protect Chalk streams. Total demand in 2050 is forecast to be 450Ml/d. The baseline supply-demand balance position, excluding the abstraction licence reductions to protect chalk streams, shows that the planning period starts with a surplus which gradually declines through the planning period, primarily as a result of growing demand, into a deficit by 2079/80. In addition to this long-term trend, further reductions in available water occur due to licence losses, result in overall planning deficits of 32Ml/d by 2050 and 93Ml/d by 2079/80 under the DYCP scenario. The draft plan includes a comprehensive set of options and adaptive plan based on demand and leakage reductions and supply-side options, including the Mendip Quarries SRO.

Consultation feedback on the draft plan includes a request to deliver abstraction reductions in the upper Hampshire Avon catchment by 2035. Following the consultation, Wessex Water will prepare a statement of response by the end of July 2023 for consideration by Defra prior to publication of the final statutory WRMP.

2.3 Summary of need for the Mendip Quarries scheme

Based on the published plans described above and the feedback from stakeholders on the draft plans, the need for the scheme is summarised in Table 2.1.

Table 2.1: Summary of need

Plan	Need
West Country Water Resources Group - Regional water resources plan	• Required in three out of five future scenarios • Recommended that the scheme continues to be developed • Recommended the development of a regional water resources model over the period 2023 to 2027 to better understand utilisation
South West Water (Bournemouth Water) - Draft WRMP	• Required in all scenarios to resolve deficits caused by abstraction licence reductions

[5] https://www.southwestwater.co.uk/environment/water-resources/water-resources-management-plan/
[6] https://corporate.wessexwater.co.uk/media/35pb0u3j/water-resources-management-plan-non-technical-summary.pdf

Plan	Need
Wessex Water - Draft WRMP and proposed revisions for the statement of response	• The preferred plan will seek to meet regulators' request that abstraction licence reductions are achieved by 2035 • As the Mendip quarries solution will not be available until the early 2040s it is not included in the preferred pathway, but it does feature in the adaptive plan

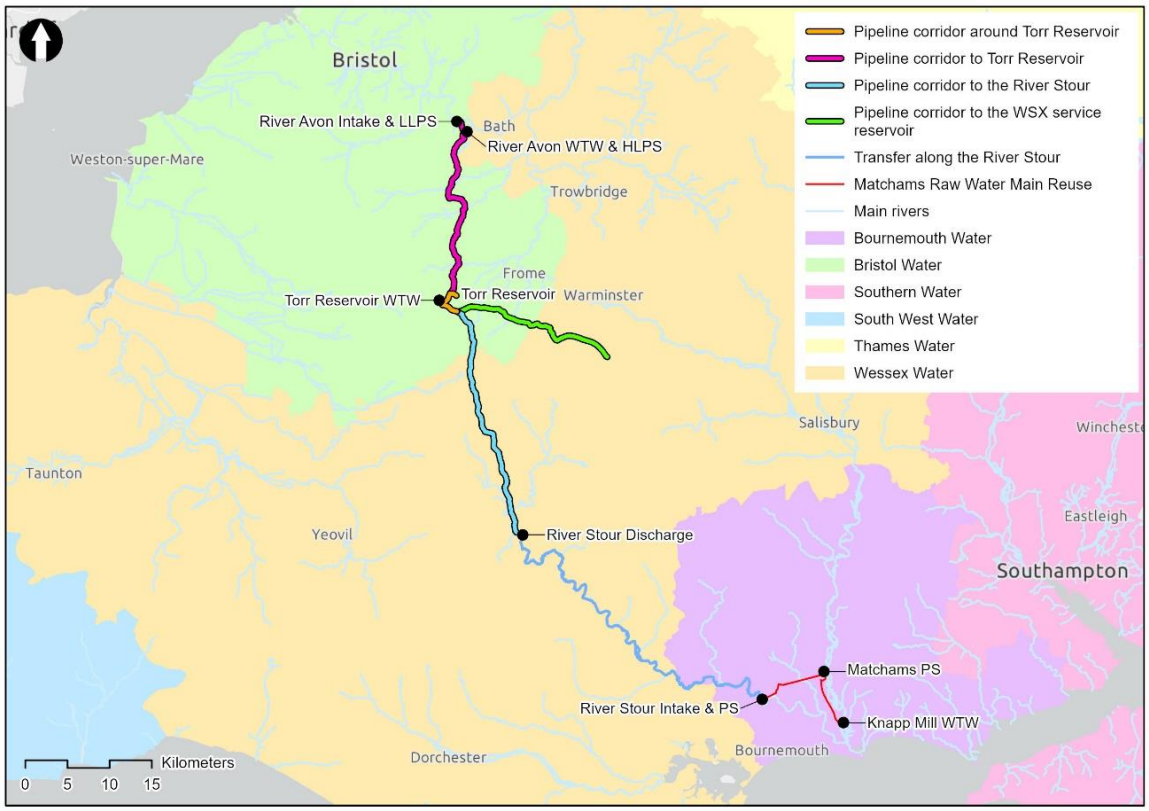
3. Solution design, options and sub-options

This section provides an overview of the solution design and a summary of the options appraisal process to select the preferred quarry site for use as a water storage reservoir. A core scheme has been selected for development as the gate two solution to meet the West Country need, and opportunities to expand the scheme to provide benefit to other regions have been identified as areas requiring further development. This section concludes with a summary of the core scheme assets, operation and interaction with other SROs.

3.1 Solution description

The Mendip Quarries Strategic Resource Option (SRO) is being jointly developed by Wessex Water and South West Water to provide resilient water supplies to the South West of England by addressing current forecasted resource deficits. The concept of the project is to re-purpose a quarry in the Mendip Hills for use as a reservoir. The gate two work has concentrated on Torr Quarry, which is located between Frome and Shepton Mallet. Mineral extraction is expected to be completed in 2040, and the studies have shown that it has a large potential storage volume and beneficial geological setting. A shortlist of other potential quarries has been identified that could be used to supplement Torr Quarry in future phases.

Figure 3.1: Gate two scheme overview



Source: Service layer credits for base mapping: Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS. Data Source: © Environment Agency copyright and/or database right. © Crown copyright and database rights 2023. © Environment Agency copyright and/or database right 2020. All rights reserved. (from Annex A1 - Options Appraisal – Quarry Site Selection)

Figure 3.1 provides an overview of the scheme. The scheme will abstract and treat river water from the River Avon downstream of Bath, and transfer it for storage within Torr Quarry. The quarry is owned and operated by Aggregate Industries (AI) and has planning permission for minerals to be extracted until the end of 2040, at which point it will become available for use as a reservoir (hereafter 'Torr Reservoir'), as part of the scheme.

Torr Reservoir would fill naturally with groundwater; however the rate of recharge would be too slow to ensure the reservoir could be used as a water resource for public water supply. It is therefore proposed to augment the refilling of the reservoir with water abstracted from the River Avon, downstream of Bath. When needed, water would be abstracted from Torr Reservoir. Two treatment and conveyance proposals have been developed:

1. Treated to potable standards and transferred to an existing Wessex Water service reservoir, located near Warminster in Wiltshire.
2. Treated to raw water discharge standards and transferred to the River Stour in Dorset for subsequent downstream abstraction and treatment to potable water standards at an existing Water Treatment Works (WTW) supplying Bournemouth Water.

The reservoir would have a useable capacity of 28.5 million m³, approximately 33% larger than Wimbleball reservoir. It would provide an estimated 1-in-500 year DYAA DO of 46Ml/d and a DYCP DO of 106Ml/d.

The existing planning permission for mineral extraction is on the basis that on completion of quarrying the void would be allowed to refill with water, with a restoration plan comprising landscaping, ecological and biodiversity measures. Using the quarry as a reservoir would require seasonal drawdown. One of the great advantages of the scheme is that the reservoir storage will have already been constructed thus avoiding the very significant environmental, social and carbon impact, as well as public relations challenges, of trying to construct a new dam and reservoir of an equivalent volume.

Positive and collaborative meetings with AI have been held monthly since 2021 with a view to acquiring the site at a suitable date prior to the end of mineral extraction. AI have confirmed that their preference is to concentrate on quarrying at new sites and allow the Mendip Quarries SRO scheme to take on after-care of the old site. The intention is to develop an option agreement for future acquisition of the site.

There are also additional opportunities for enhancing both the yield of the scheme and for additional transfers within the WCWR region as well as interregional transfers.

3.2 Options appraisal

For gate two, options appraisal has considered the following key areas:

- **Regional need** – to assess the needs of WCWRG and Water Resources South East (WRSE)
- **Source availability and capacity** – to provide greater confidence in the available source yield and to determine the 1-in-500 year yield for a range of quarry volumes
- **Quarry site selection** – to appraise potential quarry options so as to identify the best quarry sites for providing a regional water resource. This confirmed Torr Quarry as the preferred location for the development at gate two

Each of these investigations is summarised in the below sections.

3.2.1 Regional need assessment

West Country Water Resources Group

The WCWRG's published draft regional plan shows that the region faces deficits (across the range of forecast scenarios) that will require supply side solutions, in addition to ambitious demand and leakage savings. Table 3.1 below presents the selection of strategic supply options under the region's range of environmental and demand management scenarios. This shows that the Mendip Quarries SRO would be required in three out of the five scenarios by 2050.

Table 3.1: WCWRG draft plan supply deficits (Edited)

	Base DYAA Supply Demand Balance (Ml/d)	Supply Side Options			
		Non-SROs total 158Ml/d	Mendip Quarries	Poole Effluent Reuse	Cheddar Two Reservoir
Policy Future	-130	158			
Higher Demand Future	-245	158	X	X	X
Bad Future	-297	158	X	X	X
Stretching Future	-318	158	X	X	X
Alternative Future	-152	158			

Source: WCWRG Draft Regional Plan, Table 13: High-level view of the supply-side options that may be required in each future. These exclude improved infrastructure required to move the water around the region

A further review of the specific water company needs was completed by Wessex Water and South West Water to identify the specific regional need that the Mendip Quarries SRO should aim to address – this is discussed in section 4.1.

Water Resources South East

At gate one two potential transfers to WRSE from the Mendip Quarries SRO were included in the WRSE investment model but excluded from the WRSE regional plan on the basis of uncertainty around the options, in particular whether there would be any significant remaining resource available for WRSE after WCWR needs had been met.

For gate two options to supply WRSE have also been reviewed and appraised as part of WRSE's sensitivity testing. Further information is provided in section 4.3.

3.2.2 Source availability and capacity

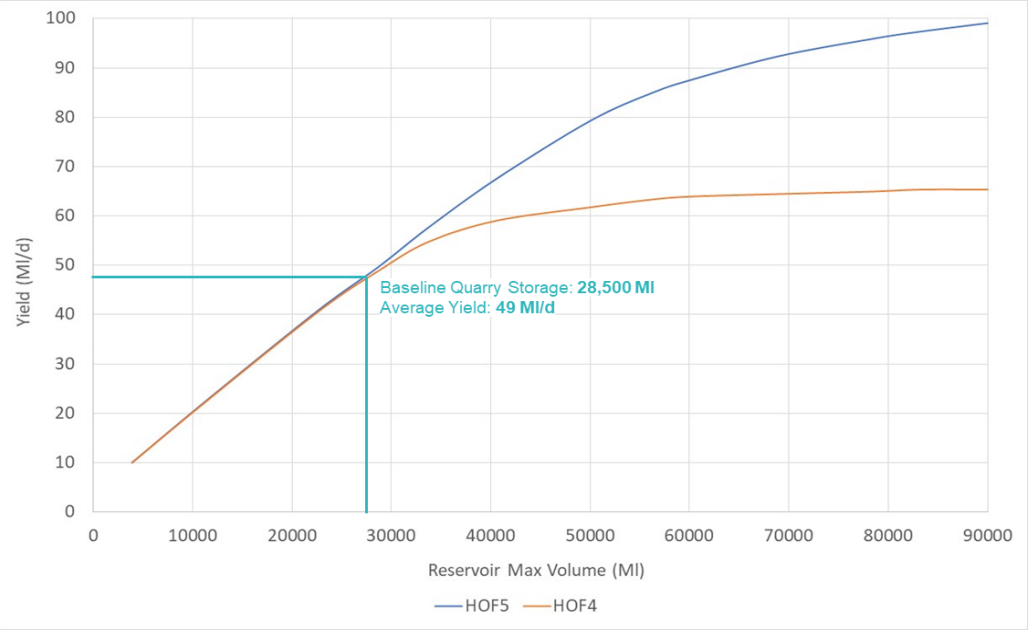
The gate one hydrology assessment assumed that an existing unused abstraction licence for the River Avon at Newton Meadows near Bath could be used as a source of water for the scheme, with permitted abstractions up to approximately 30Ml/d. Additionally, it was postulated that there was scope for a licence revision that would allow increased abstraction during periods of high flow, up to a maximum of 150Ml/d.

Following engagement with the EA in July 2022, it was proposed that an indicative licence with a stepped hands-off-flow (HOF) should be modelled for gate two. This had a lower HOF than the existing licence but a much higher potential maximum abstraction up to 452Ml/d. It was agreed with the EA that only 75% of the maximum licenced abstraction should be considered in the hydrology assessment due to uncertainty around what water would actually be available to the scheme when the licence is eventually granted.

The indicative licence was used to develop a storage-yield curve (Figure 3.2) showing the modelled 1-in-500 year yield for a median 2070 climate change scenario for a range of potential reservoir volumes. Two curves were produced, one for each of the two highest HOF abstraction rates provided in the indicative licence, 339Ml/d (HOF5), and 163Ml/d (HOF4), the latter being

similar to the gate one assumed abstraction of 150Ml/d. The full details of the assessment are provided in ***Annex A2 – Water Resource Assessment – Hydrology.***

Figure 3.2: Storage-yield curve



At gate one, the yield was estimated to be approximately 87Ml/d for the baseline quarry storage (approx. 28.5MCM), however Figure 3.2 shows that the revised gate two yield is only 49Ml/d. This a significant reduction and is predominantly due to:

- The adoption of a DYCP demand profile, compared to the fixed demand assumed for gate one,
- The revised licence, notably the increase in the HOF
- The consideration of climate change factors, which all show increase in potential evapotranspiration (PET) and reduction in overall rainfall, with a big drop in summer rainfall only partially compensated by increases in some winter months

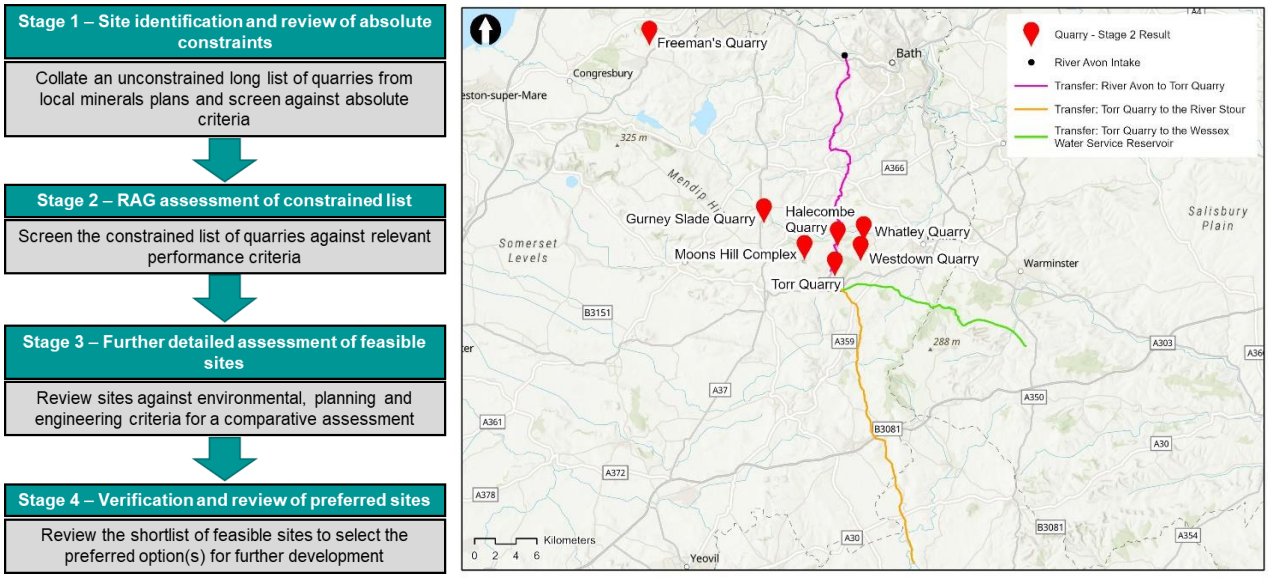
Figure 3.2 also indicates that the scheme yield is largely constrained by the available storage rather than the availability of the resource.

3.2.3 Quarry site selection

Whilst not explicitly identified, the gate one scheme focused on the use of Torr Quarry, which was proposed as a potential new reservoir site in the RAPID gap analysis report in 2020[7]. For gate two, the options appraisal process has been completed to identify and appraise potential quarry options so as to identify the best quarry sites for providing a regional water resource to meet the significant WCWR need, and potentially to supply other regions such as WRSE. A four-stage screening process was developed, as shown in Figure 3.3. The options appraisal has prioritised quarry selection over detailed optioneering of transfer corridors and fixed asset locations such as treatment works. These elements will largely be determined by the final quarry site selection and to avoid wasteful development of options it is proposed that a full options appraisal of corridors and treatment sites should follow further hydrogeological modelling proposed for gate three.

[7] Jacobs, *Meeting regional and national water resources needs: gap analysis of the current strategic infrastructure scheme portfolio* (2020), RAPID

Figure 3.3: Four stage quarry screening options appraisal methodology and shortlisted sites



In Stage 1, 125 potential sites were identified based on local minerals plans and relevant documents. These sites were then screened against rejection criteria, resulting in a constrained list of 16 options. Stage 2 involved a desk-based assessment of the 16 sites' suitability for water storage potential, further refining the list to the seven quarries shown in Figure 3.3. Limited information and uncertainties affected both stages. The primary differentiating factor among the identified quarries was their size and potential storage capacity.

Stage 3 involved reviewing each shortlisted quarry based on technical, engineering, environmental, planning, and commercial criteria. However, due to constraints in publicly available information, challenges in engaging quarry operators, and uncertainties in demand, location, and hydrogeology, this review was unlikely to identify key differentiators for robust option screening. As a result, no options were rejected at this stage.

At Stage 4, the potential storage volume was calculated for each of the seven sites, which enabled the yield to be estimated from Figure 3.2. To calculate the storage, a maximum drawdown depth of 50m was adopted, as this is roughly equivalent to the current excavation depth of Torr Quarry below the estimated natural groundwater level. Torr Quarry is continuously dewatered and is required to augment nearby watercourses to mitigate any potential environmental impacts associated with drawing down the natural groundwater level. Hence, it was deemed that there was reasonable confidence to suggest that environmental impacts associated with a maximum theoretical 50m drawdown could be mitigated sufficiently, prior to any hydrogeological modelling work undertaken for gate two. Table 3.2 summarises the shortlisted sites and their potential yields.

Table 3.2: Summary of potential reservoir yields

Quarry **(Owner)**	Stage 4 Available Reservoir Storage (MCM)	Annual Average		WCWR Profile Critical Peak	
		HOF4 Yield (Ml/d)	HOF5 Yield (Ml/d)	HOF4 Yield (Ml/d)	HOF5 Yield (Ml/d)
Gurney Slade **(Morris & Perry)**	4.1	10	10	23	23
Halecombe **(Tarmac)**	6.3	14	14	32	32
Moons Hill Complex **(Wainwright)**	Moons Hill: 4.8 Stoke: 1.7	14	14	32	32
Torr Quarry **(Aggregate Industries)**	28.5	49	50	113	115
Westdown **(Hanson Aggregates)**	4.6 to 4.9	12	12	28	28
Whatley **(Hanson Aggregates)**	24.6	44	44	102	102
Freeman's **(CEMEX UK Materials Ltd.)**	N.A.	N.A.	N.A.	N.A.	N.A.

Based on the Stage 4 assessment of potential yield, it was concluded that continuing to develop Torr Quarry would create the largest reservoir with the greatest potential and flexibility to be a significant regional resource. Whatley Quarry was identified as having the potential to provide additional storage which could be used either to develop a larger resource or as an alternative were the use of Torr Quarry found to be infeasible. Contact has now been established with Whatley Quarry and it is hoped that this will enable further progress to be made on developing an option using Whatley Quarry during gate three.

The full details of the options appraisal are provided in ***Annex A1 – Options Appraisal – Quarry Site Selection.***

3.3 Gate two core scheme and future opportunities

Hydrological and hydrogeological studies, covered in sections 4.1 and 4.2 below respectively, have shown that when utilising Torr Quarry excavated down to its current depth (approximately 50m drawdown), the reservoir deployable output can just support the estimated West Country DYAA and DYCP regional need. This provides a high degree of confidence that the environmental impact on the downstream water courses would be no worse than the current situation, and for much of the time when the reservoir is full or partially drawn down there may be beneficial impacts through increased flow rates.

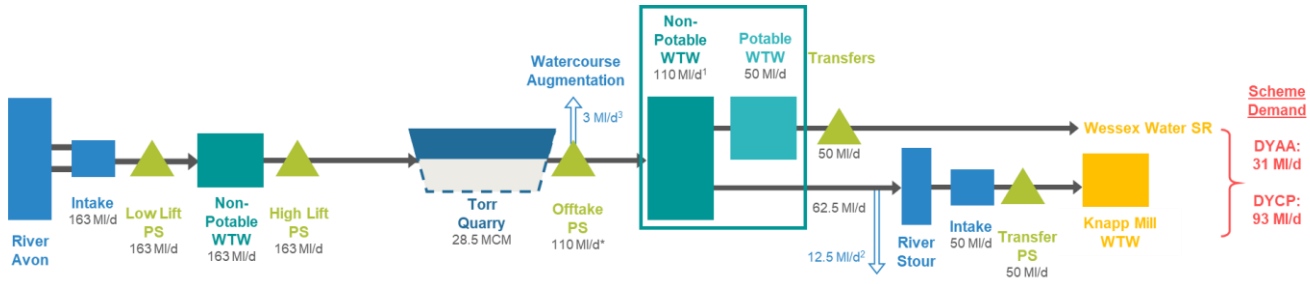
The gate two core scheme is therefore focused on meeting the WCWR need based on using a 50m reservoir draw down at Torr Reservoir. The full conceptual design for the core scheme is developed in ***Annex A4 – Conceptual Design Report***, and is summarised in section 3.4 below. Future 'opportunities' to increase the yield are covered in section 4.3.

3.4 Key assets

The gate two core scheme comprises:

- Abstraction from the Bristol Avon near Newton Meadows downstream of Bath utilising winter flows subject to hands off flow conditions, with a capacity of 163Ml/d
- High lift pumping station and approximately 25km long pipeline to the quarry
- Re-purposing of the quarry as a raw water storage reservoir, including inlet and outlet facilities in the form of vertical shafts and connecting tunnels constructed from within the quarry, as well as reservoir mixing arrangements
- Engineered augmentation of the downstream watercourses to ensure environmental flow targets are met of 3Ml/d annual average (equivalent to compensation releases below an impounding reservoir)
- Water treatment, both pre-treatment of the river water (163Ml/d), post-treatment (110Ml/d) and potable water treatment (50Ml/d), to prevent transfer of invasive non-native species (INNS), mitigate water quality deterioration and provide a supply to potable standards
- A 50Ml/d potable transfer to WW at Warminster through a 24km long pipeline
- A 32km raw water transfer pipeline to the River Stour near Sturminster Newton from where the water will flow a further c60km downstream before abstraction on a 'put and take basis' to provide a net 50Ml/d
- Abstraction at Longham through a new 50Ml/d intake for transfer to BW's rebuilt water treatment works at Knapp Mill.
- A schematic of the core scheme is shown in Figure 3.4

Figure 3.4: Gate two core scheme



Notes:

1. Peak 50Ml/d transfers to WW and BW occur in different months, so the total maximum demand is 93Ml/d (104Ml/d including losses). Offtake PS and WTW sized for 110Ml/d.
2. 20% losses to River Stour assumed from total transferred flow.
3. 3Ml/d Annual average river augmentation assumed.

3.5 Operation

The core scheme is designed to meet DYCP demand for both Wessex Water and Bournemouth Water, and hence, it is expected that the reservoir will be used seasonally each year. Sweetening flows will be required to maintain water quality within the transfer system and to keep the treatment processes online. More work will be progressed by the water companies to develop the utilisation and operational assumptions during gate three, including regional modelling for the west country.

3.6 Interactions with existing assets and other SROs

The Poole Water Recycling and Transfers SRO involves effluent recycling from Poole sewage treatment works. Recovered water is to be treated and transferred to the River Stour, for re-abstraction at the existing Longham Lakes intake (~15km downstream in Bournemouth) for treatment at Alderney WTW. With both the Poole recycling and Mendip reservoir schemes potentially discharging into the River Stour there is a need to further investigate how the two schemes should best operate together as well as with existing abstractions on the River Stour and with future environmental needs (including potential sustainability reductions impacting existing abstractions). WCWR is currently procuring development of a regional system simulator which will allow the operation of existing and potential resources to be modelled in conjunction with one another which, allowing optimal operating arrangements to be assessed, with a view to both maximising water resources benefits and beneficial environmental outcomes.

4. Water resource assessment

This section summarises the investigations completed to assess the water resource benefit. These included a review of the way the scheme is expected to be utilised to understand the demand placed on the reservoir; hydrological modelling to determine the 1-in-500 year reservoir yield for a range of storage volumes based on an assumed River Avon abstraction licence; and hydrogeological modelling to provide estimates for the reservoir leakage to establish the viability of the scheme. This section also provides further discussion of the long-term opportunities to expand the core scheme in future gates, and consideration of infrastructure resilience.

4.1 Utilisation

The reservoir yield and deployable output is influenced by the proposed utilisation. To estimate the likely utilisation, Wessex Water and South West Water reviewed their supply demand balance (SDB) for their water resource zones as part of their WRMPs and the WCWRG Regional Planning to identify specific water resource zone (WRZ) needs. This identified two DYCP needs within the

central eastern Wessex Water service area, and South West Water's Bournemouth Water WRZ. While the WCWRG regional plan sets out the region's long-term water needs up to 2050, it would not be possible to bring this scheme online until the mid-2040s due to the existing quarry planning permissions so it was proposed that the solution should be considered as a longer-term water resource option. Hence, the 2050 demands were extrapolated provide indicative 2080 demands to develop the scheme. The 2080 demands only consider population growth after 2050, assuming that all demand reduction changes have been achieved by 2050. The demand profiles were based upon the following assumptions.

- Wessex Water:
  - 1 month critical peak in August (50Ml/d)
  - 4 months prior and 1 month after this critical peak period at 50% of the critical peak flow
- Bournemouth Water:
  - Critical peak in September (50Ml/d)
  - Demand increases linearly over 6 months (April to September).

These DYAA and DYCP demands are summarised in Table 4.1.

Table 4.1: WCWR 2080 demand

	DYAA (Ml/d)	DYCP (Ml/d)
Wessex Water	15	50
South West Water (Bournemouth Water)	16	50
Total	31	100

These demands do not include any system losses that could arise between the reservoir and the point that water is input into distribution, so an allowance for the following potential losses was included in the monthly demands to produce the utilisation profile applied to the reservoir hydrology modelling, shown in Figure 4.1:

- Sweetening flows: 10Ml/d (approximately 20% of peak flow) for each transfer
- River Losses: 20% during demand months

Figure 4.1: 2080 WCWR reservoir utilisation profile

The utilisation profile was used to determine the 1-in-500 year yield for a range of storage volumes to produce the storage yield curve, which was used to estimate the potential yield from a range of reservoirs, as discussed in 3.2.2. Note, any losses due to requirements to augment local water

courses to mitigate environmental impacts, or leakage to groundwater, is specific to the setting of each individual quarry so an allowance for these losses was not applied to the utilisation profile for the hydrology modelling. Instead, this was applied to the yield for the core scheme based on the hydrogeology modelling completed for Torr Quarry, described in section 4.2.2.

4.2 Water resource benefit

4.2.1 Hydrology modelling

Water resources modelling was undertaken to estimate the 1-in-500 year yield of the reservoir. This included hydrological modelling of the water source (the River Avon catchment), assessment of the impact of climate change on river flows, determination of potential abstraction based on a potential abstraction licence discussed with the Environment Agency, and simulation of reservoir storage. The 1-in-500 year DO for the reservoir resource is calculated from the reservoir yield by subtracting the amounts used for local stream support and any net leakage to groundwater.

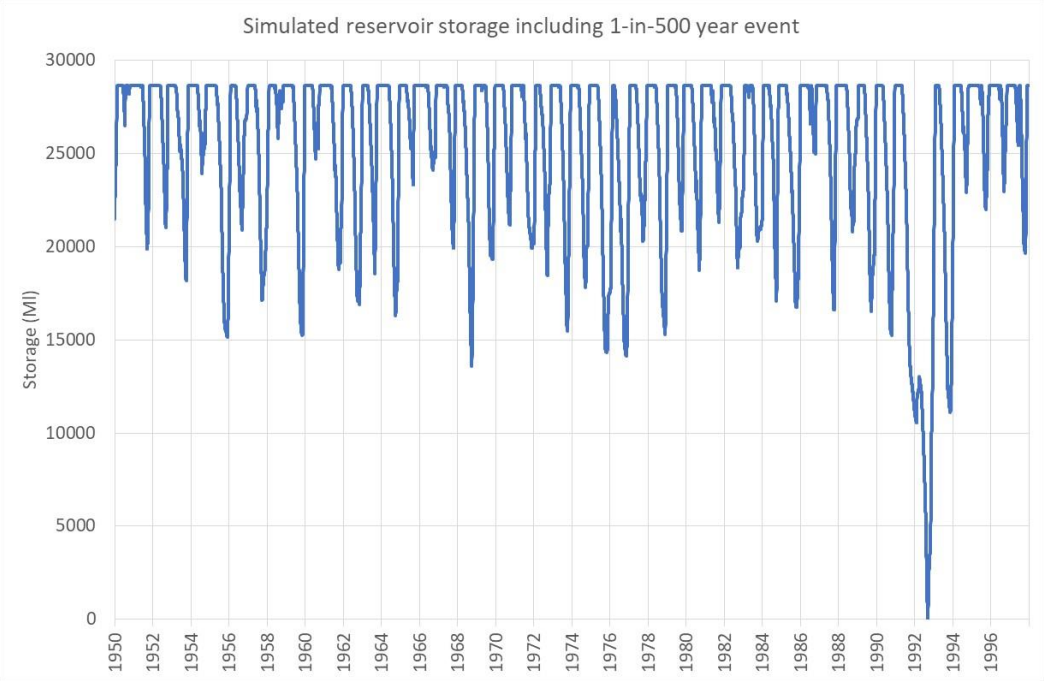
The hydrological model GR6J was set up and calibrated against flows recorded at Environment Agency gauging stations, using 1km gridded rainfall and climate data obtained from the Met Office (HadUK) and data on artificial influences (abstractions and discharges) within the catchment. Calibration used data up to the end of 2020 which was the most recent available at the time of the study. The calibrated model was then used to simulate flows, assuming an average profile of artificial influences, for baseline conditions and for a climate scenario representing conditions anticipated for the 2070s. Twelve regional climate models were initially used, with one of them then being selected as a median scenario (on the basis of derived reservoir yields) for more extensive analysis.

400 daily flow series, each covering 48 years, were simulated using stochastic rainfall and climate data obtained using a weather generator conditioned by climate drivers representing key aspects of the climate system. Each series covers 1950-97 and represents conditions that could reasonably have occurred in the prevailing climate of the second half of the 20th century. These datasets were then perturbed using monthly factors for the selected climate model to produce rainfall and potential evapotranspiration series representing potential conditions in the 2070s.

The yield model was set up using Pywr (an established model used across the UK water industry). The demand was adjusted to derive the maximum demand that could be met with not more than 38 years having a failure to meet the demand (i.e. with the reservoir empty on one or more days). 38 years represents 1/500th of the total simulation period of 19,200 years (400 x 48), so the demand is an estimate of the 1:500 year yield of the system.

The pattern of reservoir storage is illustrated in Figure 4.2 which shows the results for the core scheme storage capacity of 28.5MCM using one of the stochastic series that includes the estimated 1:500 year drought. Storage reduces in summer but is nearly always replenished during the following winter. In drought conditions, however, there is minimal recovery in winter (because the availability of water from the River Avon is only just greater than the demand on the reservoir) and the following summer sees the reservoir reach empty (marked here as zero storage, though in reality there would be some additional “dead storage” of water that cannot be abstracted).

Figure 4.2: Simulated reservoir storage



The Pywr model includes rainfall on the reservoir surface, and evaporation from it, but does not include releases to augment flow in local watercourses, or leakage to/from the surrounding ground. The latter points were considered using the hydrogeological model.

The Dry Year Annual Average (DYAA) DO has been derived for both the reservoir resource at the point of transfer, and for the gate two core scheme which accounts for a conservative estimate of potential losses due to sweetening flows and river losses. System simulation modelling is planned in future gates as part of the WRMP29 and Regional Plan 29 activities, which will help to confirm the capacities and utilisation for the proposed transfers, and future design development is expected to reduce the assumed losses. Therefore the reservoir DO has been provided to give an indication of the potential DO available, without exploiting greater volumes of storage that may be available in the reservoir, and before considering downstream losses/sweetening flows, which will be dependent upon:

1. The nature of future needs (e.g. peak or annual average).
2. The treatment requirements (e.g. for raw or potable transfer).
3. The nature of the transfer (including taking account of losses in river transfers and the lengths involved for pipelines transfers).

Derivation of reservoir and core scheme DOs is shown in Table 4.2. The reservoir resource DO is calculated by subtracting the augmentation and net leakage losses calculated in the hydrogeology modelling for Torr Reservoir from the modelled reservoir yield. The overall peak factor from the assumed WCWR demand profile applied to the reservoir (Figure 4.1) is 2.31, which has been used to convert the DYAA DO into a DYCP DO.

For the core scheme DO at the Wessex and Bournemouth WRZs, although each demand centre has a peak requirement from the scheme of 50Ml/d these occur in different months and so the overall total peak demand from the scheme for both WRZs is 93Ml/d, after deducting losses in the River Stour. The average total demand from the scheme for both WRZs (after deducting losses and allowing for sweetening flows) is about 31Ml/d, so the peak factor is about 3. This has been used to convert the average DO to the critical period DO.

Table 4.2: Derivation of deployable output

Reservoir DO	
Derived 1-in-500 yr yield	49Ml/d
Augmentation/net leakage losses	3Ml/d
1-in-500 yr DO (DYAA)	46Ml/d
Reservoir Peak Factor	2.31
1-in-500 yr DO (DYCP)	106Ml/d
Core Scheme Transfers DO	
Less sweetening flows for potable transfer	5Ml/d
Less sweetening flows for transfer to River Stour	5Ml/d
Less estimated transmission losses in River Stour	4Ml/d
1-in-500 yr DO (DYAA)	32Ml/d
Core Scheme peak factor	30.83/93 = 3.02
1-in-500 yr DO (DYCP)	96Ml/d

The DO is slightly higher than the core scheme demand, whether assessed on an annual average or critical period basis. This suggests that the reservoir can only support the WCWR demands and that supplying resource to other regions would require increasing the reservoir storage volume - this is discussed in section 4.3.

4.2.2 Hydrogeology modelling

A hydrogeological model was developed for the preferred reservoir location, Torr Quarry, the primary purpose of which was to model interactions between the reservoir and the surrounding aquifer and spring-fed watercourses, and to refine estimates of reservoir leakage. Reservoir leakage to ground was a key concern at Pre-Feasibility stage and more detailed assessment was required to constrain estimates of groundwater leakage and assess whether leakage could affect the viability of the reservoir operation during a drought. The key hydrogeological unit at Torr Quarry is the Carboniferous Limestone (Figure 4.3), a principal aquifer and important groundwater resource in the region. The Carboniferous Limestone aquifer is a karst aquifer. Flow within Karst aquifers typically occurs in dissolution-enhanced fractures, fissures and conduits. These features allow large volumes of water to flow relatively rapidly over large distances in comparison to intergranular/matrix flow (groundwater velocities in the aquifer have been recorded at hundreds of metres per day).

The hydrogeological model (Figure 4.4) was developed in Python based on a 2010 Environment Agency lumped parameter groundwater model of the Mendips, the East Mendips Model v1 (EMMv1). EMMv1 was developed to inform regulatory decisions affecting groundwater resources in the eastern Mendips including quarry development and public water supply.

EMMv1 is a spreadsheet-based model which incorporates surface water runoff, groundwater recharge, and groundwater and surface water abstractions and discharges. It simulates groundwater flows, levels, and interactions between groundwater and surface water courses including spring discharges. The EMMv1 model run period was from 1985-2007. As part of the gate two hydrogeological assessment, recent data from Torr Quarry and surrounds were evaluated to inform an updated conceptual understanding for the area, presented in ***Annex A3 – Water Resource Assessment – Hydrogeology***. This was then used to adapt and refine EMMv1 and to extend the model period up to 2020. Extending the model run period allowed the model to be validated against groundwater level, spring-flow and quarry abstraction data gathered since EMMv1 was issued where excavation at Torr has continued. Changes were made to the model code and setup to enable it to run faster and to allow direct representation of water storage in quarries, which was not possible in EMMv1.

The hydrogeological model was run stochastically during the historical period to derive a range of acceptable model parameters to be used for future scenarios, rather than one “best-fit” calibration. This allowed a range of future predictions to be generated with uncertainty bounds for each scenario. Running the groundwater model multiple times (Monte Carlo analysis) with a range of input parameter sets, allows the uncertainty associated with the model parameters to be assessed and gives confidence in the model predictions.

For future scenario modelling, input time series from the hydrological modelling were selected to represent a median scenario, and scenarios including 1-in-200 year drought, 1-in-500 year drought and 1-in-500 year drought with climate change factors applied. Augmentation flows taken from the reservoir were applied in all scenario runs to support spring-fed water courses during summer months. These augmentation flows were based on analysis of surface water flows and initial discussions with the Environment Agency, and will be subject to further refinement at gate three.

Groundwater inflows and outflows between the reservoir and groundwater were calculated by the model, along with predicted reservoir level, surrounding groundwater heads and baseflow contributions to springs. On average, net losses due to augmentation support to nearby watercourses and leakage from the reservoir equate to approximately 3Ml/d. During periods of reservoir drawdown additional groundwater inflows support reservoir levels, in some cases by as much as 20-25Ml/d. The model results from the 1-in-500 year drought with climate change factors (Figure 4.4) show that, with an expected DYAA reservoir yield of 46Ml/d (after net leakage augmentation losses), a minimum reservoir level between 89m Above Ordnance Datum (AOD) and 96m AOD is likely.

The groundwater modelling shows that although groundwater leakage does occur during periods when the groundwater level is below that of the reservoir, this tends to be when the reservoir level is increasing or at capacity. Groundwater leakage is generally significantly lower than the available inflow from the River Avon, and therefore leakage losses do not have a large impact on reservoir yield. During periods of reservoir drawdown additional groundwater inflows support reservoir levels. The modelling suggests the reservoir will continue to be operational even with anticipated climate change impacts beyond 2070.

The quarry sump level in the recent historical period has reached a current minimum level of 95m AOD. This is equivalent to the original planned reservoir minimum, and close to the target minimum water levels presented in this work based on a 50m drawdown target discussed in section 3.2.3. Hence, the model is an appropriate tool, tested and calibrated against observed data that is within the ranges of the model predictions. The modelling undertaken successfully addresses the key concern arising from the pre-feasibility work and suggests groundwater leakage will not affect the viability of the reservoir operation during future droughts.

Modelled groundwater levels surrounding the reservoir during the drought scenarios also remain within the range of recent observed groundwater levels imposed by quarry dewatering (and hence within the range of the calibration datasets). If the reservoir was to be operated down to a lower minimum level, this would not be the case. Model predictions based on simulated behaviour outside the calibration range should be used with caution and validated with additional data as quarrying progresses.

Figure 4.3: Schematic of hydrogeological model setup with bedrock geology

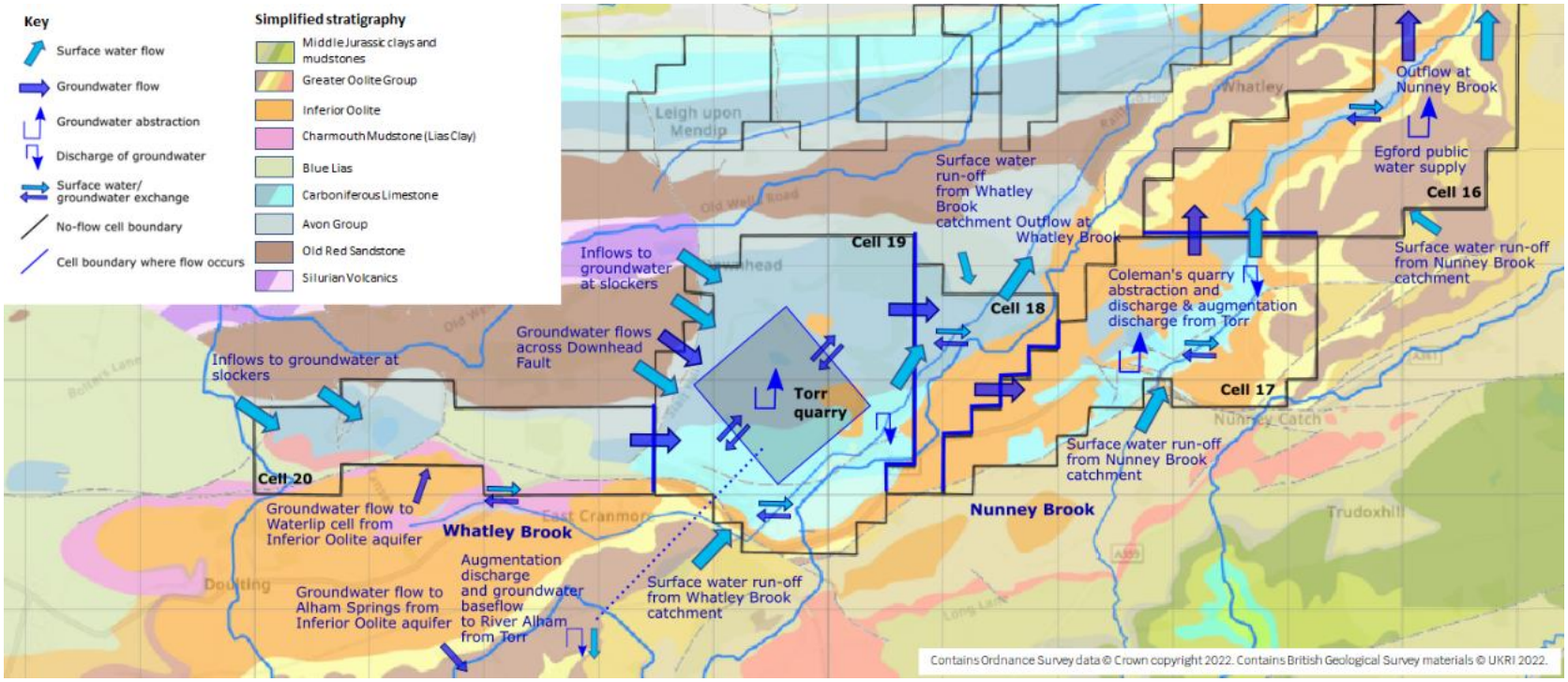
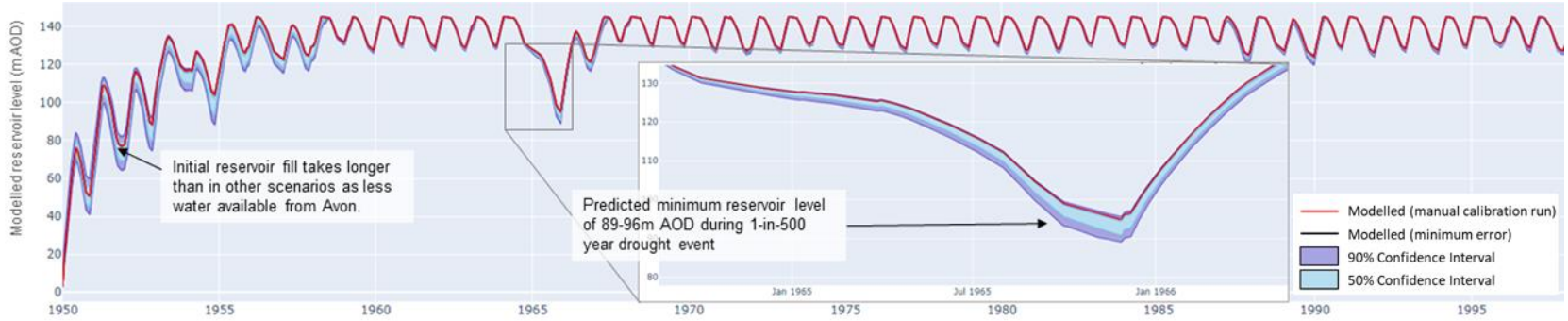


Figure 4.4:Model results for 1-in-500 year drought with climate change factors - predicted reservoir level



In general, limestone aquifers are expected to get less permeable with depth. However, there remains a small risk that further quarry excavation may encounter significant karst features that are connected to the regional system over large distances and where driving heads are different to those modelled. There remains a residual risk that encountering such features may change reservoir leakage rates and reduce reservoir yield.

The Environment Agency recently approved EMMv2, an update to EMMv1 developed to inform planning decisions regarding other quarries in the Mendips. At the time of writing the Environment Agency are looking to commission EMMv3, which is likely to be the regulator's preferred tool for assessing impacts from the Torr Quarry scheme at gate three.

4.3 Long term opportunities and scalability

4.3.1 WRSE and SWW benefit

As shown in section 3.2.2, the yield that can be delivered by the core scheme is largely constrained by the available storage, rather than by the water available for abstraction in the River Avon. Therefore, there are opportunities to increase the potential yield and DO by increasing the storage. This could be achieved by increasing the depth of useable storage assumed at Torr Reservoir and/or by linking several quarries together. The quarry screening process highlighted that there are several alternative quarries however the majority of these have very small storage volumes except for Whatley Quarry, which could provide up to 27MCM.

Hence, opportunities have focused on maximising the storage of the two largest quarries, Torr and Whatley. At 52MCM Torr Quarry has the largest net volume by a considerable margin, however the core scheme yield is based upon only using the top 50m of the proposed 142m deep excavation (28.5MCM) for reasons explained in section 3.2.3. Increasing the depth of useable volume would enable more of the total quarry volume to be utilised. Whatley Quarry could be used to provide an additional 27MCM of storage.

Figure 4.5: Storage-yield curve - potential opportunities

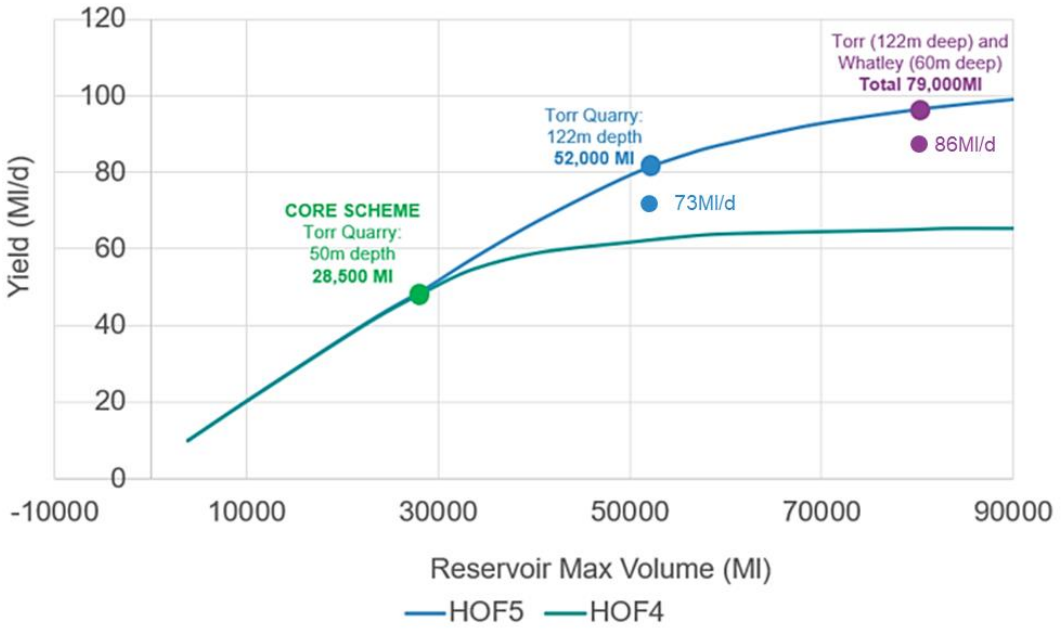
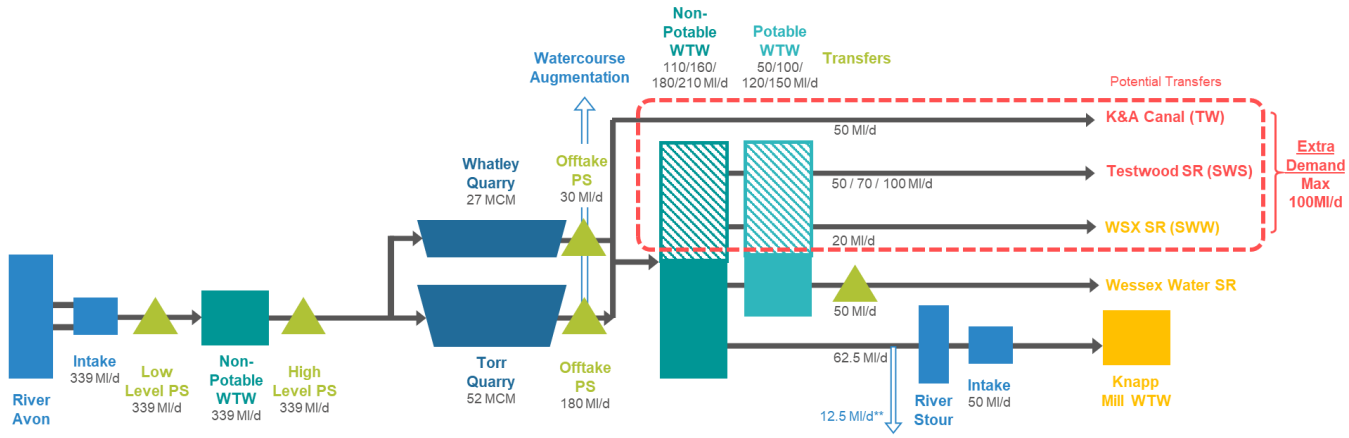


Figure 4.5 shows the storage provided by the core scheme compared to the storage and yield that could be available by maximising the storage at Torr Quarry individually, and also with Whatley Quarry. A 10% reduction to the potential yield has been applied due to the uncertainty with potential reservoir losses for both these scenarios. However, Figure 4.5 also shows that the baseline volume used for the core scheme is at the upper end of what the HOF4 River Avon abstraction limit can support, and hence represents a 'tipping point' at which larger storage volumes would need to be filled supported by the HOF5 abstraction. Note that whilst the graph shows that yield using the HOF4 abstraction rate continues to rise with the storage, capacities greater than around 30MCM start to experience periods of a number of years where the reservoir does not completely fill during winter, which may be undesirable from an operational and water resources management perspective.

The maximum abstraction available at HOF5 is over double the maximum HOF4 flow and would require effectively doubling the capacity of the abstraction, treatment, pumping and pipeline infrastructure upstream of the reservoir to deliver the higher yield. This would represent a significant £/Ml increase unless the storage was significantly increased to maximise the yield. If the core scheme was expanded to use the full HOF5 resource it is anticipated that the additional yield could be used to deliver DO to other regions including WRSE, and/or to meet South West Water demand by displacement of Wessex Water demand in Somerset. A potential scheme is shown in Figure 4.6.

Figure 4.6: Potential yield scheme using HOF5 abstraction with maximum Torr and Whatley Quarry volumes



However, there are considerable uncertainties relating to the availability of storage as the excavation at Torr Quarry is not yet complete, and the hydrogeological feasibility of drawing down the reservoir to deeper levels from an environmental perspective remains uncertain. As a result, these options have not been included in the gate two scheme and are not included in the WCWR or WRSE best value plans, or in the water company WRMPs. High level costs for the options were developed for inclusion in the WRSE investment model for sensitivity modelling in February 2023, which has shown that the options are competitive against other water resource options and should be developed further. This output has been used to develop the gate three activities scope and programme in section 7.

4.3.2 Other opportunities

Several other opportunities have been identified during gate two activities, these include

- **Bournemouth potable transfer** – A potable transfer from Torr Quarry to Bournemouth water has been investigated to identify a feasible transfer corridor, should the non-potable transfer into the River Stour be unacceptable from an ecological perspective.

- **River Stour abstraction/bidirectional transfer** – Initial investigations have been completed to review whether it would be possible to abstract water from the River Stour during high flow periods in winter. This could provide additional resource, and would help reduce the sweetening flow requirements, hence potentially increasing the reservoir yield.
- **Wetland discharge** – There are opportunities to improve the NC and BNG of the scheme through incorporating wetlands at the River Stour discharge. This will be reviewed as part of the Bournemouth Water transfer option.
- **Hydropower pumped storage** – If multiple quarries are proposed to be developed into water storage reservoirs, there may be opportunities to deliver pumped hydropower generation. This will be reviewed if the scheme expands to use Whatley or another quarry for additional storage.

These opportunities will continue to be developed as the scheme progresses at gate three.

4.4 Infrastructure resilience to the risk of flooding and coastal erosion

Unlike an impounding reservoir, the top water level in the proposed reservoir will be approximately 70m below the quarry rim so there is practically no risk of the reservoir overtopping and causing flooding. The scheme could however provide some potential benefits to help reduce flooding downstream of the River Avon abstraction by removing water from the river during high flow periods. Likewise, the opportunity to provide a bi-directional transfer to abstract water from the Stour may also help to alleviate winter flows and should be investigated as this opportunity develops.

The majority of fixed asset locations are situated outside of the Environment Agency's Flood Zones. Only River Avon intake location is recorded in both Flood Zone 2 and 3. All fixed asset locations will be further refined in gate three to minimise flood risks. Further details on surface water a groundwater flood risks during the construction phase are discussed in. ***Annex B1 – Environmental Appraisal Report***

5. Drinking water quality considerations

This section covers the drinking water quality considerations for the core scheme and identifies potential risks to water quality and how these should be mitigated in future gates.

5.1 Introduction

The All Company Working Group (ACWG) approved spreadsheet tool was used to draft the Water Quality Risk Assessments (WQRA), in line with Drinking Water Inspectorate (DWI) and ACWG guidance. Drafted WQRAs were completed for both transfers and were reviewed in collaborative strategic WQRA workshops, with technical representatives present from all partner companies affected by the scheme. The ACWG WQRA risk assessment tool is structured to allow for conversion of risk analysis into a Drinking Water Safety Plan (DWSP) format once the project reaches a sufficiently advanced stage.

During drafting, a representative high-level view of the parameters which are likely to need treatment at this stage of design were identified through analysis of water quality data and relevant DWSP information. From this, a list of limiting hazards specific to each option was produced and refined. In the workshops, the water quality experts agreed risk scores for the limiting hazards and discussed relevant control measures. These control measures and residual risks were recorded alongside any recommendations the drinking water quality experts provided for improvements to the WQRA process in subsequent stages.

Findings from the workshops are summarised in ***Annex C – Drinking Water Risk Assessment Report***. This report also outlines the next steps for the WQRA process in gate three including future stakeholder engagement plans and how to address residual risks through conducting additional technical assessments. Data gaps identified in the WQRA process are being addressed through a water quality monitoring programme which commenced in Summer 2023. After the WQRA report was completed, a draft was sent to the DWI for comment and subsequent concerns were addressed in the final DWRA report.

5.2 Drinking water quality assessment conclusions

Conclusions from the collaborative WQRA workshops that included drinking water quality representatives from all partner companies are summarised below:

- Further water quality data is required from the River Avon abstraction location, at the quarry (Green Farm spring) and at the River Stour discharge location. It is proposed that this is collected through a water quality monitoring programme at these sites. The programme will include data collection for physical parameters, nutrients, metals, organic compounds, inorganic compounds, pathogens, radiological parameters, pH and emerging hazards such as perfluorinated alkyl substances (PFAS). Further data will allow water quality assessments to be completed in gate three which are more representative of actual water quality risks, from which appropriate mitigating treatment technologies can be added to the gate two concept designs if necessary.
- Additional limiting hazards identified for study by the water quality experts in the collaborative workshops included arsenic, metaldehyde, manganese, ammonia, dissolved oxygen, Geosmin/2-Methylisoborneol (MIB), bromate, bromide and radioactivity (Alpha, Beta, Tritium).
- Nitrate/ammonia treatment is not proposed at this stage. However, further data collected through the water quality monitoring programme will allow the necessity of treatment to be reviewed to ensure no exceedances in drinking water quality levels.
- According to information provided by water quality experts, there are dirty/discoloured water risks associated with iron and/or manganese deposits in the distribution network. These existing risks are currently monitored and managed and will be continuously monitored with the implementation of the SRO.
- Parameters such as odour, taste and changes in source type should remain as risks due to acceptability issues post-treatment at the consumer stage. This is because of uncertainty around customer acceptability, as it is unlikely there will be immediate categorical acceptance of the change in water after the SRO is implemented. At this early stage in scheme development, it was deemed inappropriate to go out to public consultation considering option construction is constrained by availability of the quarry for conversion into a reservoir and therefore changes to consumer water are not likely to occur for almost 20 years. In addition to this, data gaps must first be filled to produce a more accurate prediction of changes to consumers' water quality. It has been recommended that once further iterations of the WQRAs and water chemistry modelling have provided a sufficiently accurate prediction of changes to water quality, customer engagement surveys would be used to communicate these changes to consumers.
- Types of land use around the catchment area and Torr Reservoir should be further investigated in future WQRAs to incorporate risks from industrial sites, farmed land and transport links. Examples would be heavy metal leaching, radiation, industrial chemicals, road runoff and specialised fertilisers. These activities may not be accurately reflected in the available water quality data and so this should be explored further in gate three.
- Operational variations of the transfer options, including how sources are utilised, require further exploration in the next iterations of the WQRA. For example, abstraction profiles from the River

Avon and Torr Reservoir may impact on the concentrations of limiting hazards depending on the time of year and volume abstracted. Climate change may also impact the concentrations of parameters. Changes in precipitation patterns could affect runoff and erosion which would increase the rate of sediments, nutrients and pollutants being transported into waterbodies. Prolonged drought scenarios would increase concentrations of pollutants in water bodies and higher temperatures could reduce dissolved oxygen levels and promote toxin-producing algal blooms.

- The need for mixing within Torr Reservoir should be reviewed to ensure there is sufficient circulation in the reservoir to prevent stratification and encourage oxygenation.
- An assessment of the change in chloride, sulphate, and alkalinity levels between the River Avon and the River Stour should be considered. This will allow the risk of corrosivity within the distribution networks supplied by the River Stour to be assessed.

Outputs from the drinking water quality risk assessment process are one aspect that have driven the concept design of the water treatment works proposed as part of this scheme. A potable treatment process capable of mitigating against medium and high-risk limiting hazards identified in the WQRA process has been proposed, as detailed in ***Annex A4 – Conceptual Design Report***. This Torr Reservoir WTW will ensure water is treated to the levels prescribed in the Water Supply (Water Quality) Regulations 2016 and will comply with regulation 31 material considerations to ensure safe water is delivered to consumers. As the WQRA process progresses, the concept designs will also be reviewed to ensure an appropriate level of treatment is provided.

The concept design considerations and the limiting hazards studied in the WQRA process align with those discussed in the DWI's Long Term Planning Guidance[8] and in the EA's Drinking Water Protected Areas (DrWPAs) report[9]. The DrWPA report focuses on the importance of protecting Drinking Water Protected Areas to ensure resilience to future pressures and climate change. The WQRA process was completed in conjunction with the Water Framework Directive (WFD) assessment outlined in section 6.1. Common data sets were analysed to predict the impact of new influent water on the Torr Quarry groundwater and the River Stour, with the aim to determine appropriate controls for protecting these DrWPAs.

6. Environmental assessment

Environmental appraisal of the core scheme includes a desk-based assessment across key environmental specialisms, Water Framework Directive (WFD) assessment, informal Habitats Regulations Assessment, Strategic Environmental Assessment (SEA), Biodiversity Net Gain (BNG), Invasive Non-Native Species (INNS) Risk assessment, and carbon analysis. The appraisal also includes an assessment of Wider Benefits and Cumulative Impacts. Each of the assessments undertaken are described in the following sections.

6.1 Water Framework Directive

The Level 1 and Level 2 WFD assessments explored both indirect and direct effects of the scheme. The Level 1 assessment utilised an automated spreadsheet assessment tool supplemented with further expert judgment, which identified seven waterbodies with the potential to be affected by the scheme that were therefore progressed to the Level 2 detailed assessment. These waterbodies were:

- Bristol Avon (By Bk to Netham Weir) (GB109053027371)

[8] Drinking Water Inspectorate, *Price Review Process*. Available Online: https://www.dwi.gov.uk/water-companies/price-review-process/ [accessed April 2023]
[9] Environment Agency, *Drinking Water Protected Areas: challenges for the water environment* (June 2022)

- Whatley Bk – source to conf Mells R (GB109053021990)
- Mendips Groundwater (GB40901G804600)
- Nunney Bk source to conf Mells R (GB109053022000)
- Maiden Bradley Bk – source to conf R Frome (GB109053022090)
- Frome – source to conf Maiden Bradley Bk (GB109053022080)
- Stour (Lower) (GB108043011040)

The Level 2 assessment concluded that the scheme will have a direct impact on WFD supporting conditions in the Mendips groundwater body, associated with changes in water quality as a result of the new discharge into the quarry and drawdown operation impacting groundwater levels and flow in the surrounding aquifer due to the hydraulic connectivity between the reservoir and the aquifer. It is also noted that works associated with the SRO will occur immediately adjacent to the Asham Wood Site of Special Scientific Interest (SSSI)/Mendip Woods Special Area of Conservation (SAC) – a groundwater dependent terrestrial ecosystem (GWDTE).

Further design detail and mitigation will be required beyond gate two to ensure that there is no risk of deterioration to the sites due to the construction of the scheme, and treatment of the water prior to discharge into the quarry site.

It is also noted that further WFD assessment would be required at gate three and for future planning/consent applications, to improve the confidence of certainty of WFD risks outlined in the gate two WFD Level 2 assessment. Further areas to be assessed include, but are not limited to:

- Further assessment of the impact of water discharge into Torr Quarry on groundwater levels and water quality, and potential implications on nearby watercourses, abstraction boreholes and the GWDTE of Asham Wood SSSI/Mendips Wood SAC.
- Detailed hydrological assessment of the impacts of changes in groundwater levels due to construction dewatering on flow in the streams which it supports through baseflow.
- Additional groundwater investigation (including monitoring) to understand groundwater levels across the route and how they interact with the pipeline during operation of the scheme. Further investigation should consider where groundwater levels are likely to intersect with the pipeline, calculation of whether the pipeline could form a barrier to groundwater flow (and potential to increase flood risk), and identification of additional mitigation if required.
- If dewatering is discharged to surface watercourses to help maintain flow, there is the potential for short-term impacts on water quality. Water quality analysis is required to understand the relative quality of groundwater and surface water in these areas and identify the significance of any changes in water quality in the watercourses.
- Consideration of non-dig crossings for the more sensitive ordinary watercourses.
- Hydro-ecological assessment of the impact of the new surface water discharge into the River Stour on temperature and dissolved oxygen, and therefore on biological elements in the river, including a cumulative assessment with other schemes affecting the Stour (e.g. Water Recycling and Transfers SRO).

A three year monitoring strategy will be implemented to inform the gate three assessments, this will include groundwater quality from a site near the quarry that is considered to be representative of the water quality in the aquifer. The Rivers Avon and Stour will also be sampled for a range of determinands including temperature, to inform the assessment of temperature on the Stour.

Full details of the WFD assessment may be found in ***Annex B3 – Water Framework Directive***.

6.2 Informal Habitats Regulations

An informal Habitats Regulations Assessment (HRA) Stage 1 screening has been undertaken, determining the potential for likely significant effects (LSE) on European Sites during construction and operation of the scheme. A Stage 2 Appropriate Assessment (AA) was also then undertaken based on the sites identified and screened in at Stage 1.

The Stage 1 Screening identified LSE for 24 designated sites, which were carried forward for assessment at Stage 2. The Stage 2 AA concluded that the majority of these sites were not expected to experience any LSE during construction effects providing outlined mitigation was adhered to. These mitigation measures include, but are not limited to:

- Best practice on site in line with Construction Industry Research and Information Association (CIRIA) C741 Environmental good practice on site guide, Environment Agency's Pollution Prevention Guidelines (PPGs) (PPG1: General Guide to Prevention of Pollution; PPG6: Pollution prevention guidance for working at construction and demolition sites), BS 5228-1:2009+A1:2014 (The British Standards Institute, 2008) to avoid significant effects due to noise and Guidance Notes for the Reduction of Obtrusive Light (Institute of Lighting Professionals, 2011).
- Biosecurity measures to ensure appropriate control of INNS at source.
- Works should be undertaken outside the migratory periods to avoid effects on qualifying bird species, if possible.
- Silt screening around the area of works to limit the movement and redeposition of material.
- Development of a Construction Environmental Management Plan (CEMP) which will include all the above proposed mitigation measures and any further measures identified at the project stage

As a result of the Stage 2 AA, it was identified that operational LSE could not be ruled out for four designated sites which would therefore require further assessment post gate two: Severn Estuary Special Protection Area (SPA), SAC and Ramsar, Mendip Woodlands SAC, Solent and Dorset Coast SPA and Dorset Heathlands SPA. Further areas to be assessed include, but are not limited to, assessment of:

- the effects of the abstraction on the River Avon, needed to reduce uncertainty and determine the effects of the changes in the water levels and flows on the Designated Sites located in the Severn Estuary downstream.
- the effects of the new reservoir on the groundwater and surface water, needed to reduce uncertainty and determine any changes to water levels and flows potentially affecting the hydrological processes underlying the Mendip Woodland SAC.
- the effects of the outfall in the River Stour, needed to reduce uncertainty and determine the effects of the changes in the water levels and flows on the Solent and Dorset Coast SPA located downstream.
- the effects of the new abstraction from the River Stour, needed to reduce uncertainty and determine the effects of the changes in the water levels and flows on the SPA located downstream. A detailed review of the baseline ecological data is also recommended, as well as climate change scenario analysis to account for mid and long-term effects of saline intrusion in the Dorset and Coast SPA and its potential effects on functionally linked land used by qualifying bird species.
- potential localised residual effects resulting from the construction of the air valves located in the boundary of the Dorset Heathlands SPA. Further studies are recommended to better understand the potential effects on this Designated Site and its qualifying bird species.

Full details of the HRA may be found in ***Annex B2 – Habitats Regulatory Assessment***.

6.3 Environmental appraisal

6.3.1 Strategic Environmental Assessment

A Strategic Environmental Assessment (SEA) has been undertaken at gate two, to update the gate one SEA in light of the scheme's design development. A summary of the conclusions identified in the SEA is included below. The full SEA is available in ***Annex B4 – Strategic Environmental Assessment***.

Table 6.1: SEA summaries

Positive Effects	Negative Effects
Major positive effects: Major positive effects were identified for Biodiversity at both construction and operation relating to habitat creation at the reservoir. Effects were also identified for the operational phase of the Water objective, due to provision of a more reliable water supply **Moderate positive effects:** Moderate positive effects were identified for Landscape at the operational phase, due to improved visual amenity at the reservoir, and associated recreational activities relating to Population and Human Health. **Minor positive effects:** Were identified for Climatic Factors and Population and Human Health (operational) due to increased resilience of water supplies in the area. Minor positive effects were also identified due to the use of brownfield site for the reservoir (for the Material Assets criteria).	**Major negative effects:** Identified for construction and operation (pre and post-mitigation) for Biodiversity due to impacts on Natura 2000 sites, and for Climatic Factors due to increased embodied carbon produced during construction. Historic environment also experienced major negative effects (pre and post-mitigation), due to the potential for changes to the aquifer that supply the Bath Hot Spring and the proximity of WTW and pipeline construction to Bath WHS. **Moderate negative effects:** On soils (pre-mitigation) due to loss of Grade 3 agricultural land, as well as disturbance of contaminants given the close proximity to landfill sites. Landscape is also likely to experience moderate negative effects relating to impacts on the Cotswolds Area of Outstanding Natural Beauty (AONB). Water also had such impacts (pre-mitigation) due to flood risk and risks to WFD. Potential for moderate effect due to the scheme intersecting some transport assets (pre-mitigation). Moderate negative effects are also present during construction (pre and post-mitigation) relating to Historic Environment and the proximity of the new WTW and pipelines to the City of Bath WHS. **Minor negative effects:** On soils (post-mitigation) due to loss of Grade 3 agricultural land, air quality (pre and post-mitigation) during construction and water relating to post-mitigation flood risk. Minor negative effects for Historic Environment due to potential loss of scheduled monuments around the new reservoir and associated infrastructure. Other impacts relate to impacts on health and wellbeing of the local community during construction and increased resource use and waste production.

6.3.2 Environmental Appraisal Report

A desk-based appraisal of the residual key environmental aspects has been carried out in the Environmental Appraisal Report (EAR). The full appraisal is available in ***Annex B1 – Environmental Appraisal Report*** and a summary of the conclusions identified is included in Table 6.2 below.

Table 6.2: Environmental appraisal summaries

Assessment/Topic	Environmental Appraisal Summary
Biodiversity, flora and fauna	• Potential for significant effects on Designated Sites for both construction and operational phases, some of which are internationally designated and/or GWDTE, including the Mendip Woodland SAC • Potential direct impacts on Habitats of Principal Importance (HPIs), Local Wildlife Sites (LWS) and Sites of Nature Conservation Importance (SNCIs) • Potential indirect impacts on Ancient Woodlands during construction, direct impacts are avoided through route alignment and no-dig construction
Soils	• Potential for soil contamination during construction • Temporary loss of agricultural land during construction and some permanent loss of land due to new permanent surface assets
Water	• Potential for impacts to the aquifer surrounding the quarry due to interactions with the reservoir • Several risks identified relating to flood risk during both construction and operation, as the pipeline route will cross areas of Flood Zones 2 and 3 • Possible adverse impacts associated with groundwater flow as a result of new buried pipeline

Assessment/Topic	Environmental Appraisal Summary
	• Potential for interaction with Source Protection Zones (SPZs), which would be crossed by the pipeline to the Wessex Water service reservoir • Positive impacts relating to increased water reliability and resilience
Air Quality	• Potential for air quality impacts during construction due to plant and machinery, although operational impacts are not anticipated and there are no air quality management areas in proximity of the scheme
Climatic Factors	• Anticipated to be increased levels of carbon generated from materials used to construct the new infrastructure • Adverse impacts identified through increased extreme weather events • Positive impacts from the discharge into the River Stour during low flows
Landscape	• Potential for impacts to scenic quality, landscape condition, and/or tranquillity during construction • Permanent above ground structures are likely to adversely impact 'high sensitivity' receptors, including the Cotswolds AONB • Anticipated vegetation clearance for construction could affect landscape character
Historic Environment	• Potential for major negative impacts during construction due to the proximity to the City of Bath World Heritage Site and the potential for changes to the aquifer that supplies the Bath Hot Springs, which will be investigated further at gate three • A number of listed buildings in proximity to several construction boundaries • Potential impacts to Merehead Scheduled Monument, which is located adjacent to Torr Quarry • Risk of impacting upon previously undiscovered archaeological remains during excavations
Population and Human Health	• Benefits from increased water supply security • Recreational benefits identified associated with the new Torr Reservoir • Potential for short-term adverse impacts on health and wellbeing, from increased noise, vibration and visual impacts on the local community during construction
Material Assets	• Benefits surrounding the use of an existing brownfield site for the reservoir • Potential impacts where the proposed infrastructure intercepts major roads, railway lines, Public Rights of Way and national cycle routes • There is potential for increased noise at new assets such as WTW or Pumping Stations • Operational benefits such as increased water security within Bournemouth

6.4 Other considerations

6.4.1 Natural Capital Assessment

A Natural Capital Assessment (NCA) was undertaken on the scheme in accordance with the Water Resources Planning Guideline[10] (WRPG) and Enabling a Natural Capital Approach (ENCA) requirements. The impact of the scheme was reported quantitatively against the following ecosystem services criteria:

- Carbon Sequestration
- Natural hazard management
- Water purification
- Biodiversity and habitats
- Air pollutant removal
- Recreation and amenity value
- Food production

The assessment concluded that the scheme would cause both temporary and permanent loss of natural capital stocks although best practice mitigation methods, such as directional drilling and reinstatement/compensation of habitat would mean that most natural capital stocks would have little to no change post-construction.

[10] Environment Agency, *Water Resources Planning Guidance* (July 2020). Available Online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/903694/Water_resources_planning_guideline.pdf

The NCA should be further refined at gate three, taking into account design development, finalised feasibility and planning investigations.

6.4.2 Biodiversity Net Gain

The Biodiversity Net Gain (BNG) assessment undertaken at gate one has been updated for gate two in line with the BNG 3.1 metric[11]. A biodiversity baseline has been developed by assigning Biodiversity Units to the pre-construction land use according to the habitats present within the scheme boundary. This has utilised existing datasets including the Priority Habitat Inventory and designated sites records (SSSI, SAC, SPA, and Ramsar) to identify areas with high biodiversity importance.

The BNG assessment concluded that the reservoir component of the scheme would result in a BNG gain, but without mitigation the overall scheme would likely to result in a loss of BNG habitat units due to permanent loss of natural capital assets. Mitigation and enhancement opportunities for the scheme have been suggested to reduce loss of BNG habitat units and introduce net gain.

A Phase 1 Habitat survey is likely to be required at later gate stages to determine an accurate baseline once the final scheme design is available, in order to determine the on-site and off-site mitigation, enhancement and creation required to achieve at least 10% net gain.

6.4.3 Invasive Non-Native Species

An Invasive Non-Native Species (INNS) risk assessment has been undertaken, considering the following objectives:

- To establish if the scheme will introduce hydrological connections between previously isolated catchments
- To identify INNS within an appropriate study area to understand the current INNS distribution
- To use the SRO Aquatic INNS Risk Assessment Tool (SAI-RAT) to quantify the INNS risk associated with the scheme based on conceptual design information
- To review potential biosecurity options for implementation by the client or other relevant stakeholders to mitigate INNS risk associated with the scheme

The assessment was undertaken using the Environment Agency recommended assessment tool (SAI-RAT), ensuring compliance with the relevant national legislation. The full INNS risk assessment is available in ***Annex B1 - Environmental Appraisal Report***.

Following SAI-RAT guidance, the assessment concluded that the reservoir filling transfer would not create a new connection to an isolated WFD operational catchment, as both the proposed River Avon abstraction point and Torr Quarry lie within area 35 of the Environment Agency's *Invasive Non-Native Species Isolated Catchment Mapping* (Environment Agency, 2018).

Torr Quarry and proposed discharge location on the River Stour are located in different WFD operational catchments, with the discharge being proposed within area 31 of the Environment Agency's *Invasive Non-Native Species Isolated Catchment Mapping* (Environment Agency, 2018). In respect of connectivity this catchment is classed as 'receiving to river or reservoir' and is therefore not recognised as isolated. However, there is some uncertainty as to the actual current connectivity and whether this enables the movement of INNS between these catchments. As such, it is recognised that further investigation will be required during gate three to confirm the current hydrological connectivity, and therefore fully assess the additional risk presented by the scheme.

[11] The BNG 4.0 metric was issued 28 March 2023, after the BNG assessment for Mendip Quarries was carried out and was therefore not used for the gate two assessment. BNG calculations for gate three will be undertaken using the latest metric available at the time of assessment.

This will also be informed by the three year environmental monitoring programme that commenced in summer 2023, detailed in ***Annex B6 – Monitoring Strategy***.

The proposed River Stour abstraction and transfer destination at Knapp Mill WTW are not currently located within the same catchment. However, it is important to note that abstracted water would be treated to a potable standard before it enters the public water supply and no raw water would be discharged into a natural water system.

INNS were recorded within most of the study area, with the exception of the transfer to the Wessex Water Service Reservoir. The assessment concluded that the transfer of non-potable water from the River Avon to Torr Reservoir would present a higher INNS risk than either the transfer of raw water from Torr Reservoir to the River Stour or from the River Stour to Knapp Mill WTW. INNS risk scores for the Newton Meadows WTW and Torr Quarry WTW were low relative to that identified for Torr Reservoir due to potential for public access and recreational activity at the reservoir. For safety and biosecurity purposes it may be that public access to the reservoir water body needs to be limited during operation.

A conservative approach has been taken to the conceptual design of treatment processes to mitigate the risk of INNS transfer. A Rapid Gravity Filter (RGF) treatment process is proposed to treat water abstracted from the River Avon before transfer to the quarry reservoir. It is known RGFs in conjunction with coagulation of raw water are effective at removing cryptosporidium oocysts in the range of 3-5um and so are also likely to be effective at removing INNS. Further treatment would not be considered necessary or practicable at this stage of design for the non-potable WTW at Newton Meadows. A dissolved air flotation, coagulation and RGF process is included in the Torr Reservoir WTW, which should also be capable of mitigating against INNS transfer to the River Stour. It is understood that industry research on treatment processes to address INNS is planned and the results of this work would be factored into the scheme design as the design of the scheme progresses.

6.5 Carbon

A carbon assessment has been carried out in accordance with the WRPG[12] and has followed the relevant guidance for calculating and reporting capital, operational and whole life carbon emissions quantitatively, as well as calculating the cost of carbon emissions. The carbon assessment methodology has followed PAS2080[13] principles in its carbon management approach through the emission reduction hierarchy: build nothing, building less, build clever, build efficiently. The full assessment is provided in ***Annex B6 – Carbon Report***.

From the carbon quantification, exploration of the areas for reduction at gate three has been addressed in line with the ACWG principles as well as the potential impacts of the opportunities being quantified. For a reservoir scheme of this size, the use of an existing quarry void to form the reservoir has already contributed to significant carbon savings from the reduction in earthworks. Where aspects of the design are unable to reduce carbon, reasoning has been provided as to why this is infeasible.

The whole life carbon, shown in Table 6.3 below, reports 302,700 tCO2e for the scheme. This is predominantly from the capital carbon in the construction, which has been broken down in Table 6.3 and capital replacements of the scheme which includes the embodied carbon of materials and

[12] Environment Agency, *Water Resources Planning Guidance* (July 2020). Available Online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/903694/Water_resources_planning_guideline.pdf
[13] Construction Leadership Council, *Guidance Document for PAS 2080*. Available Online: https://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2019/06/Guidance-Document-for-PAS2080_vFinal.pdf

construction efforts. Whereas the contribution from electricity emissions contributes the least to whole life emissions at 6.9% which is expected given the decarbonisation of the energy grid. The full results are below and presented for an 80-year time frame.

Table 6.3: Whole life carbon assessment summary

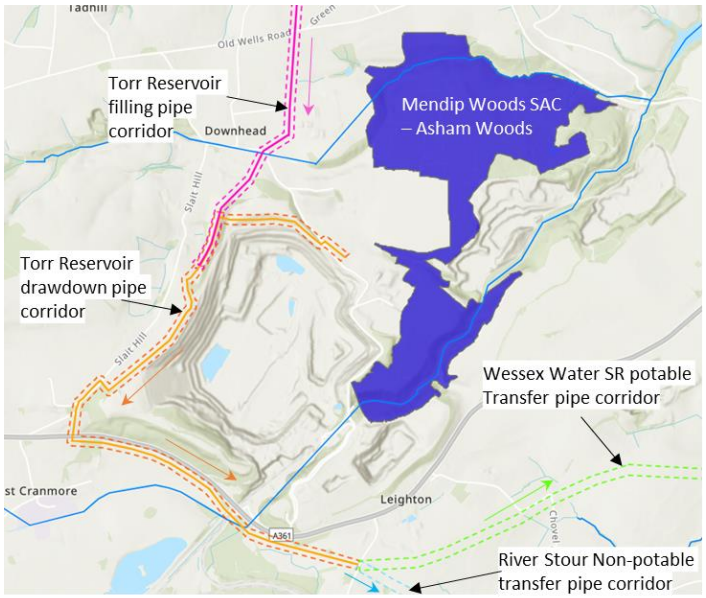
Category		tCO2e	% of total emissions
Capital (tCO2e)	Torr Reservoir Resource	81,900	38.1%
	WW Transfer	10,700	
	BW Transfer	22,700	
Capital replacements (tCO2e)		65,200	21.5%
Operational electricity (tCO2e)		20,900	6.9%
Operational chemicals (tCO2e)		68,700	22.7%
Land use change (tCO2e)		32,600	10.8%
Total (tCO2e)		302,700	

6.6 Conclusion

6.6.1 Summary of assessments

The design work that has already taken place has avoided sensitive receptors such as ancient woodland, individual ancient trees, veteran trees and trees with preservation orders, designated nature conservation sites (SACs and SSSIs), Listed Buildings and Scheduled Monuments. A key potential adverse effect identified at gate one was habitat loss in the Mendip Woodland SAC, which lies immediately adjacent to the quarry boundary. However the gate two design has progressed and all infrastructure has been routed to the west of the quarry, which will therefore avoid any habitat loss in the SAC and linked ancient woodland (see Figure 6.1 below).

Figure 6.1: Location of scheme infrastructure in relation to Mendip Woodland SAC



Source: Service layer credits for base mapping: Esri, CGIAR, USGS, Esri UK, Esri, HERE, Garmin, FAO, NOAA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS, Esri, USGS. Data Sources: © Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right 2021.

The environmental and social appraisal has identified some adverse effects that remain, of which the key impacts requiring further investigation are summarised below in section 6.6.2. However, it

is considered that with further assessment and investigation appropriate mitigation is likely to be possible that will either avoid or reduce these effects to be non-significant.

6.6.2 Recommended activities beyond gate two

The activities beyond gate two would be influenced by the programme for implementing the scheme. As the environmental and social landscape is subject to change, there are some activities that would not be worthwhile carrying out until closer to the commencement of the formal consenting process. However, activities that could be prioritised include:

- Specific work on routing and siting, informed by site walkovers of sensitive receptors and qualifying features of designated sites if appropriate, particularly focusing on the location of above ground assets and pipeline routing to avoid sensitive receptors.
- Optioneering on reducing habitat loss and deliver BNG and Consider opportunities to create and improve habitat on-site and off-site through local schemes, Nature Recovery Networks and wildlife corridors.
- Hydrogeological appraisals of GWDTE locations, for works in or near SPZ1 and SPZ2, and for works that could affect the aquifers supplying the Bath Hot Springs WHS.
- Integrating biosecurity measures and resolving uncertainty about the connectivity of the two river catchments to ensure the scheme design incorporates the appropriate level of INNS treatment.
- There should be ongoing engagement with stakeholders.

7. Programme and planning

This section summarises the proposed planning, consents and procurement strategies for the core scheme, alongside an overview of the key risks and mitigation measures carried forward to gate three. This has informed the project plan and gate three proposals which aim first to progress key activities common to the core scheme and future opportunities to ensure that all potential options are considered.

7.1 Overview of planning and land strategy

Annex D1 - Planning and Land Strategy has been prepared following the response from RAPID to the gate one submission as well as Section 7.2 (s7.2) of the RAPID gate two guidance[14] (12 April 2022).

In reviewing this strategy it should recognised that the Mendips SRO scheme is a novel solution and therefore, as with the gate one submission, the level of information provided may be less defined than in other solutions as the feasibility of the scheme is still being assessed. As a result, the work at gate two has focused on confirming the viability of the scheme rather than detailed development. However, in preparing this strategy we have sought to meet the requirements set out in the gate two guidance and signpost future activities for post gate two. Preferred planning route

The gate two Planning and Land Strategy report identified and assessed two main consenting routes for Mendip Quarries SRO – namely planning permission under the Town and Country Planning Act 1990 (TCPA) or a Development Consent Order (DCO) under the Planning Act 2008 (PA2008). The report includes a breakdown of the two main routes with different configurations.

[14] RAPID, *Strategic regional water resource solutions guidance for gate two* (2022). Available Online: https://www.ofwat.gov.uk/publication/strategic-regional-water-resource-solutions-guidance-for-gate-two/

The preferred consenting route for the scheme is a DCO application for the reservoir element and the water transfers and other elements of the scheme to be consented as associated development. This route provides a single consent for the scheme, wrapping up multiple consents, permissions and powers including providing compulsory land acquisition. It also provides greater programme certainty through a statutory timetable. There are also opportunities to build in flexibility to the scheme through the order. It is expected that a Section 35 (s35) Direction from the Secretary of State (SoS) will be required in order to use the DCO route as the scheme does not meet the qualifying thresholds for water Nationally Significant Infrastructure Projects (NSIPs) as defined in the PA2008[15].

Consent via a s73 TCPA application for the reservoir and a DCO is also explored as it could offer benefits in terms of securing consent for the reservoir, however the Local Planning Authority may deem this route unsuitable due to the scale of change proposed and equally a single consent via a DCO for the whole scheme would reduce complexity associated with seeking consent through multiple regimes.

The DCO or TCPA permission is considered a primary planning consent. In addition to the primary consent a number of other Consents, Licences, Authorisations and Permits (CLAPs) are required. An initial list has been produced which includes consents from Natural England (SSSI consent, EPS, CRoW), the Local Planning Authority (LBC, SMC, TPOs) and other bodies including Heritage England, Environment Agency and Network Rail.

7.1.1 Land lifecycle and strategy

The land strategy at gate two involves land referencing to understand all land and interested parties directly or indirectly affected by the proposed scheme, development of a landowner journey document, non-contact referencing and review of special category, crown land review and statutory undertakers land as well as contact referencing via land interest questionnaires, and site enquiry.

The DCO submission requires the preparation of a Book of Reference, Land Plans and Special category and crown land plans. A land management system is recommended to meet the industry standard of diligent enquiry required by the DCO process. An initial review of land titles, undertaken with a 20m buffer applied to the scheme, has identified over 400 affected parties. ***Annex D1 – Planning and Land Strategy*** and ***Annex D2 – Planning and Land Strategy Peer Review*** provide further detail on the land strategy for the scheme.

Agreements will be required with highway and rail authorities to route pipelines under their infrastructure. One of the benefits of the DCO process is that it provides powers of compulsory acquisition, which is particularly relevant for the scheme where there are multiple land interests. Land acquisition and easement requirements will therefore be incorporated in the DCO application for the scheme.

7.1.2 Customer journey

The customer journey has been explored from the point of view of those with land interests affected by the scheme and is addressed in ***Annex E - Stakeholder Engagement Strategy***. Consideration of the process of engaging with land interests is set out in ***Annex D1*** and ***Annex D2.***

We will work with landowners to understand any constraints, concerns or opportunities to alter design to minimise the impacts to the landowner and the local environment. The landowner journey

[15] Reservoirs within England, constructed by a water undertaker, with storage exceeding 30Mm^3 or with a deployable output of more than 80Ml/day qualify as NSIPs

document would be an important reference document and would include information to better aid landowners in understanding the process.

7.1.3 Governance and resource planning

The DCO process is streamlined by focusing the development of all aspects of the proposal in the pre-application phase. The process includes statutory deadlines to ensure the timely delivery of decisions. If a s35 Direction is required, the process requires submission of a request to the SoS with a response required in 28 days. Engagement with Planning Inspectorate for Nationally Significant Schemes (PINS) and SoS will be required prior to any formal submission. The DCO process is resource intensive with the need to establish governance procedures to manage effective delivery of the application.

7.1.4 Procurement routes and the DCO

Two procurement routes, Direct Procurement for Customers (DPC) and Specified Infrastructure Projects Regulations (SIPR), have been explored with an assessment of the implications on the proposed consenting route. The DPC route would require a s35 Direction from the SoS, as the CAP (Competitively Appointed Provider) appointed would not be a licenced water undertaker. The SIPR route would provide a licence to an appointed body which would then be a licenced water undertaker and therefore the scheme assessed would meet the thresholds for a DCO. The DPC route with a CAP appointed is currently the preferred procurement route and therefore it is expected that a s35 Direction will be applied for. The procurement strategy is summarised in section 7.2.

7.2 Procurement, ownership and operational strategy

7.2.1 Assessment for DPC

Table 7.1 summarises the assessment for DPC.

Table 7.1: Assessment for DPC

Option	Size (£200m totex)	Discreteness	Value for Money	Overall Recommendation
Core scheme	Pass	Pass	Pass	Potentially suitable for DPC

The overall assumption at gate two is that the entire scheme is suitable for delivery using the DPC model. Overall, it appears to be the case that the project meets the thresholds for DPC:

- Ofwat's PR24 DPC size threshold of £200m is met
- A high-level qualitative analysis of VfM was undertaken which indicates that VfM can be achieved. The latest guidance from Ofwat has stated that they 'no longer require companies to submit VfM assessments during the early stages of the DPC process' and therefore the analysis remained qualitative.

7.2.2 Delivery parties

Based on the results of the DPC assessment, the current packaging strategy is for all assets under the core scheme to be delivered by a CAP under a single DPC contract. This approach will be reviewed at future gates as the scope of the scheme matures and further DPC precedents are available.

7.2.3 Contractual and operational arrangements

Figure 7.1: Contractual and operational arrangements

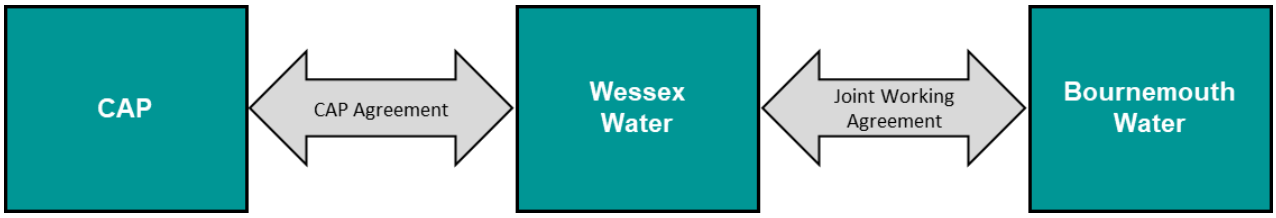


Figure 7.1 shows an indicative contractual arrangement for the DPC, detailed below:

- **CAP Agreement** - sets out the services the CAP would deliver and the basis on which they would be paid. The charges would be based on the tender submission secured from the competitive procurement process.
- **Joint Working Arrangements:**
  - Would allow Wessex Water (or South West Water) to act as the promoter of the project
  - Contractual terms with the CAP, including obligations to supply are passed down to the party that is not the promoter through a Joint Working Agreement
  - A Joint Working Agreement is similar in approach to a Bulk Supply Agreement in that all commercial rights and obligations would be allocated between the parties
  - Appointees may need to seek a licence amendment to ensure that liabilities of Appointees are carried forward in the event of a special administration so that the Appointees are protected against credit risk of one another

Operation of the scheme will require coordination between the CAP, Wessex Water and Bournemouth Water. There are several alternative arrangements that may be suitable, for example bilateral communication between each party as required, or a System Operator relaying instructions to all parties.

While a system of bilateral communications may work in most eventualities, there is a concern as to how it would respond to disruptions in any part of the chain. Therefore, a System Operator may be required.

As the regional and individual WRMPs develop and the plans firm up, including whether there are any additional beneficiaries of the SRO, the contractual arrangements and cost recovery mechanisms will be revisited.

7.2.4 DPC tender model

For the proposed scope, the most appropriate tender model for appointing the CAP has been considered. Potential alternatives include:

- **Early model** - schemes would be tendered out once the preferred solutions have been identified by incumbent companies. The tender and handover of assets would be at the 'initial solution design' stage.
- **Late model** - schemes would be tendered out after incumbent companies obtain consent and initial design has been completed. The tender and handover of assets would be at the 'detailed design of assets' stage.
- **Split model** - scheme would be tendered out in two separate tenders. One for the design and second for the construction and operation of the asset. Under this model, there would be two handover points, one at the 'initial solution design' stage and second at the 'detailed design of assets' stage.
- **Separation of construction and financing** - following the example of Thames Tideway Tunnel (TTT), the separate procurement of the construction contractor and the project company that

would finance and own the asset. This could be considered a bespoke version of the late model.

Based on a consideration of the examples where the alternative tender models have been applied or are in development (including Offshore Transmission Owners/Competitively Appointed Transmission Owners/Private Finance Initiative/ Public Private Partnership/TTT) the late model is considered to be the most appropriate tender model.

The Early DPC model and Split DPC model are unlikely to be commercially viable on VfM terms. The late model can be aligned to the DCO planning application timelines as well as providing additional benefits to customers in the form of fixed prices for the contract duration. The late model avoids bidders from taking the risk of obtaining planning consent, and the cost of transferring this risk is considered very unlikely to provide value for money.

Additional consideration on whether there is a case for applying the SIPR will be undertaken at gate three. At that point, a case for moving the third party into a separate licenced entity (as in the case of TTT) in order to manage the size and complexity of the scheme, could be considered. If a SIPR model is considered suitable at a future stage then separating the finance and construction may offer some benefits in terms of value for money. However, separate procurement of construction and financing may also mean that bidders are unable to optimise the risk allocation between contractors and the CAP.

7.3 Key risks and mitigation measures

This section provides an assessment of the key risks to the solution's planned progress to completion (including any requirements at gates), and an assessment of the risks to costs and realisation of the benefits of the solution.

The approach to risk management is to minimise the likelihood and impact of risks occurring, to maximise the value and likelihood of opportunities being realised now or in the future, and to ensure that all realise risks are tracked and managed through a proactive issue management process.

The project risks have been considered in two ways:

- **Quantitative costed risk and opportunities register:** The ACWG quantitative cost risk register template has been used to record risks (and opportunities) that could have a material cost and schedule impact on the scheme. These have been assessed using the matrix provided in the All Company Working Group (ACWG) template, shown in Table 7.2. The completed risk registers have been provided in ***Annex A5 – Cost Report***

Table 7.2: ACWG QCRA scoring matrix

Description	Probability	Cost impact	Schedule Impact	Score
1 - Very Low	Improbable (1-10%)	Minimal (<1%) effect on cost	No delay to delivery	1
2 - Low	Remote (11-30%)	Small (1-2%) effect on cost	Minimal (1-2%) effect on delivery	2
3 - Medium	Possible - Likely (31-50%)	Moderate (2.1-5%) increase in cost	Small (2.1 - 5%) delay to delivery	3
4 - High	Probable (51-70%)	Significant (5.1-15%) increase on cost	Significant (5.1-15%) delay to delivery	4
5 - Very High	Almost certain (71-99%)	Major (>15%) increase in cost	Major (>15%) delays to delivery	5

- **Project delivery risk register**: The project risk register is aligned with the RAPID quarterly dashboard reporting requirements and identifies risks that may impact the scheme delivery. The scoring criteria and risks are summarised in Table 7.3 and Table 7.4 respectively.

Table 7.3: Project risks scoring criteria

Green	No risks and progress is going to plan
Amber	There is a risk that is impeding/could impede progress but there is a plan to manage it
Red	There is a risk that is impeding/could impede the progress of the scheme, and there is no plan to manage this

Table 7.4: Project risk register

Type	Risk Description	Score	Mitigation	Score	Gate two trend
Environment	**Abstraction licence:** The River Avon abstraction licence adopted for the gate two hydrology modelling is indicative and there remains uncertainty around its availability for the scheme, particularly if competing interests in abstracting from the River Avon emerge before the licence is granted. There also remains the risks of delay in obtaining a licence and refusal of a licence for abstraction from the EA.	Pre-Mitigation	• The indicative licence was proposed by the EA and has been accepted for use on the gate two hydrology assessment. Engagement with the EA will continue through gate three to confirm the licence. • Only 75% of the maximum abstraction allowances in the indicative licence have been adopted in the gate two hydrology modelling to provide a conservative estimate in the event that the licence is reduced.	Post-Mitigation	Stable
Environment	**Water quality – Treatment:** The gate two environmental assessments and conceptual design have been limited to using existing available water quality data. Consequently, there is uncertainty in the water quality requirements for all receiving watercourses/waterbodies, including the Torr Reservoir itself, local groundwater and all augmented watercourses. There is a risk that the proposed treatment will need to be more extensive than currently proposed to ensure the scheme's viability.	Pre-Mitigation	• A dedicated three-year monitoring strategy was developed in gate two and will be started in summer 2023 to collect data to inform treatment design at later gates and determine mitigation measures needed to manage water quality.	Post-Mitigation	Stable
Environment	**INNS:** Water transfers may create new pathways for the potential spread of INNS. Mitigation measures to ensure that the risk of INNS transfer is not significantly increased may be too onerous or infeasible for the scheme. The measures may limit the potential for outgoing transfers or inhibit the scheme by removing the ability to fill Torr Reservoir using the River Avon.	Pre-Mitigation	• INNS surveys are included in the dedicated monitoring programme and will help to refine the treatment design at gate three. • A study into whether a potable water transfer to Bournemouth Water is feasible has been undertaken and could be adopted if the INNS risk cannot be mitigated sufficiently. • Engagement with the EA will continue on INNS mitigation measures.	Post-Mitigation	Increasing
Environment	**Torr Reservoir drawdown Impacts:** There is a risk that the drawdown level in the reservoir may cause unacceptable environmental impacts on local watercourses and the groundwater table.	Pre-Mitigation	• The dedicated monitoring programme includes local watercourses and will inform the gate three environmental assessments and scheme design. • Further groundwater impact modelling will be completed during gate three to predict the impact on the local environment, including local springs, boreholes, and watercourses. • Continued reservoir de-watering will improve the understanding of how reservoir drawdown will impact the local groundwater table and watercourses.	Post-Mitigation	Stable
Environment	**River Stour Transfer:** There is a risk that discharging large volumes of water into the River Stour will not be acceptable due to the potential temperature variation and change in the river's natural flow regime. This could have unacceptable ecological impacts that are challenging to mitigate.	Pre-Mitigation	• The dedicated water monitoring will provide more information to develop the mitigation proposals in gate three, including potential consideration of split discharges along the River Stour. • Investigations into an alternative potable transfer have been completed during gate three as a contingency should the non-potable transfer become unviable.	Post-Mitigation	Increasing

Type	Risk Description	Score	Mitigation	Score	Gate two trend
Technical	**Reservoir leakage:** Hydrogeological modelling has provided greater confidence in the leakage and augmentation requirements for the core scheme quarry volume, however there is a risk that leakage has been underestimated and that it may be increased by further quarrying at Torr Quarry. Increased leakage would require mitigation which may make developing the quarry a commercially unviable option.	Pre-Mitigation	• Flow monitoring at the quarry will continue to provide water ingress rates as the quarry deepens. • A review of quarries in the Mendip Hills identified several potential alternatives to Torr Quarry. Further hydrogeological modelling on shortlisted quarry sites will be completed to determine their feasibility for use as water storage reservoirs, potentially in addition to Torr Reservoir. Screening and development of the alternative quarries will continue in gate three. • Engagement with the quarry owner will continue in gate three to target a mutually beneficial arrangement. • Spot lining may be an economically viable option in areas of localised leakage.	Post-Mitigation	Stable
Technical	**Capacity of existing assets:** The capacities of the WW service reservoir and the downstream network have not been assessed. There may be insufficient reservoir or network capacity for flows from Torr Reservoir without significantly upgrading or strengthening existing assets.	Pre-Mitigation	• A capacity assessment shall be undertaken during gate three to determine the key constraints on the existing network. • WW are developing a system simulation model for WRMP29 which will help inform the downstream network constraints.	Post-Mitigation	Stable
Stakeholders	**River Avon stakeholders:** Stakeholders may oppose increasing the abstraction permitted from the River Avon if enhanced abstraction may lead to navigational and/or environmental impacts on the River Avon.	Pre-Mitigation	• Bath & North East Somerset Council, Avon Navigation Trust and other relevant stakeholders interested in the River Avon will be consulted at gate three.	Post-Mitigation	Stable
Planning	**Crown Land:** The indicative abstraction and treatment location are currently located within Crown Land at the edge of the Bath World Heritage site. There may be significant challenges to obtaining approval for development on these sites.	Pre-Mitigation	• Further options appraisal of fixed asset locations will be completed at gate three to determine alternative feasible sites to support the DCO application. • Engagement with land owners will be undertaken in gate three.	Post-Mitigation	Stable
Commercial	**Quarry purchase:** There is a risk that it will be challenging to balance the programme needs of both the quarrying activities and the scheme, which could result in delays or failure to agree quarry purchase terms within the project timescales.	Pre-Mitigation	• Continued regular engagement with quarry owner. • An option agreement is being developed by the water company in collaboration with the quarry owner.	Post-Mitigation	Stable

7.4 Project plan

7.4.1 Construction programme

A key driver for the project plan is the date when quarrying operations at Torr Quarry are planned to cease. Planning permission for quarrying operations is currently up until the end of 2040, after which point the site is proposed to be reinstated and the quarry would gradually fill with groundwater, becoming a natural lake, with a water level changing in line with surrounding groundwater levels. Whilst construction works to deliver the Mendip Quarries SRO can run in parallel with quarrying operations, filling of the quarry cannot start until quarrying operations have ceased. Equally, were the quarry not to be developed as a water resource at the end of quarrying operations and left to fill naturally, it would be significantly more difficult to later develop it as a water resource as in order to construct the reservoir inlet/outlet adits it would be necessary to fully drain down the lake using temporary pumping facilities with potential for adverse environmental impacts. There is however uncertainty around when quarrying operations will actually cease, as this depends upon a number of factors including:

- The rate at which quarrying operations proceed, which in turn is influenced by the demand for the aggregates produced by the quarry, which is itself influenced by the state of the construction market and wider economy
- Ongoing monitoring of environmental impacts from the greater drawdown of groundwater as quarrying proceeds to greater depths
- The economic viability of quarrying operations as they proceed to greater depths and whether it becomes mutually beneficial to conclude operations earlier than 2040

Taking account of these uncertainties, alternative high level construction programmes are proposed in Figure 7.2 assuming an early quarrying end date in 2038 and assuming a most likely quarrying end date in 2040. It can be seen on the programmes that reservoir filling is assumed to take two years and that this can only commence once quarrying operations have ceased. The reservoir works (including inlet/outlet infrastructure) and upstream infrastructure for filling the reservoir needs to have been completed by the time that filling commences. The downstream infrastructure is assumed to have been commissioned after the first year of reservoir filling, giving partial resource availability at the end of 2039 or 2041 for the early and most likely programmes respectively, with full resource availability programmed for the following years.

Figure 7.2: Proposed construction programme

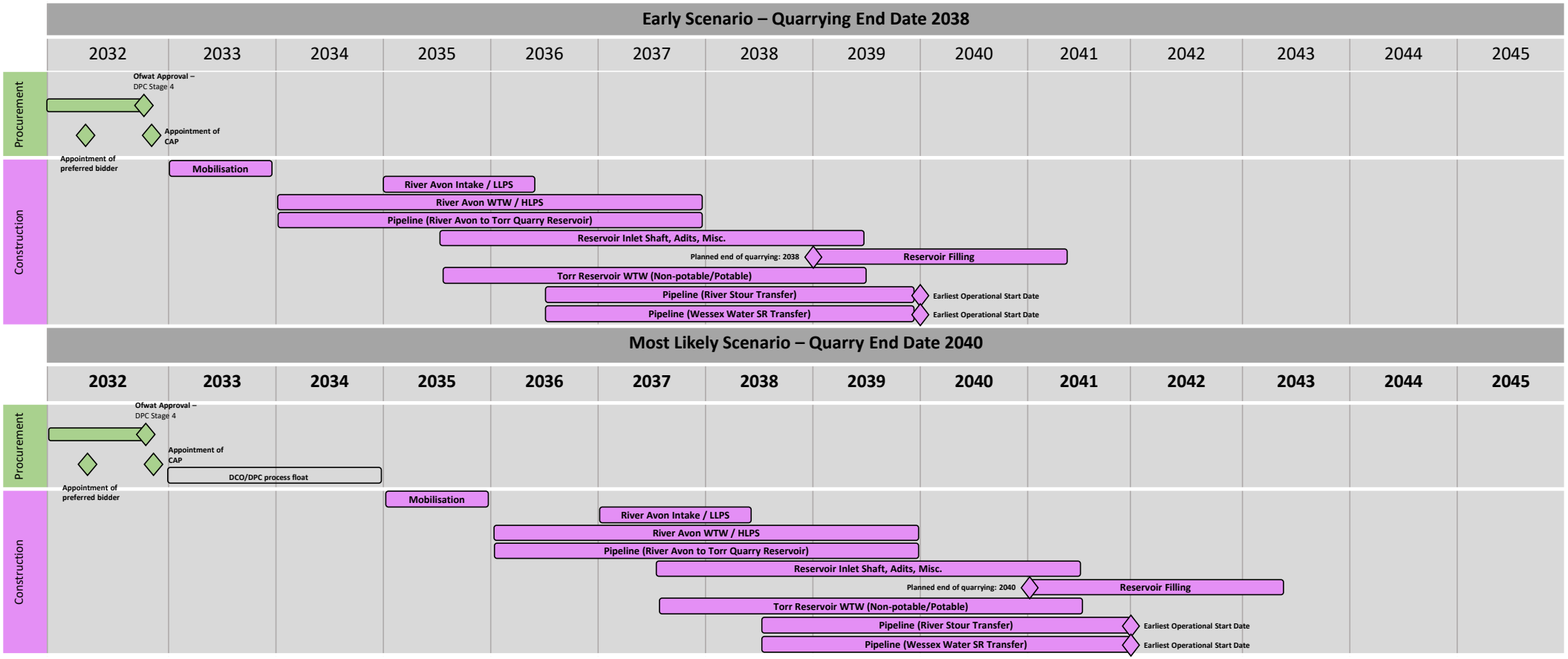
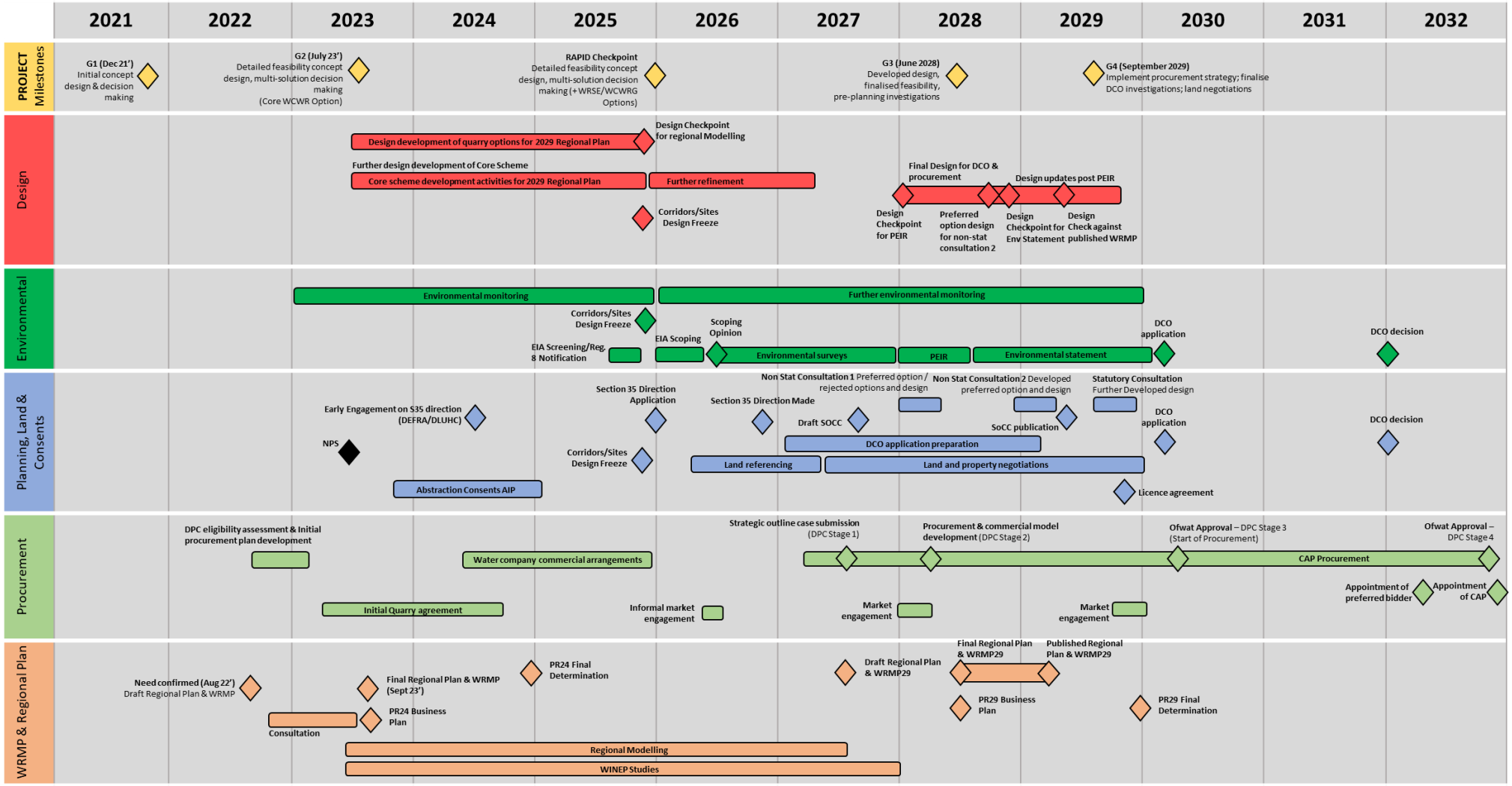


Figure 7.3: Proposed project planning and development programme



7.4.2 Project development programme

So as to keep open the opportunity to take advantage from a potential early quarrying end date in 2038 the project development programme set out in Figure 7.3 has been designed to conclude with the Development Consent Order being made at the start of 2032 and the Competitively Appointed Provider being appointed at the end of 2032, with mobilisation to site for construction in 2033. If it becomes clear during scheme development that the quarrying end date will be later than 2038 then a decision will be needed at that point around whether to push back certain activities.

At gate two the focus has been upon developing the core option to supply the anticipated needs of the West Country Region, using the excavated quarry depth that is currently available. However, it is recognised that further work is required to determine how Torr Reservoir is best to operate in conjunction with existing resources in the West Country, and potential changes to existing abstractions resulting from future sustainability reductions. The Mendip Quarries scheme is currently assumed to be required to operate during peak summer periods, but more detailed modelling in the proposed regional system simulator will enable the initial assumptions on how the scheme should be operated to be refined, which in turn will potentially have significant impacts upon the design capacities of the treatment and transfer infrastructure and the associated peak and average deployable output benefits of the different transfers.

There is also the need to further investigate opportunities that are described in section 4.3, including:

1. The opportunity to exploit a greater volume of storage at Torr Quarry through assuming a lower bottom water level and/or a higher top water level.
2. The opportunity to further expand available storage through use of multiple quarries, and the potential associated multi-sector benefit of using a pair of reservoirs at different levels to provide pumped-storage hydroelectric generation.
3. The opportunity to provide additional resource through abstraction from the River Stour, with the associated benefit of reducing or eliminating the sweetening flow requirement for the Bournemouth Water transfer.
4. The opportunity to facilitate the transfer of resources to Devon and Cornwall.
5. The opportunity to export surplus resources to WRSE.

It is expected that investigation of these opportunities during gate three through the WCWR regional simulator and investment model may add further elements to the scheme scope, whether in the form of additional upstream resources, storage or downstream transfers. This will require some wider option development work early in gate three to ensure that the proposed system simulator and investment model have the range of options available to fully explore these opportunities. It is expected that the draft 2029 Regional Plan will be published during 2027 and so a gate three submission date during 2028 is proposed as by that point it is expected that the gate three requirements will have been largely met. That is to say a single solution will have been determined, including through modelling in a system simulator (digital twin) and the first round of non-statutory planning consultation will have been conducted.

As well as exploring the wider opportunities and potential scheme operation using the system simulator, further development of the core scheme is recommended in gate three, including to:

- Assess environmental impacts from reservoir drawdown
- Further assess (in conjunction with RAPID and the Environment Agency) water treatment requirements at the River Avon WTW and at the Torr Quarry WTW to address WFD requirements and INNS transfer risk mitigation

- Further investigate the suitability of the proposed discharge location on the River Stour, investigation of losses, interaction with the Poole Reuse scheme and potential abstraction licencing arrangements
- Further investigate the feasibility of reusing existing infrastructure for the transfer from Longham to Knapp Mill.

Further details on the proposed further core scheme development in gate two can be found in Table 7.5 and in ***Annex A4 - Conceptual Design Report***.

An environmental monitoring plan (focusing on water quality and aquatic ecology) has commenced during gate two to collect the information required for more detailed assessment of environmental impacts and potential mitigations. It is expected that this programme will continue through until the DCO application, but will be adapted over time to reflect potential changes in the scheme and also to include additional environmental monitoring and surveys that may be identified as being required. Further details are provided in ***Annex B5 – Monitoring Strategy***.

It is expected that environmental activities during gate three will focus on the actions required to deliver a compliant Environmental Impact Assessment (EIA) to support the DCO application. Following the Section 35 Direction Application, activity is expected to include EIA Scoping and identification of relevant environmental surveys. This information will inform the preparation of a Preliminary Environmental Information Report (PEIR) which will be based on the core scheme. The preparation of an Environmental Statement will follow. These activities will be aligned with the DCO application activities and consultations described below. In addition, other environmental assessment documents will be produced, providing updates on environmental performance such as compliance with Water Framework Directive, Habitats Regulation Assessment and other environmental metrics as required by Rapid, the NPS and inputs to the 2029 Regional Plan.

Planning, Land and Consents related activities will substantially begin with early engagement with Defra/ Department for Levelling Up, Housing and Communities (DLUHC) regarding the application for a Section 35 Direction from the SoS. Once agreed a Section 35 Application will be submitted and is expected to be obtained prior to 2027. Land referencing activities are expected to begin by this time in order to begin to compile the list of affected landowners. In parallel, drafting of the DCO application documents will commence. Initial drafts of application documents will be shared with the public through the non-statutory consultation 1 on the Preferred option and the rejected options. The methodology for consultation will be agreed with Local Authorities through the Statement of Community Consultation (SoCC). It is proposed that non-statutory consultation 1 will occur after the consultation on the draft 2029 regional plan. There will be a second round of non-statutory consultation (2) with further design development, incorporating comments from the initial round of consultation. Prior to the DCO application a final statutory consultation will be held, following which a consultation report will be required summarising the programme, comments and changes made to the design as a result. The SoS will determine the DCO application, this is expected to take 18 months with a decision in 2032.

The next key steps for the commercial and procurement workstream will be to develop a Joint Working Agreement between Wessex Water and Bournemouth Water. In addition to this, the workstream will also support the land team in their negotiations with the quarry. Initial informal market engagement on scheme procurement is programmed for 2026, by which point it is expected that the scope of the project will be more mature and meaningful informal engagement with the market can take place on key areas such as risk allocation and the proposed commercial structure. Should the scheme scope increase substantially, choices such as a DPC vs the SIPR route could be tested at this stage.

Should there be a significant change in scope, then a formal DPC Stage 1 submission for the scheme may take place in mid-2027, aligned with the publication of the draft 2029 regional plan. A formal market engagement exercise is anticipated to take place in 2028, based upon the design developed for the PEIR and in parallel with the first non-statutory consultation. Learning from other SRO's will also help structure this market engagement and the procurement strategy developed for the Stage 2 submission to Ofwat.

Further market engagement will then take place while the tender documents are finalised ready for Stage 3 submission to Ofwat and the commencement of the CAP procurement. The CAP procurement process will begin post DCO application so that the procurement is based upon a mature design. We anticipate that a preferred bidder will be selected post DCO approval and several months prior to approval from Ofwat at Stage 4 to proceed with the CAP appointment.

7.4.3 Proposed gate three activities

The activities and outcomes envisaged for gate three are summarised in Table 7.5 below. The high level activities are colour coded and mapped onto the project development programme included in Figure 7.3. The table includes some activities that commence in gate three, but are expected to complete after gate three submission – these activities are shown in italics.

Table 7.5: Proposed gate three activities

Ref.	Activity	Outcome
1.	Design development of quarry options for 2029 Regional Plan	RP29 quarry option set
1.1.	Hydrogeology	
1.1.1	Scoping of groundwater modelling approach together with regulators	Modelling approach
1.1.2.	Further hydrogeology review and modelling of suitability of selected shortlisted quarry sites	Groundwater impacts and leakage of other quarries
1.1.3	Engagement with the EA on augmentation requirements for streams taking account of additional data that is obtained through monitoring	Augmentation volumes
1.1.4.	Investigate deriving suitable level/leakage relationship for inclusion in the regional simulator	Leakage/level relationships
1.1.5.	Modelling and assessment of environmental impacts of utilising quarries as reservoirs, taking account of additional data that is obtained through monitoring	Identification of impacts
1.1.6.	Assessment of the potential constraints on future quarry development from development of a reservoir(s)	Identification of impacts
1.2.	Hydrology	
1.2.1.	Refresh review of potential additional resources that could augment quarry storage (incl. River Avon, River Stour)	Identification of resources
1.2.2.	For potential new resources to engage with EA to agree, where applicable, indicative abstraction regime (e.g. River Stour)	Assumed abstraction regime
1.2.3.	Undertake rainfall runoff modelling for any new abstractions (e.g. River Stour)	Flow series
1.2.4.	Assess benefit of bankside storage (e.g. at River Stour) and where applicable undertake site selection	Bankside storage benefits and locations
1.2.5.	Refresh River Avon rainfall runoff modelling, building on EA feedback and work with EA to refine the indicative abstraction conditions previously provided	Updated flow series, and abstraction conditions
1.2.6.	Investigate losses for raw water transfer(s)	Estimates of losses
1.2.7.	Engage with EA to define river regulation arrangements for River Stour	Agreement in principle on river regulation
1.2.8.	Investigate the interaction of new resources with existing abstractions and the potential for conjunctive use – in conjunction with regional system simulation modelling	Inform use of system simulator
1.2.9.	Use system simulator to estimate deployable output for WCWR options for regional plan, including considering options to increase storage (including using lower Bottom Water Level, higher Top Water Level and additional quarries) and additional transfer locations	Deployable Output for options
1.3.	Transfers from the reservoir(s)	
1.3.1.	Refresh engagement with WCWR and WRSE companies around expected future water demands (incl. potential to support transfers to Devon/Cornwall)	Potential needs defined

Ref.	Activity	Outcome
1.3.2.	Update potential conveyance options considering both raw/treated water transfers and the potential for phased development of treatment and alternative pipeline capacity options that cover the range of potential needs	Transfer elements
1.3.3.	Collaborative option development with Canal and River Trust around works needed on Kennet & Avon canal to facilitate a canal transfer to the River Kennet	Definition of canal works
1.4	Quarry site selection	
1.4.1	Update quarry site selection report taking account of; hydrogeology on further quarry options and updated analysis for existing options; and any updates in locations of water resources and water demands	Quarry sites and storage volumes
1.5.	Transfer(s) from abstraction(s) to reservoir(s)	
1.5.1	Update potential transfer options from abstraction location(s) to reservoir(s) including considering treatment requirements, capacities, phasing and routing	Transfer elements
1.6.	Mendip Quarries water resources feasibility report, building on work done in pre-feasibility, gates 1 and 2 and further gate three optioneering	Feasible MQ phased/ modular resource options
1.7.	Option development for Regional Plan – prepare option information at level of detail required for regional modelling, including cost estimates and best value metrics (incl. carbon). Refined estimates of sweetening requirements will also be needed	Option metrics and costs
1.8.	Investigate potential multi-sector pumped-storage hydroelectric scheme/water resource – in the event that multiple quarries are potentially viable, investigate feasibility of pumped storage hydroelectric scheme to operate when full storage volume is either not needed or when storage has been drawn down	Decision of feasibility of pumped storage hydroelectric scheme
2.	Design development of core scheme	
2.1.	Detailed site selection for River Avon intake and water treatment works	Preferred treatment works site
2.2.	Detailed pipeline route development for pipelines from River Avon to Torr Reservoir. Include pipe diameter optimisation and consideration of single or two stage pumping	Preferred pipeline route
2.3.	Develop strategy for mitigating risk of Zebra mussel encrustation on intake pipework	Preferred mitigation
2.4.	Taking account of monitoring and engagement with regulators, update the assessment of treatment process requirements at River Avon abstraction	Preferred Avon WTW treatment process
2.5.	Taking account of monitoring and engagement with regulators, scope out and undertake more detailed investigations to better define INNS transfer risk mitigation requirements for transfer to the Stour	Preferred Torr WTW treatment process
2.6.	Investigation and modelling of water quality deterioration in Torr Reservoir (and other potential quarries) and evaluate potential mitigation solutions.	Recommended water quality mitigation solution
2.7	Further development of Torr Reservoir inlet and outlet shaft designs, slope stability and protection needed at adit portals	Preferred inlet/outlet arrangement
2.8	Investigate environmental impacts of River Stour discharge (including upon the flow regime and a review of effects to downstream fish passes including fish counter monitoring) and consider optimal location that minimises the transfer length but is environmentally acceptable	Agreed River Stour discharge location
2.9	Network modelling to identify network constraints downstream of the receiving Wessex Water SR and identification of any scheme modifications and/or reinforcements required	Understanding of downstream network impact
2.10	Investigation of existing pipeline and associated infrastructure for transfer from Longham to Knapp Mill and further analysis to confirm feasibility of repurposing	Confirm feasibility of plan for reusing assets
2.11	Detailed pipeline route development and pipe diameter optimisation for pipelines from Torr Reservoir to WTW and to River Stour and service reservoir near Wendover	Preferred pipeline routes
2.12	Planning and procurement of ground investigations	Geotechnical information
2.13	Environmental inputs into design development including Environmental Net Gain and securing Biodiversity Net Gain	Required environmental mitigations/enhancements
2.14	Develop access strategy for reservoir site taking account of health and safety, physical security and biosecurity risks	Access strategy
2.15	Develop Drinking water quality risk assessments/Drinking water safety plan, incl. liaison with water co drinking water quality teams and DWI	Drinking water safety plan and mitigation
3.	Design development for DCO and Procurement	
3.1.	*Development of the reference design for river intakes, Low Lift Pumping Station, River Avon WTW, High Lift Pumping Station and pipelines to Torr Reservoir*	*Reference design for upstream works*
3.2.	*Develop reference design for reservoir inlet/outlet shafts and associated infrastructure for abstraction and reservoir mixing*	*Reference design for reservoir works*
3.3.	*Develop reference designs for downstream treatment and transfers*	*Reference design for downstream works*

Ref.	Activity	Outcome
3.4.	*Surge analysis of pipeline sections and surge mitigation design*	*Reference design for surge protection*
3.5.	*Development of planning drawings and associated materials for consultations*	*Planning drawings*
3.6.	*Develop construction strategy, including requirements for environmental mitigation*	*Reference construction strategy*
3.7.	*Develop commissioning plan for core scheme*	*Reference Commissioning Plan*
3.8.	*Develop operation and maintenance strategy, including identifying activities for ramping up and down and detailed assessment of sweetening flow requirements*	*Reference O&M strategy*
4.	Environmental assessment, monitoring and surveys	
4.1.	*Ongoing environmental monitoring and surveys – ongoing water quality, flow monitoring and aquatic ecology monitoring and additional surveys to support environmental assessments*	*Monitoring reports* *Survey reports*
4.2.	EIA Screening – determine the approach to EIA and contact the Secretary of State	Screening opinion or EIA notification
4.3.	EIA Scoping – prepare and EIA Scoping Report and request a Scoping Opinion	EIA Scoping Report EIA Scoping Opinion
4.4.	EIA: Preliminary Environmental Information Report (PEIR) – prepare preliminary environmental information that enables consultees (both specialist and non-specialist) to understand the likely environmental effects of the Proposed Development and helps to inform their consultation responses	PEIR
4.5.	*EIA: Environmental Statement – prepare Environmental Statement*	*Environmental Statement*
4.6.	WFD/HRA/Other assessments/metrics for gate three reporting – prepare additional assessments to meet the requirements for gate three reporting and inputs to 2029 Regional Plan	Supporting assessments
4.7.	Assessments for environmental net gain, biodiversity net gain, natural capital, wider benefits – use metrics to help drive environmentally and socially positive outcomes through the design development process and report on outcomes	Reporting on environmental and social metrics
5.	Planning, Land & Consents	
5.1.	Engagement with Defra and DLUHC on Section 35 Direction leading to application for s35 Direction	S35 Direction Application
5.2.	Preparation for Statement of Community Consultation (SoCC)	Draft SoCC
5.3.	*Non-statutory consultations – planning and implementation of the consultations and preparation of consultation reports and feedback to stakeholders*	*Consultation materials, processes and reports*
5.4.	*DCO Application preparation – initial application preparation in advance of the second non-statutory consultation*	*Draft DCO application documentation*
5.5.	*Land referencing to inform design, environmental assessment, surveys, planning and property purchase*	*Book of Reference, negotiated land purchase*
5.6.	*Land negotiations*	*Option agreements*
5.7.	*Engagement with stakeholders to reach agreement*	
5.8.	Engagement with EA to reach agreement in principle for abstraction licences	Agreement in principle
5.9.	*Engagement for other consents not included within DCO process*	
6.	Procurement	
6.1.	Joint Working Agreement between Appointees	Cost allocation mechanism
6.2.	Commercial and Procurement Strategy	Packaging approach and indicative commercial terms
6.3.	Project Execution Plan	Delivery Strategy including resourcing plan
6.4.	DPC Stage 2	DPC Stage 2 submission
6.5.	Market Engagement	Market Engagement feedback report

8. Solution costs and benefits

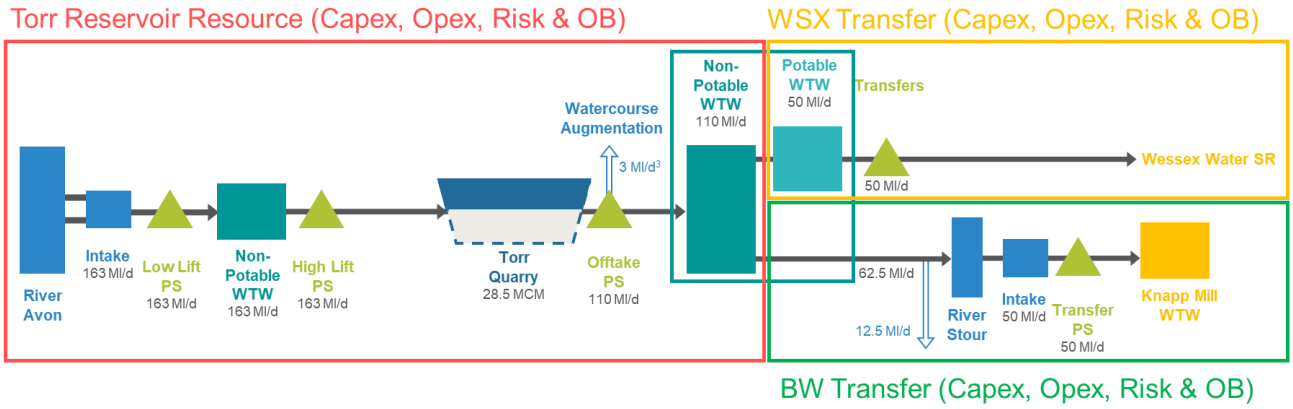
This section provides a summary of the costing methodology, solution costs, and an overview of the best value assessment.

8.1 Methodology and cost structuring

The capital cost estimate, including key risks and optimism bias has been calculated in accordance with the All Company Working Group (ACWG) Cost Consistency Methodology[16] and update to guidance on optimism bias[17]. Average Incremental Cost (AIC) estimation has followed the process from the ACWG to ensure consistency in the net present value (NPV) and AIC across all SROs. The estimation method is consistent with that used in WRMP24. Full details of the cost estimation are provided in ***Annex A5 – Cost Report***.

The scheme costs have been structured to enable shared costs to be apportioned to WW and SWW[18] for inclusion in their respective WRMP option cost tables. All costs for elements up to and including the non-potable process at Torr Reservoir WTW are required for both transfers and can be split based on the proportion of flow sent to each transfer destination, as shown in Figure 8.1. The shared costs are referred to as the 'Torr Reservoir Resource'. This includes capital and operational costs, in addition to costed risk and optimism bias.

Figure 8.1: Shared costs structure



Whilst both Wessex Water and Bournemouth Water have peak demands of 50Ml/d, the different demand profiles (refer to Table 4.1) and transfer losses result in an uneven demand on the shared resource, as derived in Table 8.1. The scheme splits into the two transfers downstream of the non-potable treatment at Torr Reservoir so costs downstream of this point are fully assigned to the relevant transfer destination water company.

Table 8.1: Summary of shared cost proportions

Torr Reservoir Resource DO	46Ml/d[1]	
Water Company	SWW	WW
Annual Average Demand (pre losses)	25Ml/d	20Ml/d
Shared cost proportions	56%	44%

1. The core scheme annual average demand is 1Ml/d less than the available reservoir yield.

[16] Mott MacDonald, *Cost Consistency Methodology - Technical Note and Methodology - Rev E* (February 2022).
[17] Mott MacDonald, *Cost Consistency Methodology - Appendix A-1 - Optimism Bias and QCRA Template - Rev C* (October 2021).
[18] Bournemouth Water is part of South West Water ltd. and hence the cost of transferring water to Bournemouth Water is allocated to South West Water.

8.2 Capital costs

The capex estimates have been produced using our cost consultant ChandlerKBS' Cost Intelligence Database (CID). The CID is a system of integrated cost databases and costing tools that allows users to review and compare multiple cost models, project data and indices to normalise and derive industry average costs for a range of asset drivers. The CID comprises data from thousands of capital projects delivered by UK water companies over the past 20 years, including Wessex Water, South West Water, Bristol Water, Thames Water, Welsh Water, Scottish Water and Northern Ireland Water.

The process for deriving a 'total cost to client' capex cost was based on two approaches. A top-down estimate was initially assessed using high level, total cost to client rates and cost models. Subsequently, a low-level refined cost estimate was produced comprising direct costs and indirect costs. Direct costs consist of aggregated labour, plant and material costs to reflect the scope. Indirect costs, relevant to the asset type, are added as an uplift factor to account for contractor management, design, tender-to-outturn and client overheads. Land acquisition and power supply costs have been estimated with provisional sum allowances, which are also reflected in the key risk allowances.

To adjust cost data to account for its age, a factor has been applied that represents the industry's variance in construction costs from the cost data's base date to the estimate base date of Q3 2020. The adjustment factor used is determined by a construction cost index. The index that has been used to adjust capex costs is the Civil Engineering cost index (reference 1191) published by Building Cost Information Services (BCIS). This index has cost components that align specifically with the UK water industry.

8.2.1 Risk

The Quantitative Cost Risk Assessment (QCRA) was carried out with reference to the ACWG Cost Consistency Methodology[19].

The key risks were identified by the project team and recorded using the ACWG QCRA Templates. Three QCRAs were completed; one for the shared Torr Reservoir Resource elements, and one for each of the two transfers, as illustrated in Figure 8.1. Common risks were applied to each of the QCRAs, but specific risks associated with particular elements were only included in the relevant QCRA.

As specified in the QCRA Template, the risk costs included in the SRO capex cost estimates is the P50 value, whereby it is anticipated that half of the potential outcomes are expected to be below the selected value.

8.2.2 Optimism bias

The optimism bias (OB) for the scheme was derived in accordance with the Cost Consistency Methodology and the update to guidance on optimism bias[20]. As with the QCRA, three OB assessments were completed to cover the shared Torr Reservoir Resource cost elements, and individual water company transfer elements (Figure 8.1).

The proportions of standard and non-standard civil engineering activities were attributed based upon the proportions of capital costs associated to different project types e.g. transfer pipes (standard) and reservoirs (non-standard). This allowed the upper bound of optimism bias to be

[19] Mott MacDonald, Cost Consistency Methodology - Technical Note and Methodology - Rev E (February 2022).
[20] Mott MacDonald, Cost Consistency Methodology - Appendix A-1 - Optimism Bias and QCRA Template - Rev C (October 2021).

calculated ***(Stage 1).*** A review was carried out by the project team which had technical and commercial knowledge of the project together with an understanding of the approach to costing. Each contributory factor was considered, and mitigation factors have been applied to produce a scaled back optimism bias ***(Stage 2)***.

Following completion of the capex cost estimating and the QCRA, a review was carried out to consider whether there was any further adjustment required to the optimism bias. The optimism bias percentage for the SRO was further adjusted to mitigate risks identified in the costed risk register, to give a final value OB value ***(Stage 3)***. The OB values for each stage are provided in Table 8.2.

Table 8.2: Optimism bias by scheme element

Risk Category	Torr Reservoir Resource			BW Transfer			WW Transfer		
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3
	Upper Bound OB (%)	Adjusted Upper Bound OB (%)	Risk Register Adjusted OB (%)	Upper Bound OB (%)	Adjusted Upper Bound OB (%)	Risk Register Adjusted OB (%)	Upper Bound OB (%)	Adjusted Upper Bound OB (%)	Risk Register Adjusted OB (%)
Procurement	7.14	6.70	6.70	6.82	6.41	6.41	6.45	5.96	5.96
Project specific	17.04	14.91	7.09	16.27	11.82	3.68	15.39	8.68	1.96
Client specific	18.69	16.27	12.45	17.85	15.35	11.14	16.87	14.28	9.61
Environment	4.67	4.17	2.80	4.46	3.76	2.38	4.22	3.03	2.27
External influences	7.42	6.22	5.02	7.09	4.83	3.79	6.70	3.71	3.45
Total	**54.96**	**48.27**	**34.07**	**52.49**	**42.18**	**27.40**	**49.63**	**35.65**	**23.25**

8.2.3 Benchmarking

The capex cost benchmarking focused on the most significant cost components of the capex cost estimate, i.e. pipe laying, treatment works and pumping stations.

The benchmark for pipelines utilised project cost data from various sources in the South West region. Major pipe laying projects were analysed to assess their alignment with the base estimate. In addition to the project cost analysis, recent estimates and benchmarks of similar works were utilised to identify a range of anticipated costs.

There are no WW treatment works benchmark projects available with capacities to align with the large capacity of the treatment works, however the Cheddar SRO and Poole Recycling SRO reports identified good alignment of estimated capex costs for treatment works of smaller capacity.

The civil works in Torr Reservoir are unique to this project and have no comparable projects from WW or SWW to provide a benchmark cost. In addition, land and power costs were excluded from the benchmark due to the highly subjective nature of procuring these items and should be firmed up in gate three.

Overall, 83.5% of capex costs were benchmarked, with the benchmarked costs within 7.4% of the scheme capex estimate. At a programme level, a variation of 10% would generally be an acceptable indication that the estimate of costs is in line with the market.

8.3 Operating costs

The opex cost estimate was produced from combining ChandlerKBS' CID data and Wessex Water rates for power and chemical costs. The estimate is based on modelled historical data and assumptions that can be affected by many different factors including operating regimes and raw water quality. ChandlerKBS' CID opex utilisation rates have been normalised to 100% and adjusted to align with the utilisation rates required by the scope.

8.3.1 Fixed opex

The fixed opex costs were calculated for the annual operation including sweetening flows and capital maintenance costs of the assets irrespective of the flow though the assets. Fixed opex costs were derived on a base rate of 1.5% of MEICA capex and 0.5% of civil capex. A benchmark check of the fixed opex calculation utilising a base rate method of 3% of MEICA derived a variance of circa 9.9%, which indicates an acceptable confidence in the fixed opex value.

8.3.2 Variable opex

The variable opex cost per megalitre was estimated for the individual assets to derive costs for power, chemicals, labour, maintenance and other costs.

Power and chemical usage for each asset was estimated based on the minimum and maximum outputs. Unit rates from the CID were applied to the estimated power and chemicals usage. This information was used to adjust the CID opex models to suit the forecast operating regime for each site. Variable opex costs have been indexed to Q3 2020 to align with the capex and fixed opex costs. It should be noted that power and chemical costs have changed considerably from the historic baselines in the past year and there remains a risk of further volatility.

8.4 Cost estimates

The 80-year NPV of capital financing costs, opex and Water Available for Use (WAFU) have been calculated using the AIC MS Excel template produced by Mott MacDonald (Rev G, August 2022). The AIC tool calculates the NPV over an 80-year period from the beginning of the capital investment.

AIC calculations have been calculated for the Torr Reservoir Resource and the individual transfer elements, as well as combined assessments to include the proportion of the reservoir resource costs that should be allocated to each water company. The WAFU's have been calculated for the scheme elements based on the annual average DO figures provided in Table 8.3.

Table 8.3: Summary of scheme DOs

Cost Element		Maximum Annual Average DO, Ml/d
Torr Reservoir Resource		46
WW Transfer		15
BW Transfer		16
WW Combined	Torr Reservoir Resource (44%)	20
	WW Transfer	15
BW Combined	Torr Reservoir Resource (56%)	25
	BW Transfer	16

8.4.1 Core scheme

Table 8.4 shows the 80-year NPV summary outputs for cost element in the core scheme, and Table 8.5 shows the combined NPV for each transfer, including the proportion of the reservoir resource costs based on the individual Ml/d demands placed on the reservoir.

Table 8.4: Torr Reservoir Resource NPV cost summary – individual elements

	Torr Reservoir Resource		WW Transfer		BW Transfer	
	Min utilisation	Max utilisation	Min utilisation	Max utilisation	Min utilisation	Max utilisation
NPV Capex (£m)	452	452	103	103	69	69
NPV Finance (£m)	387	387	89	89	58	58
NPV Opex (£m)	103	192	19	26	13	17
NPV WAFU (m³)	241,365,529	241,365,529	87,097,257	87,097,257	81,653,678	81,653,678
AIC (p/m³)	203	240	124	132	87	92
NPC (£m)	490	580	108	115	71	75

Table 8.5: Torr Reservoir Resource NPV cost summary – combined elements

	WW Transfer + Torr Reservoir Resource		BW Transfer + Torr Reservoir Resource	
	Min utilisation	Max utilisation	Min utilisation	Max utilisation
NPV Capex (£m)	355	355	270	270
NPV Finance (£m)	304	304	230	230
NPV Opex (£m)	76	133	59	103
NPV WAFU (m³)	87,097,257	87,097,257	81,653,678	81,653,678
AIC (p/m³)	436	502	354	407
NPC (£m)	380	437	289	332

The AIC figures are relatively high for the individual components, which largely reflects the conservative assumptions with respect to potential scheme yield due to the uncertainty and novelty of using a quarry for public water supply storage. Whilst the combined AICs provide an indication of the total cost to deliver water for South West Water and Wessex Water individually, it should be noted that the Mendip Quarries SRO is an 'end-to-end' solution that includes both resource and transfer costs. As such, it is not easily comparable with the AICs of some other SROs that only include costs for a resource or transfer element independently. It is also important to recognise that the AICs are calculated using the annual average WAFU benefit, whereas the scheme has been designed to deliver peak supplies at approximately three times the annual average flow rate, which required the treatment and transfer infrastructure to be substantially larger than would be required for a constant annual average supply. This is illustrated in Table 8.6 which shows the overall cost per Ml/d of capacity for both peak and average.

Table 8.6: Peak normalised cost summary

	WW Transfer + Torr Reservoir Resource		BW Transfer + Torr Reservoir Resource	
	Min utilisation	Max utilisation	Min utilisation	Max utilisation
NPC (£m)	380	437	270	332
Average WAFU (Ml/d)	15	15	16	16
Peak WAFU (Ml/d)	50	50	50	50
Average Normalised cost £m per Ml/d	25.3	29.1	16.9	20.8
Peak Normalised cost £m per Ml/d	7.6	8.7	5.4	6.6

8.4.2 Cost sensitivity

A further review of the hydrology, conceptual design and costing assumptions has been completed to demonstrate how the AICs could be reduced through several low-risk interventions, as discussed below.

- **DO benefit** – Figure 3.2 (section 3.2.2) shows the approximately linear relationship between the available storage and yield up to volumes of approximately 30MCM for both the HOF4 and HOF5 abstraction rates. Beyond this, the yield benefit rate reduces unless the larger HOF5

abstraction is utilised. For reasons discussed in section 3.2.3, the gate two core scheme assumes that only the currently available storage (circa 28.5MCM) is used, it is likely that the HOF4 could support volumes up to around 40MCM once this is available for minimal additional cost to provide a yield of 60Ml/d. This would provide headroom in the reservoir resource for other transfers, hence reducing the proportion of Torr Reservoir Resource costs apportioned to each of the BW and WW transfers.

- **Sweetening flows** – The minimum turndown for the treatment works has been used to drive the scheme sweetening flows. This means that the sweetening flows within pipelines are likely to be higher than necessary and are contributing to a larger annual average demand on the reservoir. It is likely that design optimisation will enable sweetening flows in the pipe to be reduced significantly through recirculating flow through the treatment works. This will reduce the annual average demand on the reservoir providing further headroom for additional transfers, hence reducing apportioned resource costs for the BW and WW transfers.
- **Power costs** – Electricity rates were provided by WW to ChandlerKBS at a base date of Q3 2022 to be used for estimating WRMP option opex for PR24. For use in the SRO for estimating opex, multiple source rates have been normalised to the Q3 2020 base date using the Office for National Statistics Retail Price Index (RPI), however it was noted that electricity rates set by WW for PR24 included for significant fluctuations in prices that had occurred in the market since Q3 2020. In real terms, electricity prices increased by between +200% and +300% between Q3 2020 and Q3 2022, which creates a significant increase in power costs. Although there remains uncertainty over future electricity prices, it is likely that electricity costs will stabilise at a rate lower than Q3 2022, and so a rate of 50% of Q3 2022 has been assumed for the sensitivity test.

The AIC calculation has been repeated to test the sensitivity of the AICs to these assumptions:

- **Torr Reservoir Resource yield –** Increased to 60Ml/d annual average
- **Pipeline sweetening flows –** Reduced to 50%
- **Power costs** – Reduced to 50% compared to base core scheme costs

The results are summarised in Table 8.7 and Table 8.8.

Table 8.7: Torr Reservoir Resource NPV cost summary – individual elements – sensitivity assessment

	Torr Reservoir Resource		WW Transfer		BW Transfer	
	Min utilisation	Max utilisation	Min utilisation	Max utilisation	Min utilisation	Max utilisation
NPV Capex (£m)	452	452	103	103	69	69
NPV Finance (£m)	387	387	89	89	58	58
NPV Opex (£m)	83	170	12	15	11	14
NPV WAFU (m³)	314,824,603	314,824,603	87,097,257	87,097,257	81,653,678	81,653,678
AIC (p/m³)	150	177	116	119	84	87
NPC (£m)	471	557	101	104	68	71
AIC Delta (%)	-26%	-26%	-6%	-9%	-3%	-5%

Table 8.8: Torr Reservoir Resource NPV cost summary – combined elements – sensitivity assessment

	WW Transfer + Torr Reservoir Resource		BW Transfer + Torr Reservoir Resource	
	Min utilisation	Max utilisation	Min utilisation	Max utilisation
NPV Capex (£m)	273	273	201	201
NPV Finance (£m)	234	234	171	171
NPV Opex (£m)	44	79	35	63
NPV WAFU (m³)	87,097,257	87,097,257	81,653,678	81,653,678
AIC (p/m³)	319	359	252	286

	WW Transfer + Torr Reservoir Resource		BW Transfer + Torr Reservoir Resource	
	Min utilisation	Max utilisation	Min utilisation	Max utilisation
NPC (£m)	277	313	206	234
AIC Delta (%)	-27%	-28%	-29%	-30%

The sensitivity assessment demonstrates that significant reductions in the scheme AICs are expected to be achievable as the scheme progresses, notwithstanding any improvements through further optimisation to civil and MEICA design to reduce the scheme costs whilst maximising the available DO.

8.4.3 Option scalability and tipping points

Option scalability has been considered throughout our gate two work as described in section 4.3 above.

We have also been very conscious of the tipping points provided through the different hands-off flow constraints and storage volumes in the quarry, as illustrated in Figure 4.5. For the core scheme our assessment was that a suitable tippling point was the HOF4 flow limit and the storage volume provided by a 50m drawdown, due to the doubling of capacity for infrastructure upstream of the reservoir that would be required. Options beyond this tipping point have been categorised as future opportunities to be investigated further in gate three.

8.5 Comparison with gate one costs

There have been significant changes to the scheme's scope and resource benefit since gate one, and hence it is challenging to draw direct comparisons between the gate one and gate two costs. Gate one and two costs for similar elements have been summarised in Table 8.9 with notes on the key changes. The gate two sensitivity test figures are also included for reference.

Table 8.9: Summary of gate two and gate two costs

	Element Name	Assumed DO (Ml/d)	Peak Capacity (Ml/d)	Total Max. Utilisation NPC (£m)	Min. Utilisation AIC(p/m³)	Max Utilisation AIC (p/m³)
Torr Reservoir Resource						
Gate one	Mendip Reservoir	87	150	623	69	84
Gate two	Torr Reservoir Resource	46	163	580	203	240
Gate two[1]	Torr Reservoir Resource	60	163	557	150	177
WW Transfer						
Gate one	Outlet Transfer to SR near Warminster and WTW	30	35	275[2]	77	105
Gate two	WW Transfer	15	50	71	87	92
Gate two[1]	WW Transfer	15	50	69	84	87
BW Transfer						
Gate one	Outlet Transfer to R. Stour	30	35	63	16	21
Gate two[3]	BW Transfer	16	50	115	124	132
Gate two[1,3]	BW Transfer	16	50	104	116	119

1. Gate two sensitivity costs
2. Includes all treatment, whereas for gate two shared non-potable treatment costs were included in the resource
3. Includes non-potable treatment for INNS mitigation + additional abstraction and transfer to Knapp Mill WTW

The large differences are likely due to several key factors:

- The scheme yield is significantly reduced due to consideration of climate change and the adoption of the indicative River Avon licence. This means that the abstraction infrastructure is delivering a much lower yield with no reduction to the infrastructure capacity
- The demand on the reservoir now follows an assumed DYCP profile, rather than a baseline demand which reduces the reservoir yield
- Gate one costs used yield as a proxy for deployable output, which omitted system losses, resulting in an inflated DO and WAFU
- A non-potable treatment process has been included for the River Stour to mitigate the risk of INNS transfer
- Increase in peak transfer capacities to WW and BW has increased the transfer pipeline sizes
- Change of cost models

8.6 Best value assessment and solution benefits

8.6.1 Best value assessment

The WCWRG draft regional plan sets out three outcomes that the plan seeks to achieve:

- Improve the environment
- Ensure water supply resilience
- Deliver societal benefits i.e. affordable customer bills.

It then provides a series of metrics that are used to score the plan against the strategic outcomes. The preferred plan, which includes for continued development of the Mendip Quarries SRO, performs well for the each of the outcomes in a radar plot of the scores, with an appropriate balance between each of the outcomes.

The individual company WRMPs follow the EA's water resources planning guidelines with regard to best value planning.

Wessex Water's dWRMP assesses the preferred plan against all of the 13 criteria in the guidelines. The Mendip quarries project contributes to the delivery of a large number of the criteria.

South West Water's dWRMP has a dedicated chapter on their approach to best value planning and the plan benefits. It includes three dimensions, ten sub-dimensions and 16 metrics which are used to assess the plan for the Bournemouth water resource zone. The recommended plan, which includes the supply-side option of a transfer from the Mendip Quarries SRO, performs well when all the factors are considered.

8.6.2 Solution benefits

The principal benefits that the scheme would provide are related to environmental destination ambitions, comprising:

- It can provide a significant supply to Wessex Water that will enable reductions in groundwater abstraction from the upper Hampshire Avon. Regulators are seeking reductions in abstraction from several groundwater sources that are considered to impact on ecologically sensitive chalk streams. The precise changes in abstraction are subject to further WINEP studies. These studies should also quantify the benefits of the reductions in order that the information is available prior to the next round of regional planning and so that an informed decision can be made on the costs and benefits of the solution

- It can also provide a large peak supply to South West Water's Bournemouth area, which will enable a reduction in river abstraction from the lower Hampshire Avon at Matchams and Knapp Mill. There are significantly fewer options available in the Bournemouth area and therefore the adaptative plan includes a decision point for the implementation of an SRO in 2028. Without the Mendip Quarries option, delivery of the environmental destination requirements would be at risk.

Secondary benefits include:

- The augmentation of the River Stour, which is the proposed method of transferring raw water from the quarry to the intake at Longham, would also enhance river flows and therefore assist in meeting environmental flow indicator targets for the river
- Wider benefits such as increased employment, health and wellbeing, education as described in ***Annex B1 Environmental Appraisal Report***

9. Stakeholder and customer engagement

This section presents a summary of the stakeholder and customer engagement completed for the scheme to date, both as part of the RAPID gated process and within the water company WRMPs and regional plans.

9.1 Introduction

The primary objective of the partner water companies is to deliver exceptional service and value for customers and communities, all while safeguarding and enhancing the environment. These wider benefits are a key consideration in the design, development and delivery of the scheme. Ensuring meaningful involvement of stakeholders and customers directly affected by the scheme is crucial in fostering a collaborative approach in the development of these broader benefits.

The involvement of the community and stakeholders is of utmost importance in the development of the Mendip Quarries SRO. 'High level' engagement with key stakeholders has taken place throughout gates one and two, which provides a platform for a much more extensive programme of community engagement and formal consultation going forward.

9.2 Stakeholder engagement overview

Engagement with regulators and key stakeholders has taken place regularly across a range of forums and at various levels within the organisations, initially to help shape the partner water companies approach to the SRO options appraisal and to identify the preferred option.

Gate two stakeholder engagement builds on the early work completed in gate one, as well as ongoing feedback from RAPID and other key stakeholders. Throughout gate two, engagement with a broader range of stakeholders has been undertaken to further develop understanding of stakeholder concerns so that key risks and opportunities are identified and mitigated or optimised early. A summary of key stakeholders and engagement activity is provided in Table 9.1.

Table 9.1: Overview of stakeholder engagement

Stakeholder	Interests	Activity
Drinking Water Inspectorate (DWI)	As the regulator for drinking water quality, DWI is interested in ensuring that the scheme is developed in a way that manages risk to drinking water quality in line with requirements	Project specific meetings including final briefing in May including water company drinking water quality managers
Environment Agency	EA works to create better places for people and wildlife and support sustainable development. Areas of particular interest include: • Mendip Woods SAC • Hydrology Modelling • Hydrogeology Modelling • Nutrient Neutrality	Project specific meetings, including hydrogeology engagement via East Mendips Model Liaison Group

Stakeholder	Interests	Activity
Natural England (NE)	NE is responsible for ensuring the natural environment, are protected and improved. It also has a responsibility to help people enjoy, understand and access the natural environment. Areas of particular interest include: • Mendip Woods SAC • Hydrology Modelling • Hydrogeology Modelling • Nutrient Neutrality	Project specific meetings, regular meetings in addition to ad-hoc meetings in regard to areas of key concern
RAPID	RAPID identifies and addresses issues relevant to the development of joint infrastructure projects and analyses the feasibility of nationally strategic supply schemes	Quarterly meetings and on specific issues, such as DPC. Pre-submission meeting on 8th June (in person meeting)
Regional Planning Groups	Regional planning groups seek to facilitate a coordinated approach to water resources planning in England that transcends water company boundaries	Regular briefings on progress at WRSE and West Country Water Resources Group (WCWRG) steering group and Board meetings
Historic England (HE)	HE ensures that the historic environment is protected, reconciling this with economic and social needs and aspirations of the people who live and use the area. Its particular interest is around Bath World Heritage Site	Submission of Technical Note considering risks to Bath Hot Springs
Consumer Council for Water	The Consumer Council for Water is independent of both the regulator, Ofwat, and the water companies. CC Water represents the interests of water and sewerage consumers in England and Wales	Briefing meeting on 22nd June 2023
Water Company Water Quality Teams	ACWG approved methodology for drinking water quality assessments indicates water company experts from all stakeholder water companies involved in the SRO need to be involved in the DWQA process	3x water quality risk assessment workshops to review the drinking water quality assessment for each option
Local Authorities	Local authorities are interested in how their local development plans and major infrastructure development projects will be affected by our SRO, and if the planning application process will be at a local or national level	Engagement with Somerset Council via established Quarry Liaison Committee
National Farmers Union (NFU)	The NFU is a representative body for agriculture and horticulture in England and Wales representing more than 46,000 farming and growing businesses. The NFU is interested on impacts on farm holdings during construction of the scheme	Monthly meetings via WCWRG steering group meetings
Mendip Quarry Producers Group	Represent all the quarries in the Mendips	Attended East Mendips Groundwater Model stakeholder meeting arranged by the EA in May 2023, and other model liaison meetings
Aggregate Industries (Torr Quarry Operator)	The quarry owners who own the land on which Mendip Quarries SRO is located	Monthly meetings

9.3 Company-led and regional engagement

9.3.1 Company-led engagement

Extensive engagement and pre-consultation took place with statutory stakeholders and regulators in the development of the partner water companies preliminary plans. This approach enabled stakeholders to comprehend the proposed strategies, contribute their insights, and inform decision-making processes during the preparation of the preliminary plans.

Engagement with customers was also undertaken while developing their preliminary plans to ensure current and future needs were reflected. It is important for clarity, consistency, and efficiency that these engagement activities inform the development of the Strategic Resource Options (SROs) and is coordinated with dialogue on the regional plans and the partner water companies WRMPs.

Engagement with customers has been undertaken to ensure current and future needs were reflected. This engagement has taken the form of a number of quantitative and qualitative research studies which form part of WW's and SWW's extensive programme of customer engagement.

WW and SWW recently consulted on their respective draft WRMP24 proposals, both of which will provide valuable feedback about customer and stakeholder views across a range of issues. The Statements of Responses (SoRs) from these consultations, which are due to be published in August 2023 will provide insights into customer concerns and preferences and will frame some of the issues customers and stakeholders are concerned about, including the level of support for a new strategic resource option to be delivered in the Mendip Hills. A further round of company led engagement and consultation will take place as part of the next round of planning to inform WRMP29.

9.3.2 Regional engagement

WCWRG has been developing the first-ever water resource plan for the West Country region. In January 2022, WCWRG sought feedback on its emerging regional plan from stakeholders in a consultation that ran between January 2022 and 28 February 2022.

In January 2023, WCWRG's Draft Regional Plan was published setting out the long-term water requirement for the region to 2050, and the options available to respond to those needs. Consultation commenced on 1 February 2023 and finished on 26 April 2023.

The plan is currently being finalised in collaboration with individual water company WRMPs and regional plans. The final plan is due to be published in late 2023. The Mendips SRO solution was identified as a key strategic solution within the emerging West Country Water Resources regional plan to meet a supply-demand balance need in the 2040s.

9.4 Next steps

From statutory consultees and specialist interest groups to local communities and businesses, there is a need to engage effectively with people who have an interest in, or could be impacted by, Mendip Quarries SRO. Going forward the stakeholder engagement programme will focus on two areas, more detailed engagement with groups of stakeholders around specific issues, this engagement will involve one-to-one meetings, established stakeholder forums and Technical Working Groups (TWGs) in addition to engagement with customers and local communities directly affected by the proposed scheme.

Strong and effective relationships can be fostered by further developing and accessing local knowledge through engagement with local community leaders and groups. Discussions with community leaders encourage trust and confidence in scheme promoters. This will also provide an understanding of local aspirations, concerns and perceptions.

This approach means the preliminary scheme design can be optimised to include validated insights from the community where appropriate. A feedback loop between stakeholders and the design team can be developed which helps build stakeholder trust and confidence ahead of non-statutory and statutory consultation.

The date when the proposed solution is expected to be able to begin to operate is 2042 or potentially earlier around 2040. There is a significant period prior to submission of a planning application for the solution where there could be changes to the scheme and the external environment. Therefore, it is important that in the short-term proactive, regular engagement with the quarry/landowner is maintained via the established quarry liaison committee to obtain further clarity as the scheme progresses whilst also investigating other potential quarries which could be used in a similar way within the Mendips quarries complex.

10. Board statement and assurance

This section provides an overview of the approach to assurance and the agreement of the Board statement that accompanies the submission.

10.1 Assurance approach

A three levels of defence approach has been adopted in line with Wessex Water's information assurance framework. The three levels comprise:

- **First line assurance:** Quality assurance checks by the organisation responsible for preparation of the relevant report.
- **Second line assurance:** Review of key deliverables by the programme manager, members of the wider programme team and internal experts from the companies. In addition, we organised for an inter-disciplinary review to be carried out by the consultant's major projects director specifically targeted at ensuring a robust consenting strategy was included in the submission.
- **Third line assurance:** Independent third-party external assurance as described below. In addition, we commissioned a separate peer review of the groundwater modelling also described below.

This approach provides an effective risk-based level of assurance. Areas of higher risk received three lines of assurance, whereas other areas which are lower risk received first and second line assurance only.

Our approach built on the experience gained through the gate one and gate two submissions for other SROs.

10.2 Third-party assurance scope and findings

The final determination and the report template provided by RAPID calls for external assurance of the quality and consistency of data and approaches used in preparation of the submission, as well as evidence of efficient cost expenditure. Based on feedback and lessons learnt from the previous gate submissions the assurance requirements should focus on the desired outcomes as well as providing constructive feedback on how well the submission templates have been completed.

The main purpose of the assurance is to support the Boards in the signing of the Board statement.

WSP were appointed as independent third-party external assurers. The specific objectives and scope of their assurance were as set out in Table 10.1.

Table 10.1: Scope and objectives for third line assurance

Board statement	Assurance carried out
The Board support the recommendations for solution and/or option progression made in this submission.	Review of the recommendations about scheme progression Check alignment with the West Country Water Resources Group regional plan and with the partner's WRMPs.
The Board are satisfied that progress on the solution is commensurate with the solution being "construction-ready" in the period 2025 to 2030. [Note this bullet point has been amended for the Mendip quarries SRO].	Review of the programme, consenting strategy and procurement strategy. Review of the detailed project plan.
The Board are satisfied that the work carried out to date is of sufficient scope, detail and quality as would be expected of a large infrastructure scheme of this nature at this stage in its development.	High level review of the supporting information and analysis used to carry out the assessment. Review of the annexes and the gate two report.
The Board are satisfied that expenditure has been incurred on activities that are appropriate for gate one and is efficient.	The project sponsor will provide evidence of efficient cost expenditure at a meeting and overview of the procurement plan. Review of section 11 of the gate two report.

The lead assurer and assurance coordinator attended various meetings, including:

- An initial briefing session and fortnightly progress meetings during the assurance period
- Checkpoint meeting with RAPID (the meeting prior to sign off of the submission)
- The final sign-off meeting

Based on their reviews the assurers concluded that the gate two submission satisfies the guidelines and they were able to provide the necessary confidence to the Boards in the signing of the Board statement.

10.2.1 Peer review of groundwater modelling

Given the importance of the hydrogeological assessment of the quarry storage, we commissioned a separate independent review of the groundwater modelling for the project by a specialist firm Atkins. The CV of the specialist was approved by the EA. The output of the review was provided to the EA and to WSP in their role as overall project third line assurers.

10.3 Board assurance statement

The signed Board statement including the evidence and factors considered is attached to the covering letter for the submission. A copy (with signatures redacted) is provided in ***Annex G – Board Statement***.

11. Efficiency of expenditure for gate two and forecast

This section sets out:

- The maximum ring fenced expenditure that the regulator allowed for the gate two activities and the provisional allowances for gates three and four
- The actual gate two costs, with a breakdown, as well as a comparison with the allowance and the partner share percentages
- The future gate allowances and forecast for gate three

All expenditure is reported at 2017/18 prices as requested.

11.1 Gate allowances

The Mendip quarries SRO entered RAPID's gated process as a new solution after a gate one submission in December 2021 and draft and final decisions by Ofwat in March 2022 and May 2022 respectively. The maximum allowances based on the final decision by Ofwat in May 2022 are set out in Table 11.1 below.

Table 11.1: Gate allowances

Gate	£m @ 2017/18 prices	Comment
Gate one	n/a	No allowance is provided for gate one for new solutions
Gate two	5.01	
Gate three	11.70	To be reviewed at gate two
Gate four	13.37	To be reviewed at gate three
Total	30.08	

11.2 Gate two costs

We have aimed to deliver the gate two studies efficiently, through close management of the work, use of well qualified consultants with recent experience on similar projects and a focus on the key aspects that influence the feasibility and deliverability of the solution.

In summary the current position is as presented in Table 11.2.

Table 11.2: Summary of gate one and two expenditure (£m @ 2017/18 prices)

Gate	Allowance	Expenditure	% of funding allowance
Gate one	0	n/a	n/a
Gate two	5.01	2.13	42%

In particular our approach to ensuring efficient delivery includes:

1. Work has only been undertaken on activities included in the list of gate activities in the PR19 final determination appendix for the specific solution.
2. The packages of technical work, environmental assessment and third-party assurance have been awarded following competitive tenders, with compensation events for additional work in line with the contracts. The packages are based on defined scopes of services, activity schedules, defined deliverables and key dates.
3. The selection of consultants was based on quality and cost criteria. The weighting of quality and cost was based on the technical complexity of each contract and the technical risk to the programme. Overall this approach ensured that the most commercially advantageous procurement for the project in line with the companies' own procurement guidelines.
4. Other activities such as cost estimating have been commissioned through framework agreements that were competitively tendered by the procuring water company.
5. Table 11.4 below provides a breakdown of the work according to the category of procurement that has been used for the packages of work.
6. We have kept the services obtained by single option to the absolute minimum, predominantly for legal and land services.
7. For the environmental monitoring (such as flow gauging, fish surveys, water quality analysis etc.) it is necessary to draw from a small number of specialists suppliers. In this case we have obtained quotations wherever possible and then placed orders with the supplier that provided best value for money, in accordance with our procurement rules.
8. Programme management and scheme partner in-house staff costs are based on actual and forecast staff time (hours) and rates, with budgets which are subject to regular reviews.
9. Efficiencies have been realised by running the solution in parallel with other West Country SROs as a single programme with a single programme manager.
10. We have sought to learn for the other two West Country SROs that are following the standard gate two timeline.
11. Third-party costs such as the EA's National appraisal unit and Natural England's discretionary advice service are based on offer letters from the regulators.

Table 11.3 provides a breakdown of the costs for gate two, in the format requested by RAPID, at 2017/18 prices.

The breakdown is based on actual costs incurred at the time of writing and a forecast of costs to complete. Current costs have been deflated to a 2017/18 price base using the CPI-H index. Additional breakdowns are provided for any categories that exceed £0.25m in value.

Table 11.3:Gate two efficiency of expenditure template (£m @ 2017-2018 prices)

Category	Activity	Expenditure	% of Total	Description of Activity
Programme & Project Management	Programme management and partner costs	0.10	5%	Programme management and oversight, partner costs
	Technical assurance	0.06	3%	External technical assurance to support Board statement. Peer review of groundwater modelling
	Sub-total	**0.17**	**8%**	
Feasibility Assessment and Concept Design	Project technical lead	0.17	8%	Project technical lead and project management
	Concept design	0.11	5%	Technical studies reported as follows: Concept design - Annex A4
	Hydrological & hydrogeological modelling and studies	0.13	6%	Technical studies reported as follows: Hydrology Annex A2, Hydrogeology Annex A3
	Drinking water quality assessments	0.02	1%	Technical studies reported as follows: Drinking water quality assessments Annex C
	Reporting	0.06	3%	Preparation of the gate two report
	Sub-total	**0.50**	**24%**	
Option benefits development and appraisal	Options appraisal	0.13	6%	Options assessment as reported in Screening report Annex A1; Carbon assessment Annex B6; Various transfer options
	Cost estimating	0.03	1%	Preparation of cost estimates as reported in Annex A5
	Sub-total	**0.16**	**8%**	
Environmental Assessment	Environmental assessments - HRA, WFD, INNS etc	0.09	4%	Integrated environmental assessment as reported in Annex B1
	Environmental coordination and integrated environmental assessment	0.11	5%	Environmental assessment - HRA, WFD, SEA, INNS as reported in Annex B2, B3 and B4
	Sub-total	**0.20**	**10%**	
Data Collection, Sampling, and Pilot Trials	Development & management of the monitoring programme	0.08	4%	Development and agreement of the monitoring programme, as described in the monitoring strategy in Annex B5. Data management system
	Flow monitoring	0.03	1%	Flow monitoring
	Water quality monitoring	0.44	21%	Water quality monitoring – sampling and analysis. To inform DWQRA and environmental assessments. Refer to additional table for breakdown
	Ecological surveys	0.12	6%	Fish, INNS, macrophytes and habitat surveys
	Sub-total	**0.67**	**31%**	
Procurement Strategy	Procurement strategy	0.04	2%	DPC and procurement assessment as reported in Annex E
Planning Strategy	Planning strategy	0.05	2%	Preparation of the consenting and land strategy as reported in Annexes D1 and D2; Project plan
Stakeholder Engagement	Environment Agency National appraisal unit and area costs	0.23	11%	Environment Agency National appraisal unit and area costs (based on offer letters from EA)
	Natural England Discretionary advice service costs	0.01	1%	Natural England Discretionary advice service costs
	Stakeholder engagement - other	0.00	0%	n/a

Category	Activity	Expenditure	% of Total	Description of Activity
	Sub-total	**0.25**	**12%**	
Legal	Legal	0.04	2%	Legal and land agent advice
Other		0.04	2%	Contingency to be removed in final actual costs
Total		2.13	100%	
Gate two Allowance		5.01		
Gate Underspend		-2.88	-58%	

Table 11.4 below provides a summary of procurement methods as percentages of the total cost (excluding regulator costs (EA and NE) and partner costs).

Table 11.4: Procurement categories

Procurement categories	%
Tender	64%
Framework agreement	2%
Quotations	31%
Single option	2%
Total	100%

Table 11.5 below provides a breakdown of the water quality sampling and analysis costs (the only single category in Table 11.4 greater than £0.25m). The sampling programme will be reviewed after six months to identify whether any parameters can be dropped from the schedule of analysis.

Table 11.5: Breakdown of costs for environmental monitoring – water quality (2017/18 prices)

Description	Quantity	Rate £	Cost £m
Sampling	1 year		0.04
Laboratory analysis – by specialist laboratory that is capable of testing for the large range of parameters	Monthly samples at 9 locations = 108 samples	3,598	0.39
In-river water quality sonde	1 year		0.01
Total			0.44

The gate two expenditure has been reviewed by the third-party assurer to confirm that expenditure is on relevant activities and has been subject to efficient procurement processes and management.

Solution partner share percentages are as shown in Table 11.6 below.

Table 11.6: Solution partner shares

SRO	South West Water	Wessex Water
Mendip Quarries SRO	50%	50%

Interim reconciliations of the costs due from each partner have been carried out at regular intervals during the project. At the end of the query period for the gate two submission a final reconciliation will be prepared. In addition a final out-turn cost will be provided to RAPID prior to the closing of the gate two decision consultation window.

11.3 Forecasts for future gates

As explained in sections 4, 5 and 6 we have commenced flow, water quality and ecological monitoring. We have awarded a three year contract for this work, alongside individual package

orders for specific field surveys based on quotations. Table 11.3 above includes the costs for the first year of the monitoring programme for 2023.

Other than the environmental monitoring mentioned above, no gate three activities have been advanced into the gate two period, and therefore Table 11.3 above does not include expenditure for any gate three activities.

The proposed gate three activities and timelines are described in section 7 above. The aim of gate three is to demonstrate substantive progress in solution design, costs and benefit assessment, planning and consenting, procurement, environmental and drinking water quality assessments, such that the project can be implemented to the required timeline. The required timeline is driven by the need in the regional and company water resource plans and the lead-in time of the solution.

Based on carrying forward the forecast underspend from gate two, the provisional allowances for gates three and four and the split between this AMP and AMP8 are as set out in Table 11.7 below.

Table 11.7: Gate three and four allowances

	£m @ 2017/18 prices	Comment
Original allowances:		
Gate three	11.69	
Gate four	13.36	
Underspend carried over from gate two	2.88	
Revised allowance for gate three and four:		
Gate three	14.58	
Gate four	13.36	
Total for gates three and four	27.94	
Split between AMPs:		Based on project plan in section 7 which indicates gate submission dates of: Gate three June 2028 Gate four September 2029
AMP7 2020 - 2025	5.8 (21%)	
AMP8/PR24 2025 - 2030	22.1 (79%)	

We have prepared a high-level estimate for gate three and are confident that gate three can be delivered within the original allowance based on carrying over the underspend from gate two.

Solution partner shares will remain as shown in Table 11.6. In due course it will be necessary to base the percentage share of costs by partner on the final agreed shares of the deployable output of the scheme, but we envisage that this information will not be available until after gate three in line with the next round of regional planning.

No changes to the proposed penalty scale, delivery incentives, assessment criteria or contributions are currently proposed for gate three.

12. Conclusions and recommendations

The conclusions and recommendations are agreed by both the solution sponsors.

The purpose of gate two is to confirm the feasibility and deliverability of the scheme and to provide cost estimates and a project plan. In parallel the regional water resource planning and company Water Resource Management Plans provide support for the need for the scheme.

Our ***conclusions*** on both of these aspects are summarised below.

Detailed feasibility and concept design

The gate two studies commenced immediately after the draft decision on gate one in March 2022. We have completed detailed hydrological and hydrogeological studies, drinking water quality and

environmental assessments as well as the preparation of cost estimates, a project plan and proposals for procurement. In addition the concept design for a core scheme has been developed.

No showstoppers have been identified to date although there remain numerous risks and issues to be overcome at the next stage.

The core scheme is based on re-purposing Torr Quarry and utilising the top 50m of the available storage. In this case the bottom water level during severe drought events will be approximately the same as the current base level of the dewatered quarry. This provides an analogue for the future operation of Torr Reservoir and provides a high degree of certainty that the impact of the scheme will be acceptable.

There are a number of opportunities to scale up the scheme and provide further benefits, which will be investigated in gate three.

Therefore, based on the gate two studies, we conclude that the scheme:

- is technically feasible and deliverable
- has environmental impacts that can be satisfactorily mitigated given that one of the major components, the quarry storage is already constructed
- would provide a drought and climate change resilient regional water resource with an average annual reservoir resource DO of 46Ml/d and a peak DO of 106Ml/d.
- can provide a potable supply to Wessex Water of up to 50Ml/d. The concept design is based on a transfer to a strategic service reservoir near Warminster, which enables the water to substitute for groundwater abstractions which are planned for reduction
- can provide a raw water transfer to the River Stour near Sturminster Newton from where the water will flow a further c60km downstream before abstraction on a ‘put and take’ basis to provide a net 50Ml/d for South West / Bournemouth’s rebuilt water treatment works at Knapp Mill. The discharge location will be refined during gate three to reflect comments from regulators
- can be construction ready in the period 2030 to 2035, and on line by 2042.

One of the great advantages of the scheme is that the reservoir storage will have already been constructed thus avoiding the very significant environmental, social and carbon impact, as well as public relations challenges, of trying to construct a new dam and reservoir of an equivalent volume.

Demonstration of need

There is support for the need for the scheme through the following published plans and the statements of response that will be issued in summer 2023:

- West Country Water Resources Group – Regional water resources plan
- South West Water (Bournemouth Water) – Draft WRMP
- Wessex Water – Draft WRMP and proposed revisions for the statement of response

Recommendations

Therefore based on the conclusion regarding feasibility and the need for the scheme identified in the regional and company water resources plans, it is recommended that the scheme proceeds to gate three.

Gates three and four involve design development, pre-planning activities, procurement, planning applications, consents etc. such that by the end of gate four the scheme is ‘construction ready’. An extended environmental baseline monitoring programme, including flow, water quality and ecological surveys, has already commenced in spring 2023.

13. Supporting documentation

Further information on the work conducted on the scheme in preparation for gate two can be found in the annexes listed in Table 13.1. An update on progress with actions identified by RAPID at gate one is included in Table 13.2.

Table 13.1: Summary of gate two supporting annexes

Annex	Document Title	Summary of contents
A1	Options Appraisal Screening Report – Quarry Site Selection	Outlines the screening undertaken to identify potential options for a quarry for the Mendip Quarries SRO and summarises screening outputs, which informed the selection of Torr Quarry for the scheme's development during gate two.
A2	Water Resource Assessment – Hydrology	Describes the hydrological assessment of the scheme, including the proposed source for refilling the reservoir and its operation to meet the anticipated demand.
A3	Water Resource Assessment – Hydrogeology	Summarises the groundwater modelling work carried out to refine predictions of potential leakage from the reservoir by developing a groundwater model to model flow into and out of the quarry and its interaction with the surrounding aquifer and spring-fed watercourses.
A4	Conceptual Design Report	Summarises the development in gate two of the engineering design and scheme delivery details.
A5	Cost Report	Summarises the capex costs, including key risks, optimism bias and average incremental costs, and opex costs estimated for the gate two concept design. Data tables with cost and benefit profiles are included as Appendices.
A6	Peer Review of Hydrogeology Modelling	Provides a peer review of the hydrogeological modelling to check and confirm the modelling methodology and conclusions.
B1	Environmental Appraisal Report (EAR)	Draws together the conclusions of all the gate two environmental appraisal work into a single document, including the identifications of potential environmental effects and enhancement opportunities for each element of the gate two scheme.
B2	Habitats Regulations Assessment (HRA)	Supports Annex B1 and presents the findings of an informal HRA for elements of the scheme, undertaken in gate two to inform the scheme development, identify any likely impediments to the scheme's practicality or deliverability, and reduce risk of non-compliance at a later stage.
B3	Water Framework Directive (WFD)	Supports Annex B1 and presents the findings of the gate two WFD assessments applied to elements of the scheme, including the potential impacts on the water environment.
B4	Strategic Environmental Assessment (SEA)	Supports Annex B1 and presents the findings of an SEA applied to elements of the scheme, carried out in gate two as best practice and to help inform the Water Resource Management Plan 2024 (WRMP24) SEAs.
B5	Monitoring Strategy	Sets out the strategy for monitoring, including proposed environmental surveys and data management, to support the environmental and drinking water quality assessments in gate three.
B6	Carbon Report	Provides an overview of how carbon emissions have been managed through gate two, covering how whole life carbon emissions have been estimated to provide a breakdown of carbon hotspots and how these have informed focus on mitigation measures on the scheme alongside other drivers.
C	Drinking Water Risk Assessment	Covers the water quality considerations for the scheme, analysed in the form of water quality risk assessments.
D1	Planning and Land Strategy Report	Addresses the proposed planning and consenting route and responds to the specific feedback provided on the gate one planning submission from RAPID.
D2	Planning and Land Strategy Peer Review	Provides a peer review assessment of the Planning and Land Strategy to check and confirm the key conclusions presented in Annex D1.
E	Procurement and Commercial Strategy Report	Provides an initial assessment of the most suitable commercial model for the scheme based on Ofwat guidance for assessing an appropriate procurement route.
F	Stakeholder and Customer Engagement Report	Summarises all gate one and gate two stakeholder engagement, the most recent draft WRMP24 consultations and future stakeholder engagement, and the statutory stakeholder requirements under the Planning Act 2008. Assesses the Development Consent Order and application risks with relevant mitigation measures.
G	Board Statement	The Board statement including the evidence and factors considered.
H	Gate two guidance signposting	Provides a summary of the RAPID gate two guidance and how each criterion has been met, with references to the relevant supporting documents.

Table 13.2: Summary of responses to gate one decision actions and recommendations

No	Section	Detail (from RAPID Final decision)	Gate two update	Gate 2 / Other documentation reference
Actions				
1	**Cost and Benefit**	Include metric benefits associated with the options and how the solution provides best value to customers beyond cost. Ensure societal and economic metric benefits are considered. Update natural capital assessment (NCA) & biodiversity net gain (BNG) providing greater detail on metrics used and potential impacts on Ancient Woodland.	NCA and BNG assessments have been completed. The option has been assessed against the Best Value Metrics which have been used for the WCWRG regional plan and in each water company draft WRMP.	**Annex B1:** Environmental Appraisal Report **WCWRG Regional Plan:** Table 6 **SWW WRMP:** 10 Development of our Best Value Plan, 1.6.3 **WW WRMP:** Table 6.4
2	**Cost and Benefits**	Ensure wider resilience benefits are investigated and quantified. Include resilience metric benefits associated with the options, ensuring these are consistent with regional planning, and how this contributes to the solution providing best value to customers beyond cost.	Resilience has been factored in through development of the 1:500 year yield and deployable output, which takes account of a median climate change scenario for 2070. 'Ensuring water supply resilience' is a Best Value Metric for the WCWRG regional plan, for which Mendip Quarries SRO is selected in three of five plans.	**Gate two report:** 4.2.1 and 8.6.1 **WCWRG Regional Plan:** Table 6 **SWW WRMP:** 10 Development of our Best Value Plan, 1.6.3 **WW WRMP:** Table 6.4
3	**Cost and Benefits**	Compare costs and benefits of the options considered and demonstrate which of the solution options are considered to provide best value for customers. Include both WCWR and WRSE regional plan Best Value Plan outputs in the submission.	A cost report has been completed to provide option NPV and AICs for the core scheme. The options appraisal report considers the primary benefit (capacity) provided by each quarry and selects Torr Quarry on this basis. The main gate two report discusses inclusion of the Mendip Quarries core option in the WCWR plan, and the SWW and WW WRMPs. The option isn't included in the WRSE plan but has been included in sensitivity runs to continue investigating its performance against other WRSE options.	**Annex A5:** Cost Report **Annex A1:** Options Appraisal – Quarry Site Selection **Gate two report** Section 8.6
4	**Programme and Planning**	Please provide analysis for the different tender models for delivery of this project via DPC.	A procurement and commercial strategy report has been completed at gate two.	**Annex E:** Procurement and Commercial Strategy Report
5	**Environment**	Consider all reasonable alternative sites within the site selection study proposed for gate two.	Consideration of feasible sites has been addressed in the quarry site selection report.	**Annex A1:** Options Appraisal – Quarry Site Selection
6	**Environment**	Progress and complete the full assessment of the potential impacts on the integrity of the Mendip Woods SAC.	A full assessment of the Mendip Woods SAC has been included in the HRA. Pipeline corridors have been adjusted to mitigate the risk.	**Annex A4:** Concept Design Report **Annex B2:** Habitats Regulations Assessment
7	**Environment**	Complete hydrogeological assessment and modelling of the scheme to include the ecological requirements of the Mendip Woods SAC.	Initial hydrogeological feasibility modelling has been completed to establish the viability of the scheme from a leakage and augmentation flows perspective. Gate three will include impact modelling to consider the environmental impacts. It is noted that the core scheme would not result in drawdown below the levels currently experienced due to quarry dewatering, and most of the time water levels would be higher.	**Annex A3:** Water Resources - Hydrogeology
8	**Environment**	Consider the potential impacts of the recreational use of the proposed reservoir and surroundings on the Mendips Woods SAC.	Recreational use of the reservoir has been considered within the EAR in the context of the INNS risk assessment.	**Annex B1:** Environmental Appraisal Report
9	**Environment**	Ensure that the water quality assessment of the options covers all hydrologically connected designated sites and for the River Stour option show that nutrient	A technical note has been produced to support the HRA, which concluded no LSE on the Solent due to nutrients.	**Annex B2:** Habitats Regulations Assessment

No	Section	Detail (from RAPID Final decision)	Gate two update	Gate 2 / Other documentation reference
Actions				
		neutrality requirements are met for the SACs associated with the Solent.		
10	**Environment**	The current proposals for abstraction at Newton Mendip do not fully acknowledge the environmental constraints on the wider catchment. Engage with the Environment Agency to progress the approach for abstraction licensing to facilitate capture of high flows whilst providing the required environmental safeguards.	Hydrology assessment completed based on an indicative licence proposed by the EA. The hydrology report has been reviewed by the EA. The HRA has considered the potential effects of the abstraction on downstream designated sites.	**Annex A2:** Water Resources Assessment – Hydrology **Annex B2:** Habitats Regulations Assessment
11	**Drinking Water Quality**	Investigate any risks associated with River Avon and surrounding catchment for inclusion in Drinking Water Safety Plan and risk assessment development. DWSP and risk assessment to include risks identified with R Avon and surrounding catchment in line with All Company Working Group (ACWG) methodology.	A drinking water quality risk assessment has been completed for all scheme elements in line with the ACWG.	**Annex C:** Drinking Water Quality Risk Assessment
Recommendations				
1	**Solution Design**	Ensure utilisation is determined through regional modelling as part of gate 2, including uncertainty and sensitivity. Provide detailed explanation of the methodology for defining utilisation from the regional modelling. Reassess operation for baseline supply vs resilience following regional plan reconciliation.	There is no regional model for determining the utilisation of WCWR options, so utilisation has been assumed as described in Section 4.1 of this report. A roadmap for developing a regional model has been produced and is included in the project plan to confirm the option need case as part of the 2029 WRMP and regional plan. The regional modelling package is currently being tendered by WRWRG	**Gate two report** Section 4.1
2	**Solution Design**	Review with regulators implications of option to transfer water to WRSE as reconciliation of regional plans progresses in the context of water company environmental obligations on designated sites under Habitat Regulation.	WRSE options are excluded from the gate two core scope but were included in WRSE sensitivity modelling, which has confirmed that these should be further developed as potential options in gate three, as discussed in section 4.3.1	**Gate two report** Section 4.3.1
3	**Solution Design**	Ensure outputs of further engagement activities are included for Gate 2. Ensure CCW are included in WCWR regional plan stakeholder engagement going forward and is consulted on any plans for customer research.	A meeting with CCW took place on 22 June 2023, after which future participation will be agreed.	**Annex F:** Stakeholder Engagement Strategy Report