

Strategic regional water resource solutions: Preliminary feasibility assessment

Gate-1 submission for Grand Union Canal Transfer SRO

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Attention: Mr Paul Hickey
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Ofwat
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01 July 2021

Grand Union Canal (GUC) SRO Gate 1 Submission

Dear Paul

Affinity Water, Severn Trent Water and the Canal & River Trust are pleased to submit our gate-1 report for the GUC Transfer Strategic Resources Option (SRO). The report outlines how we have developed this SRO since its approval in the PR19 Final Determination, and the key steps we intend to take in gate-2.

Through this SRO and our proposals for the Minworth SRO, we intend to transfer water from Minworth wastewater treatment works to the Grand Union Canal and into the Affinity Water supply area, supporting customers in the South East of England with up to 100ML/d of water in times of need.

We are proposing to upgrade the Grand Union Canal for the transfer, and to abstract, store and treat the water downstream before it enters Affinity Water's supply area. Utilising existing canal infrastructure will allow us to provide value for money and to enhance the recreational value of the canal for local people.

Our cross-industry team, including personnel from Affinity Water, Severn Trent Water and the Canal & River Trust, has been delighted to make this contribution to strengthening the UK's water infrastructure and creating a legacy of resilient water resources for future generations.

The Boards of Affinity Water and Severn Trent Water confirm their support for this SRO with the supporting board statement attached. We have also included a separate statement from the Canal & River Trust.

We have aimed to create a gate-1 report that meets RAPID's requirements at this stage in the process. If there are elements you would like to discuss with the team, please send your queries to wrmppcomms@affinitywater.co.uk, justin.bailey@severntrent.co.uk and GUC@severntrent.co.uk; we would welcome the opportunity to provide further clarity where needed. We have received a letter of support from the Environment Agency, which can be provided on request. We look forward to receiving your feedback, and to developing this SRO into gate-2.

Yours sincerely

Ian Tyler
Chair Affinity Water

Liv Garfield
Chief Executive Severn Trent

Gate 1 preliminary feasibility assessment

Grand Union Canal Strategic Resource Option

Joint Board Assurance Statement

This joint board assurance statement is provided by the Grand Union Canal partners, Severn Trent Water and Affinity Water. The two companies, together with the Canal & River Trust, have worked effectively and collaboratively on the Gate1 solution development. In support of this statement the two companies have undertaken both joint and individual company assurance and due diligence.

Each of the boards are satisfied that the data and approaches used to develop the concept design and decision-making information included within the Gate 1 submission:

- meets the requirements set out in Ofwat's Final Determination, and subsequent additional feedback from Ofwat;
- have been subject to sufficient processes and internal systems of control to ensure that the information on design, costs and benefits contained in this submission are reliable;
- have been appropriately assured to give our stakeholders, including customers, trust and confidence in this Gate 1 submission;
- and have appropriately considered the feedback and opinion of independent external assurance partners.

The Severn Trent Water Board confirm that they understand their role in this submission as suppliers of the water. Affinity Water confirms that they understand their role in this submission as a recipient of the water.

The Boards all support the recommendation for the solution progression made in this submission and are satisfied that the:

- progress on the solution, to date, is commensurate with the Final Determination timeline of being 'construction ready' in AMP8;
- scope, detail and quality of the preliminary activities are that which would be expected of a large infrastructure scheme of this nature at this stage;
- expenditure incurred in generating the Gate 1 submission is efficient and relevant to the development of the submission.

On Behalf of:	Name and position:	Date:
Severn Trent Water	Liv Garfield, CEO	01 July 2021
Affinity Water	Ian Tyler, Company Chair	30 June 2021

Gate 1 preliminary feasibility assessment

Grand Union Canal Strategic Resource Option

Canal & River Trust – Statement of Support

This statement of support is provided by the Canal & River Trust (the Trust) who have been working in partnership on the development of the Grand Union Canal Strategic Resource Option. The Trust, together with Affinity Water and Severn Trent Water have worked effectively and collaboratively on the Gate1 solution feasibility assessment.

The Trust can play a significant role supporting the water sector as it strives for resilience and affordability in delivering public water supply. Our waterway infrastructure already exists and with investment from the sector could unlock resilient and cost-effective water transfer schemes across England and Wales.

The Trust confirm that they understand their role in this submission as the conveyor of the source water from Severn Trent Water, transferring it to Affinity Water, for abstraction as the recipient. The Trust will continue to support the development of this Strategic Resource Option provided it remains cost effective for all parties involved and the Trust's statutory obligations and responsibilities remain unaffected.

The Trust supports the recommendation for the solution progression made in this submission and are satisfied that the:

- scope, detail and quality of the preliminary activities are that which would be expected of a large infrastructure scheme of this nature at this stage;
- development of the Grand Union Canal as a strategic transfer route, is a sensible and efficient use of existing infrastructure.

On Behalf of:

Name and position:

Date:

Canal & River Trust

Stuart Mills, Chief
Investment Officer

25 June 2021

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Glossary

Glossary	
Gate-1 / Gate-2	Strategic regional water resource solutions: Preliminary feasibility assessment – Gate one submission / Gate two submission
GUC SRO	Grand Union Canal Transfer Strategic Resource Option
Minworth SRO	Minworth Strategic Resource Option
Ofwat	Water Services Regulation Authority
RAPID	Regulator's Alliance for Progressing Infrastructure Development
The Trust	The Canal & River Trust
WRMP19	Water Resources Management Plan 2019
Water UK	UK Water industry trade body

Abbreviations	
ACWG	All Company Working Group
AD	Associated Development
ADO / DO	Average Deployable Output / Deployable Output
AfW	Affinity Water
AMP8	Asset Management Period 8 (Period between 2025/26 to 2029/30)
BAU	Business As Usual
BNG	Biodiversity Net Gain
CAP	Competitively Appointed Provider
CAPEX	Capital Expenditure
DBFOM	Design Build Finance Operate and Maintain
DCO	Development Consent Order
DPC	Direct Procurement for Customers
DWI	Drinking Water Inspectorate
DWSP	Drinking Water Safety Plan
EA	Environment Agency
EQS	Environmental Quality Standards
FD	Final Determination
GUC	Grand Union Canal
HRA	Habitat Regulations Assessment
INNS	Invasive Non-Native Species
JV	Joint Venture
MI/d	Megalitres Per Day
NAU	National Appraisal Unit (for EA)
NPS	National Policy Statement for Water Resources Infrastructure
NSIP	Nationally Significant Infrastructure Project
OB	Optimism Bias
OPEX	Operational Expenditure
PFOS	Perfluorooctane sulfonate
PMB	Programme Management Board
RAID	Risks, Assumptions, Issues and Dependencies
RSS	Regional System Simulation
SEA	Strategic Environmental Assessment
SLR	South Lincs Reservoir SRO
SRO	Strategic Resource Option
SSSI	Site of Special Scientific Interest
STT	Severn to Thames Transfer SRO
STW	Severn Trent Water
TCPA	Town and Country Planning Act
TOTEX	Total Expenditure
TWUL	Thames Water Utilities Limited
WFD	Water Framework Directive
WINEP	Water Industry National Environment Programme
WRMP	Water Resources Management Plan
WRSE	Water Resources South East
WRW	Water Resources West
WwTW	Wastewater Treatment Works

1. Executive Summary

Opening Statement

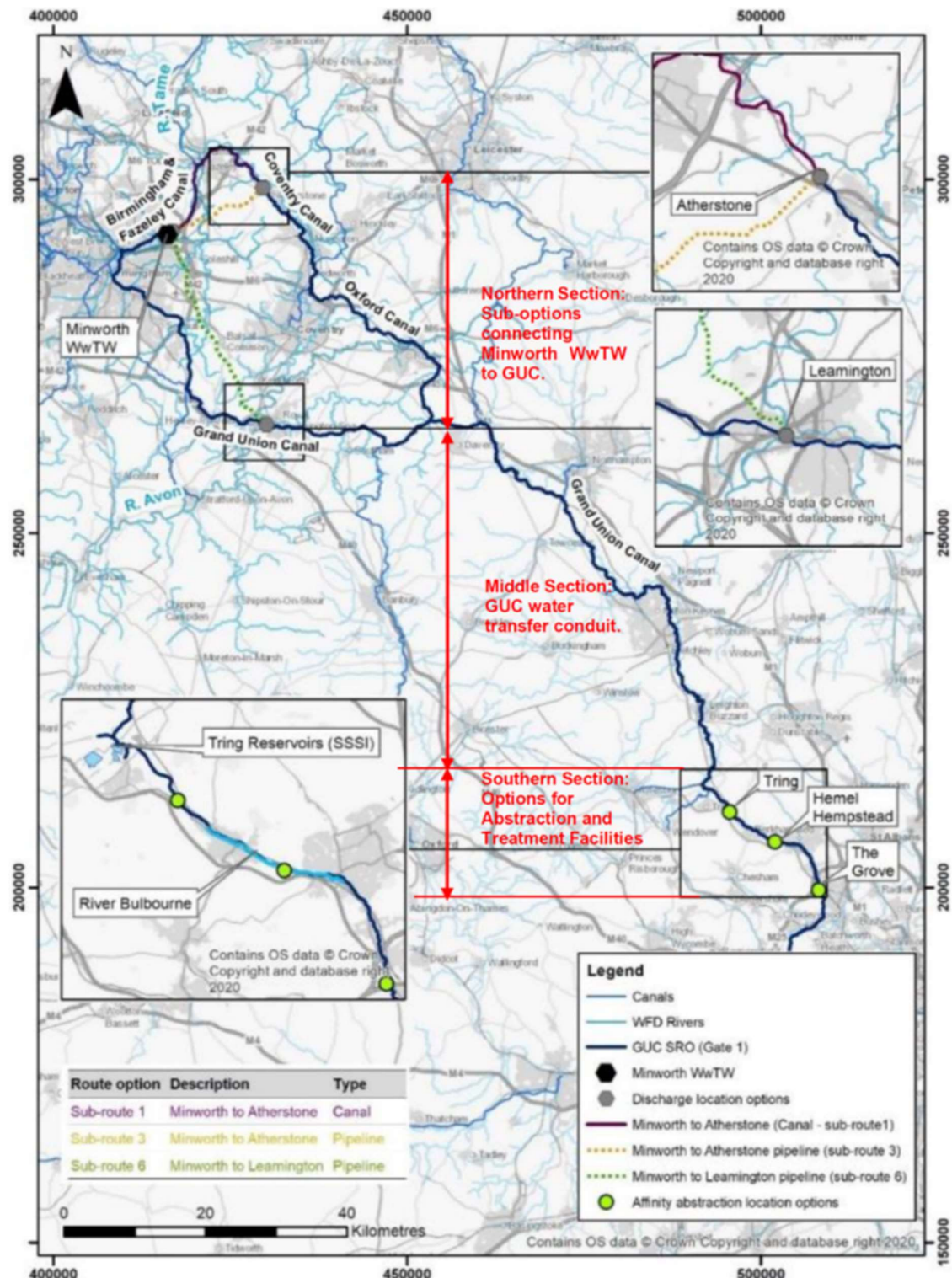
- 1.1 The Grand Union Canal (GUC) Transfer Strategic Resource Option (SRO) is a viable solution that transfers surplus water from Severn Trent Water's (STW's) supply area to areas of water deficit in Affinity Water's (AfW's) supply area. A new pipeline and existing canal will be utilised to convey treated wastewater from Minworth SRO to the GUC SRO. Water will be abstracted from the GUC in AfW's supply area and treated prior to distribution to customers. The anticipated transfer capacity will be between 50 Megalitres per day (MI/d) and 100MI/d.
- 1.2 The RAPID gating process has allowed this SRO to develop at pace, making significant progress since SRO investigations began in April 2020.
- 1.3 Through gate-1, we have established that GUC SRO offers drought resilience by utilising treated wastewater, and also provides an alternative water supply in the event of an incident affecting supplies from the River Thames. We have not discovered any showstoppers, and therefore recommend this SRO proceeds to gate-2.
- 1.4 Environmental data on the canal network is not as readily available as it is for rivers. As part of our efficient and relevant spend in gate-1, we have utilised around one-quarter of our budget to fill this gap in ecological and water quality monitoring. (Please note that this amount is for monitoring only, and does not represent our full environmental spend in gate-1.)
- 1.5 Minworth SRO will be the sole source of flow augmentation to support the new abstraction for the GUC SRO. The Minworth SRO is reported separately in its own gate-1 submission.

Key Facts

- 1.6 In the northern section of the scheme, water from Minworth Wastewater Treatment Works (WwTW) will be transferred to the GUC. At the start of gate-1, we derived a range of sub-options to transfer this water into and through the northern section of the canal. We have shortlisted three route options based on the following criteria: environmental and societal impacts; operational flexibility and resilience; operational and embedded carbon; and cost.
- 1.7 In the southern section of the scheme, we have shortlisted three locations for abstraction and treatment facilities from an initial longlist of eight. Shortlisting was based upon the suitability of the location for connection to AfW's existing key water infrastructure, along with site access, environmental, planning and societal impacts, and cost.
- 1.8 In the middle section, the GUC, owned by the Canal & River Trust (the Trust), provides a water transfer conduit to AfW's supply area.
- 1.9 During gate-1, we built integrated hydrological and hydraulic models to test where increased flow would put pressure on the current system, and to outline engineering solutions. In gate-2, we will use the models to refine the engineering design and constraints on the transfer. The models will be upgraded iteratively, utilising targeted topographical and hydraulic data gathered through field-based surveys.
- 1.10 The current model predicts that the transfer of 100MI/d could lead to an increase in water level of up to 50mm in the Birmingham-to-Tring section of the SRO. In the Grand Union South, the predicted increase is greater, with a maximum of between 220 and 300mm. Part of the gate-2 investigations will be to better understand the reasons for these differences.
- 1.11 Maximum velocity change in each part of the canal result in an increase of 0.12 to 0.14 m/s in the Birmingham-to-Tring section and a maximum increase of 0.42 to 0.53 in the Grand Union South. These do not represent unacceptable engineering concerns at this stage, so we recommend that both the 100MI/d and 50MI/d options are taken forward to gate-2.

1.12 Customer and stakeholder consultations have indicated that transfer of water via river or canal is considered more appealing than pipeline options, because they are perceived to have wider benefits and fewer negative impacts.

Figure 1.1 GUC SRO layout



Key Risks

- 1.13 As detailed in Chapter 9, there is a significant risk associated with the relative lack of baseline environmental information available before SRO investigations started in 2020. Interaction with the Water Resources South East (WRSE) regional plan is also a significant risk, as this scheme interacts with other SROs in a cross regional manner, meaning the final choice over selection in gate-2 will require cross-regional collaboration.
- 1.14 Our work in gate-1 shows that there is a complex interaction with the environment, and environmental data on the canal network is not as readily available as it is for rivers. We will carry out further in-depth environmental monitoring and investigations for gate-2 to address these gaps, but there is a residual risk that we will have less ecological and water quality data than other SROs. We are mitigating this risk through a targeted, integrated approach to water quality, and the use of hydraulic/hydrological models to refine the design of the transfer and determine the preferred option for minimising environmental risk to the rivers downstream of the AfW abstraction point.
- 1.15 Despite our planned gate-2 activities, there is likely to be a residual risk associated with the degree of confidence at gate-2 that the scheme will achieve the required environmental consenting, particularly in relation to the Water Framework Directive. We are working closely with the Environment Agency (EA) through the National Assessment Unit to minimise uncertainty at gate-2, and will work closely with RAPID and the Environment Agency (EA) to determine if remaining uncertainties affect the viability of the scheme for the final WRSE regional plan.
- 1.16 In gate-2, we will refine the scale and localised effects of the GUC SRO on canal hydraulic behaviour in order to protect existing canal assets. This will also allow us to better understand the way water from Minworth SRO travels along the canal system, and how that might afford opportunities for environmental and operational risk mitigation.

Conclusions

- 1.17 At gate-1, all the indications are that the GUC SRO offers a viable solution that could, if required, be built in a modular way to enable an early start. We therefore recommend this SRO proceeds to gate-2.
- 1.18 A key benefit of this SRO is its utilisation of existing infrastructure, providing value for money, alignment with customer views, and a significant opportunity to maintain and improve the recreational value of the canal by creating a reliable revenue stream for the Trust.
- 1.19 Utilising treated wastewater from Minworth WwTW provides drought resilience, because wastewater is being produced and fed into the WwTW for treatment at all times. The scheme also provides an alternative major surface water supply to AfW in the event of an incident affecting supplies from the River Thames.
- 1.20 Despite a lack of baseline data, we have carried out extensive environmental and water quality monitoring for gate-1. The data indicate that the main risks are limited to environmental impacts on the canal itself, which is of generally good quality and ecological potential, and to possible changes in the rivers downstream that interact with Grand Union South. We evaluate these impacts as 'Moderate' at this stage under Strategic Environmental Assessment (SEA) criteria.
- 1.21 GUC is one of the more complex SROs, both operationally and in terms of procurement, due to the use of existing assets that are owned by the Trust, and the number of companies involved. As a result, suitable commercial and legal arrangements will be required from gate-2 onwards.
- 1.22 We have welcomed the opportunity to consider a Direct Procurement for Customers (DPC) procurement route. Initial evaluation of procurement options indicates that the DPC route may not be suitable for GUC SRO, and that the preferred model is likely to be based on ownership of new key assets by AfW and service agreements with STW and the Trust. We will continue to examine procurement options in gate-2. At this stage, the size and nature of the scheme means there is no definitive requirement for a Development Consent Order as the planning delivery route, but this route has some clear advantages.

- 1.23 The GUC SRO will be construction ready in Asset Management Period 8 (AMP8), with an earliest Deployable Output (DO) date of 2034.
- 1.24 Care has been taken to ensure efficient and relevant spend on agreed activities to advance this project. We are demonstrating efficient spend through our third line assurance and in Chapter 14.
- 1.25 The cost estimates prepared for the scheme for gate-1 used the All Company Working Group (ACWG) methodology. They therefore contain a standardised optimism bias (OB) that will reduce as we gain more certainty through the gates. Scheme Average Incremental Costs range from 94 to 137p/m³ based on full utilisation, to as low as 64p/m³ based on expected operation.

2. Solution Description

Outline of the Solution

- 2.1 A new pipeline and existing canal infrastructure (the Grand Union Canal) will be utilised to convey treated wastewater from Minworth SRO in the STW supply area to areas of water deficit in Affinity Water's (AfW's) supply area. Water will be abstracted from the GUC in AfW's supply area and treated prior to distribution to customers.
- 2.2 The size of the required transfer is subject to both forecast demand (dependent on the outcome of the Water Resources South East (WRSE) need) and the available supply (dependent upon potential environmental constraints on the River Trent), so both 50MI/d and 100MI/d options have been shortlisted. In gate-2, we will identify a single transfer route and location for abstraction, and WRSE will indicate the size of the required transfer.
- 2.3 Water will be abstracted from the GUC in AfW's supply area and treated prior to distribution to customers. The anticipated transfer capacity is between 50MI/d and 100MI/d.

Options and Configurations

- 2.4 Water will be sourced from Minworth WwTW in STW's supply area and taken to a delivery point in AfW's supply area. For much of its length, the transfer will make use of existing canals owned by the Canal & River Trust (the Trust), with interventions as necessary along its route.
- 2.5 The initial gate-1 options identification process concluded that there are six potential routes for taking water from Minworth WwTW to the middle section of the canal, and eight abstraction and treatment points in the southern section.
- 2.6 As detailed in Chapter 4, the six potential routes for transferring flow from Minworth WwTW to the canal network have been shortlisted to three (sub-route 1, sub-route 3 and sub-route 6).
- 2.7 Similarly, the eight potential abstraction points have been shortlisted to three (Tring, Hemel Hempstead, and The Grove). At the abstraction point, the scheme will include water abstraction, treatment, storage, and a connection to the AfW network. As Tring is outside the AfW supply area, this would involve a longer pipeline connection to the AfW distribution network than at either Hemel Hempstead or The Grove.
- 2.8 In total, the GUC scheme therefore has 18 potential combinations of options at gate-1, as shown in Table 2.1.

Table 2.1: GUC scheme potential combinations of options

Connection to Minworth WwTW:	Sub-route 1		Sub-route 3		Sub-route 6	
Abstraction point:	50MI/d	100MI/d	50MI/d	100MI/d	50MI/d	100MI/d
Tring	Option 1.1	Option 1.10	Option 1.4	Option 1.13	Option 1.7	Option 1.16
Hemel Hempstead	Option 1.2	Option 1.11	Option 1.5	Option 1.14	Option 1.8	Option 1.17
The Grove	Option 1.3	Option 1.12	Option 1.6	Option 1.15	Option 1.9	Option 1.18

- 2.9 These options will be further evaluated in gate-2, as described in Chapter 4.
- 2.10 If needed, the GUC SRO could be built in a modular way to enable an early start. The optimum transfer capacity will be better understood in gate-2, as we continue to progress initial designs and enhance the hydrological and hydraulic models for the GUC.
- 2.11 Upgrading of the canal will be required in specific sections, including bank raising and modification to increase the flow capacity through existing structures. The extent of work required will depend upon the transfer capacity selected.

Hydrological and Hydraulic Modelling

- 2.12 To confirm feasibility of the GUC SRO, we developed integrated hydrological and hydraulic models of the canal system to understand the effect of increased flow. Development of the models included a full survey of the canal and its interactions with the River Bulbourne and River Gade. Assumptions were reviewed with stakeholders and the model was calibrated against existing flow and level data.
- 2.13 At this stage, results arising from the model should be considered indicative only. Our studies in gate-1 have identified gaps in the model itself and in the information used to develop it. We will address these gaps in gate-2, including gathering targeted topographical and hydraulic data through field-based surveys. We have agreed with stakeholders a set of flow scenarios to run through the model, refining our understanding of the engineering works required, and their associated costs.

Overall Costs

- 2.14 Costs will be dependent upon the option size and frequency of use selected, the sub-option chosen for the transfer route from Minworth WwTW to the GUC SRO, and the location for abstraction and treatment within the AfW supply area. The estimated costs are compared in Chapter 10.
- 2.15 Cost estimates prepared for gate-1 used the ACWG methodology. They therefore contain a standardised optimism bias (OB) that will reduce as we gain more certainty through the gates.

Resource Benefit of the Solution

- 2.16 AfW's Water Resources Management Plan 2019 (WRMP19) shows that the central region faces a significant supply-demand deficit from 2020 onwards, resulting in a shortfall in supply during a 1 in 200-year drought. The predicted deficit is likely to increase under a 1 in 500-year drought, and even further under increased pressure to reduce abstraction from chalk aquifers. Available water supplies in AfW's supply area are also predicted to fall due to the impacts of climate change, with additional pressures on demand due to population growth.
- 2.17 The GUC SRO was selected in the AfW WRMP19 to help solve the supply-demand deficits. It has been submitted to WRSE to help meet the regional planning requirement by offering a potential 50-100MI/d solution. Draft outputs from the WRSE model are expected in August 2021.

- 2.18 This SRO offers drought resilience by utilising treated wastewater from Minworth WwTW, and also provides an alternative water supply in the event of an incident affecting supplies from the River Thames.

Conjunctive use benefit

- 2.19 Because the GUC transfer uses treated wastewater, its output is not constrained by hydrology or drought conditions and can, in theory, provide the required output as stated. The only potential constraints on transfer capability relate to:
- Potential risks to flow availability in the River Trent. Initial Aquator modelling has shown that the scheme has the potential to slightly increase the frequency at which flows would breach the Hands off Flow (HoF) limit at North Muskham, so the environmental and navigation implications of this will be subject to further review through the River Trent Working Group.
 - Any environmental constraints on transfer, either as a result of concerns for canal water quality or the potential for increasing invasive non-native species (INNS) pathways and risks along the canal transfer route and the associated water.
- 2.20 Whilst these will continue to be investigated prior to gate-2, at this stage there are no identified limiting conditions. The volumetric benefit of this scheme is therefore equal to the Average Deployable Output (ADO) impact that AfW can receive from a 50MI/d to 100MI/d transfer – that is, the annual average demand that the system can cope with under drought conditions. This is being modelled through the WRSE Regional System Simulation (RSS) process, which indicates that AfW's primary supply-demand risk is associated with long summer demand events occurring at the same time as groundwater drought conditions. The ADO benefit is therefore proportional to the size of the summer demand event, in relation to average demand conditions.
- 2.21 For a system such as AfW's, with no significant water storage, ADO is less than the capacity in a capacity-constrained scheme such as GUC. Behavioural modelling suggests that the scheme will deliver an ADO that is circa 90% of the constraining capacity. For the 50MI/d transfer, the ADO benefit is therefore circa 45MI/d, and for the 100MI/d transfer the ADO benefit is circa 90MI/d.
- 2.22 The conjunctive use of the GUC SRO with AfW's existing water supply sources and other SROs being considered will increase the volume and reliability of supply in the region. There is the potential for beneficial interaction with Thames Water (TWUL) in particular.
- A significant proportion of the demand that AfW will be supplying from the scheme will be returned to either the River Colne or River Lee upstream of TWUL's intakes, as a routine part of the wastewater system operation. In reality, the impact on TWUL depends on the net balance between supply and demand for AfW in comparison to the base year. It cannot therefore be ascribed to a specific scheme, and has been incorporated into the WRSE best value modelling as a percentage of the change in the base year demand, which occurs irrespective of which schemes meet any increases in demand.
 - RSS modelling shows that AfW tends to experience the critical point of a drought later than TWUL, often in the year afterwards when TWUL has been able to partially recover its storage position. The GUC scheme is only likely to have to operate fully during significant late spring-summer demand events, and there may be spare capacity from the scheme that could, in theory, be used to provide resource benefit to TWUL at other times. However, this would require that water is released by the scheme down the River Colne, which is unlikely to be acceptable to environmental regulators. This will be examined as part of the gate-2 environmental programme.
- 2.23 We will investigate the potential conjunctive use benefit during gate-2. The benefit will depend on both the iterations to operating strategy and further definition of environmental constraints. Potential operating scenarios under consideration are described in Chapter 6.

Summary of Social, Environmental and Economic Assessment

- 2.24 Figure 1.1 shows the shortlisted sub-routes 1, 3 and 6 for the transfer of water from Minworth SRO to the GUC. Routes 3 and 6 involve pipelines, whereas Route 1 does not, which means

routes 3 and 6 are likely to result in greater environmental and societal impacts, as described in Chapter 4 .

- 2.25 Through the gate-1 screening process, we shortlisted three sites at Tring, Hemel Hempstead and The Grove for the location of abstraction from the GUC (shown in Figure 1.1). Although the sites are affected by different constraints, all are located in the Green Belt, which is a significant planning constraint. The full screening process is described in Chapter 4.

Drinking Water Quality Considerations

- 2.26 There were no historic water quality data available for the canal network, so in order to carry out a risk assessment, we began water quality monitoring immediately. Phase 1 water quality monitoring has been carried out throughout gate-1 to establish a baseline, and focused on WFD-based parameters, as agreed with the EA and Drinking Water Inspectorate (DWI).
- 2.27 Locations for sampling in the northern section of the canal were chosen where sub-options would discharge, giving us an indication of potential treatment requirements.
- 2.28 Locations for sampling in the southern section of the canal were upstream of key environmental inputs into the GUC: the Rivers Bulborne, Gade and Colne, as well as at potential abstraction locations in, or close to, AfW's supply area.
- 2.29 Completion of the ACWG Treated Water Assessment Methodology has highlighted four parameters that present a risk and require further scrutiny in gate-2: Bromate, Nitrate, Perfluorooctane sulfonate (PFOS) and Corrosivity. These parameters are included in Phase 2 water quality monitoring, created in conjunction with the EA and DWI. Drinking water quality considerations are described in more detail in Chapter 5.

Wider Benefits

- 2.30 We carried out a baseline assessment and screening of benefits beyond supply capability for gate-1, as summarised below.
- 2.31 There may be the opportunity to incorporate measures to provide added flood risk reduction at the same time as engineering works. The potential measures include:

Table 2.2: Flood risk reduction measures

Nr	Potential Measure	Potential Outcome
1	Increasing the capacity of the canal by active management of water levels or widening the GUC and connecting canals.	Providing additional capacity to manage flood events.
2	Diverting flows from nearby watercourses.	Relieving capacity pressures in times of flooding.
3	Incorporating blue/green infrastructure corridor along the SRO routes.	Enhancing drainage capacity and reduce/intercept surface water flow routes.
4	Provision of additional cut/fill (excavating areas and creating embankments to retain water) during SRO route construction.	Increasing floodplain capacity.

- 2.32 Further investigation into flood risk mitigation opportunities will be carried out in gate-2, utilising the enhanced hydraulic modelling of the canal system.
- 2.33 Wider economic, recreational and leisure benefits have also been identified, associated with the upgrade of the canal, as described in Chapter 5.

Interaction with Other Proposed Water Resource Solutions

- 2.34 The source for the GUC SRO is Minworth SRO, which is also a potential source for the Severn to Thames Transfer (STT) SRO. Further information on the interrelationship between STT SRO and GUC SRO is given in the Minworth SRO gate-1 submission. At this stage, we believe Minworth SRO can support both STT SRO and GUC SRO, and are continuing to explore potential limitations.
- 2.35 Another potential interaction that the GUC SRO could have is with the South Lincolnshire Reservoir (SLR) SRO. We expect at this stage the GUC SRO is most likely to be used to feed AfW during the summer in periods of elevated demand and, as the SLR would primarily refill in winter, initial water resource modelling evaluation suggests that the two schemes can operate without significant detriment to one another. The interaction between these proposed water resource solutions will be considered in more detail at gate-2 (Minworth SRO).
- 2.36 TWUL is developing a WRMP19 scheme with the Trust to transfer water from the Midlands via the Oxford Canal, which has possible interactions with the GUC SRO transfer route. We are continuing to liaise with TWUL and the Trust regarding potential overlaps and issues.

Meeting the National Framework Requirements

- 2.37 The National Framework explores England's long-term water needs and aims to increase supplies and move water to where it is needed. We believe the GUC SRO represents a viable transfer to help deliver resilience to a 1 in 500-year drought.
- 2.38 The GUC SRO will be reflected in the regional plans for the donor region (WRW) and the recipient region (WRSE).

3. Outline Project Plan

Timing of the Solution

- 3.1 We expect that GUC SRO will be construction ready in AMP8, as per the Final Determination requirement. There are a number of assumptions and risks associated with this scheme, which are to be resolved as we proceed through the RAPID gated process.
- 3.2 Depending upon the success of demand reductions, AfW's adaptive WRMP19 raised the requirement for the GUC SRO between 2050 and the late 2060s. This need and timing will be reviewed through the Water Resources South East (WRSE) best value assessment process, but the scheme could be delivered well in advance of this, as early as 2033-34.

Phasing of Key Activities and Decisions

Prior to gate-2 (October 2022)

- 3.3 We will gather environmental data, along with targeted topographical and hydrological data, in order to complete canal hydraulic and water quality modelling. From this, we will identify the preferred options and scheme capacity, and then prepare and cost the overall concept solution and designs.
- 3.4 The Final National Policy Statement is likely to be available during gate-2, allowing us to determine the appropriate planning route and establish whether the scheme is a Nationally Significant Infrastructure Project (NSIP), and therefore required to be delivered by Development Consent Order (DCO).
- 3.5 At gate-1, the GUC SRO does not meet all Direct Procurement for Customers (DPC) qualifying criteria. Once the scheme is more fully defined in gate-2, we will re-assess its suitability for DPC. We will then establish contractual and commercial arrangements between scheme partners.

Prior to gate-3 (Summer 2023)

- 3.6 In summer 2022, WRSE will publish a revised draft regional plan and AfW will submit its draft WRMP24 to Defra. If both organisations include GUC SRO in their plans, it will progress through the gated process. If an early date for implementation of the SRO is selected, we may need to progress pre-planning application work at gate-3.

Prior to gate-4 (Summer 2024)

- 3.7 In winter 2023, WRSE will publish its final regional plan and AfW will publish its WRMP24. If the GUC SRO is selected, then the timing of the scheme could be earlier than shown in WRMP19, depending on how the option compares with other solutions proposed in the WRSE regional plan. If the scheme is to be construction ready during AMP8, we will need to submit a planning application early in 2024, along with supporting design and environmental assessment work.
- 3.8 Following the submission of gate-4, and dependent upon when the option is selected by WRSE, the following will be required:
- Preparation of tender documents ready for bidding (anticipated to coincide with a successful planning outcome).
 - Land acquisition.
 - Planning application outcome.

Assumptions and Dependencies

- 3.9 The timing of the solution and key activities are based upon a number of critical assumptions and dependencies, outlined in Tables 3.1 and 3.2.

Table 3.1: Assumptions

Assumption	Commentary
No delay in securing planning permission for Minworth SRO	The Minworth SRO (treatment) is necessary to supply the water to be transferred, but does not form part of the transfer facility. There are two planning consent routes for the Minworth SRO: Town and Country Planning Act (TCPA), or as an associated development (AD) to GUC SRO. We do not anticipate a delay in Minworth SRO securing planning permission.
Timely completion of Minworth SRO	The GUC SRO is dependent upon Minworth SRO for supply. It is therefore assumed that the Minworth SRO will be completed in time to meet GUC SRO commissioning requirements.
Improved connectivity in the Affinity central region to unlock current network constraints	AfW has developed a long-term strategy that allows for improved connectivity in the AfW central region. This includes a portfolio of new strategic internal transfers to move water more freely from further north and east within the region. A cross-SRO project is due for delivery early in gate-2 to better understand the internal transfers needed to support potential supply changes caused by the SROs.
GUC SRO will be classified as a NSIP	It is assumed that GUC SRO will be classified as a NSIP and that part or all of the scheme will fall under the requirements of a DCO. To be classified as a NSIP, the DO must exceed 80MI/d; or, if the transfer is less than 80MI/d, a Section 35 direction may be sought from the Secretary of State on whether the development is to be treated as requiring development consent under the Planning Act 2008 (as a DCO).
A published WRMP24 is required prior to formal DCO consultation	It is assumed that a published WRMP24 is required prior to the commencement of formal DCO consultation, although pre-consultation studies and engagement would be commenced during earlier stages (post gate-2).

Table 3.2: Dependencies

Dependency	Commentary
No environmental showstoppers	Our work in gate-1 has shown that there is a complex interaction with the environment, and environmental data on the canal network is not as readily available as it is for rivers. We have not identified any showstoppers in gate-1.
Confirmation of the Minworth SRO in the WRW regional plan	The regional plan will inform the statutory WRMP24, which in turn is expected to form the Statement of Need for the SRO during subsequent scheme promotion. The regional plan therefore needs to inform the preferred solution(s) within the SRO project.
The scheme will be able to achieve the required environmental consenting post gate-2	Despite the planned gate-2 activities, the lack of historic data means that there is likely to be a residual risk associated with the degree of confidence that the scheme will be able to achieve the required environmental consenting post gate-2.

Pre-construction Activities

- 3.10 Pre-construction activities are expected to take 34 to 40 months. Ten months of this will be preparatory work (preliminary design, consenting and land strategy, environmental and land surveys, preparing Environmental Impact Assessment scoping report and opinion, preparing and carrying out non-statutory consultation), followed by six months of statutory consultation and four months of preparation of the planning application. Defra is expected to make a decision approximately 17 months after the application is submitted.

Delivery Schedule

- 3.11 Our engineering work to date suggests a lead time of eight years for the 50MI/d variant of the GUC SRO, and nine years for the 100MI/d variant, as outlined in Table 3.3 below. The dates in the table assume that the remainder of the RAPID gated process, which will run throughout AMP7, has been completed.

Table 3.3: Lead times for project variants

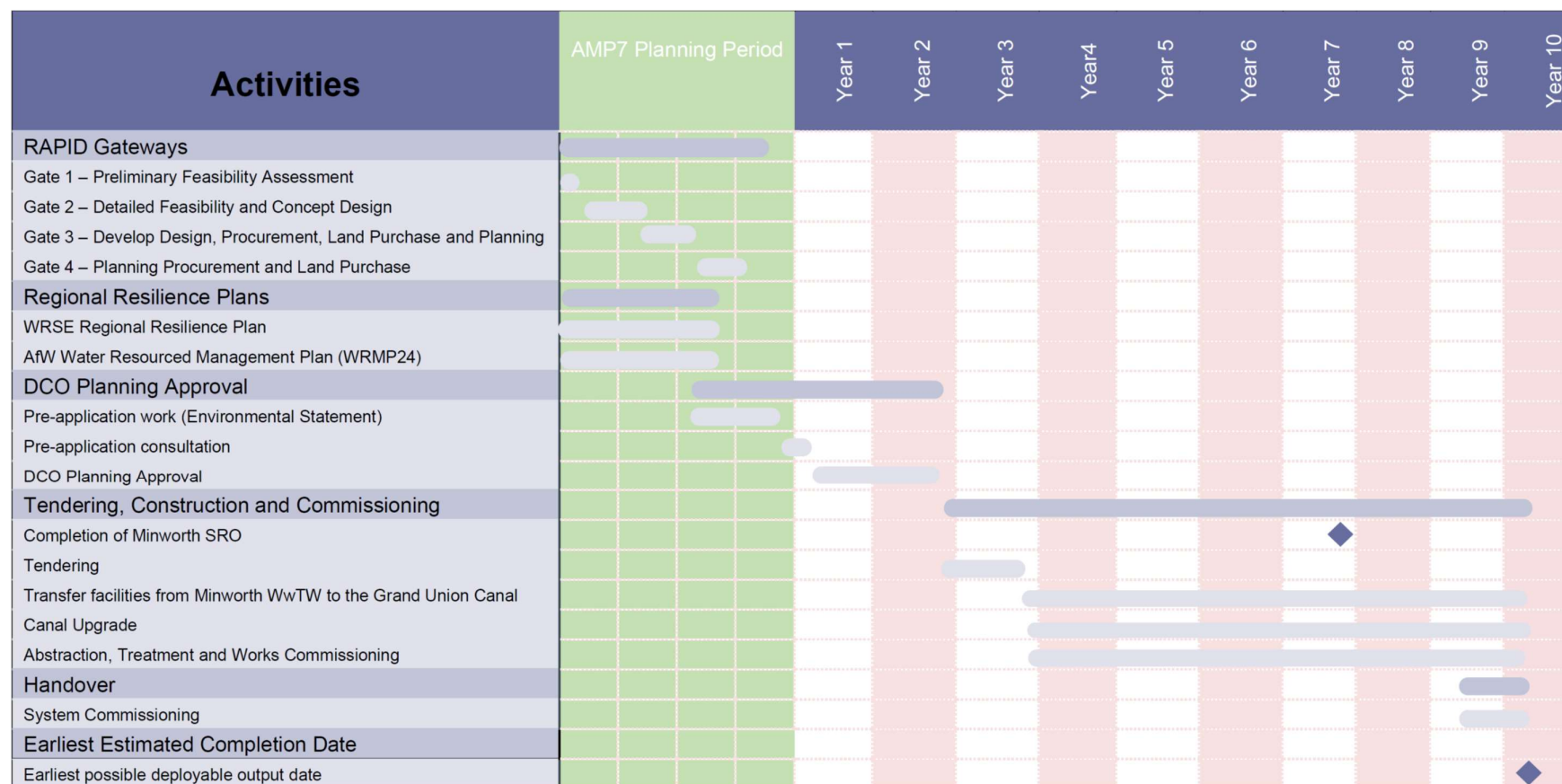
Scheme Size	Planning and Development Phase	Construction Phase	Total lead time
50MI/d	3 years	5 years	8 years
100MI/d	3 years	6 years	9 years

- 3.12 Figure 3.1 provides a summary of the key activities and timescales, showing the fixed AMP7 planning period and a flexible timescale for the planning, development and construction phases.
- 3.13 The earliest construction start date for GUC SRO is 2026/27, with the earliest deployable output (DO) available in the year 2033/34 for the 50MI/d variant (Year 9) and in 2034/35 for the 100MI/d variant (Year 10). This aligns with the RAPID requirement for the scheme to be construction ready in AMP8.
- 3.14 Because the GUC SRO utilises existing infrastructure, an early supply of a proportion of the scheme capacity may be feasible. We will examine this possibility in gate-2.

Issues and Missing Information

- 3.15 Our work in gate-1 has shown that there is a complex interaction with the environment, and historic environmental data on the canal network are not as readily available as they are for rivers. Data collection will continue throughout gate-1 and gate-2, and will include a wide range of additional surveys to address uncertainties. Data collection is likely to need to continue for some years. Planned tasks in gate-2 are detailed in Chapter 15.

Figure 3.1 Summary of key activities and timescales (for 100MI/d option)



4. Technical information

Option Configuration

- 4.1 The GUC SRO will receive water from Minworth SRO via a new pipeline and existing canal waterways to the northern section of the GUC. Upgrades to existing canal assets are required to facilitate additional flows of up to 100MI/d, and to ensure sufficient freeboard to the canal is maintained. In the southern section of the GUC, water will be abstracted from the canal and further treated utilising a multiple barrier approach and final conditioning prior to distribution to AfW customers. A maximum average daily flow of 50MI/d to 100MI/d is currently considered. Refer to Figure 1.1 for scheme layout.

Sub-routes linking Minworth SRO to the northern section of the GUC SRO

- 4.2 A longlist of potential sub-option routes was compiled collaboratively by the EA, the Canal & River Trust (the Trust), Severn Trent Water (STW) and Affinity Water (AfW), to transfer flow from Minworth WwTW to a common meeting point at Braunston Junction on the GUC, as per Table 4.1 below. We have shortlisted three route options based on the following criteria: environmental and societal impacts; operational flexibility and resilience; operational and embedded carbon; and cost.

Table 4.1: Description of sub-routes

Sub-route	Type	Route Description	Short listed (Y/N)
1	Canal/ Canal	Short pipeline from Minworth WwTW to discharge into Birmingham Fazeley Canal. Connection to Coventry Canal at Fazeley and transfer south via Coventry/Oxford Canal to GUC just north of Daventry.	Y
2	River/ Canal	Short pipeline from Minworth WwTW to discharge into the River Tame. Connection to Coventry Canal at Fazeley and transfer south via Coventry/Oxford Canal to GUC just north of Daventry.	N
3	Pipeline/ Canal	Pumped from Minworth WwTW via a new 15.5km pipeline to Coventry Canal at Atherstone and transfer south via Coventry/Oxford Canal to GUC just north of Daventry.	Y
4	Canal/ Canal	Short pipeline from Minworth WwTW to discharge into Birmingham Fazeley Canal which pass through Birmingham before joining the GUC near Spaghetti Junction and transfer south via GUC.	N
5	Pipeline/ Canal	Pumped from Minworth WwTW via a new 15.75km pipeline to the GUC at Copt Heath and transfer south via GUC.	N
6	Pipeline/ Canal	Pumped from Minworth WwTW via a new 33.0km pipeline to GUC at Leamington Trough Pound, south of Leamington Spa and transfer south via GUC.	Y

4.3 Shortlisted sub-routes:

- Sub-route 1 utilises canal waterways, which require fewer upgrades to accommodate increased flow. The canals have lower level variation, meaning fewer pumped bypasses to locks are required in comparison to routes 4 and 5.
- Sub-route 3 transfers flow to canal waterways by pipeline. It joins part of the canal waterways used by sub-route 1 and therefore has similar advantages.
- Sub-route 6 transfers flow further south along the GUC than sub-route 5 via a longer pipeline. It bypasses more canal infrastructure and it avoids the significant level variation of Hatton Locks.

4.4 Eliminated sub-routes:

- Sub-route 2 was eliminated because pollution in the River Tame would require water treatment at the point where flow is lifted to the eastern canal waterways.
- Sub-route 4 passes through built-up areas of Birmingham. Numerous existing canal assets require upgrades to accommodate increased flows and would be difficult to access.
- Sub-route 5 transfers flow south via a pipeline prior to joining the GUC and bypasses built-up areas of Birmingham. The route requires significant upgrades to canal infrastructure.

Canal upgrades

- 4.5 Upgrades to existing canal assets are required to facilitate additional flows of up to 100MI/d, and to ensure sufficient freeboard to the canal is maintained. Modifications are also required to canal structures (e.g. bridges and tunnels), to avoid increased velocities impacting upon navigation and operation arrangements at locks. Velocities can be reduced by providing bypass arrangements around bridges and tunnels. These have been initially identified and costed for gate-1, and we will confirm the enhancements required to the canal, and the optimum volume to be transferred, when modelling work outputs are refined during gate-2.

Abstraction and treatment located in the southern section of the GUC SRO

- 4.6 AfW provided initial options for possible sites within its central region supply area, based on the option submitted at WRMP19. We applied a high-level screening process to establish if there were other potential sites, based on the following operational criteria:
- in reasonable proximity to major trunk mains and strategic water storage
 - in excess of 10 hectares in area;
 - outside the Environment Agency (EA)-designated Flood Zone 3; and
 - not in conflict with HS2 reserved areas.
- 4.7 This process resulted in a longlist of eight abstraction options. The site at Tring was included following a meeting with the EA, in which the regulator highlighted the need to consider a location upstream of the canal's interactions with sensitive chalk streams.
- 4.8 The longlist was screened against strategic value/system connectivity, geological constraints, environmental constraints, planning constraints and flood risk. Table 4.2 below shows the shortlisted sites. The site at Iver, although passing screening, will not be taken forward to gate-2 because it is heavily constrained on all sides, and occupied by existing businesses.

Table 4.2: Site options screened for abstraction and treatment

Nr	Potential Site	Shortlisted (Y/N)
1	Nash Mills	N
2	The Grove	Y
3	Rickmansworth	N
4	Springwell	N
5	West of Uxbridge	N
6	Hemel Hempstead	Y
7	North of Iver	N
8	Tring	Y

- 4.9 Based on water quality monitoring and an evaluation of the contaminants present at the proposed abstraction points, the treatment processes were selected using a multiple barrier approach, consisting of coagulant-aided settlement, filtration, disinfection and final conditioning prior to discharge into supply. The ACWG methodology for drinking water risk assessment and water safety planning has been used and referred to in the development of the water quality monitoring programme for gate-2, which will be used to further develop the treatment works design in gate-2.

Network Connectivity

- 4.10 AfW's long-term strategy for supply resilience is to move water within its supply area from areas of surplus (south) to areas of planning deficit (north/north east). The final requirements for network enhancements will be planned as part of AfW's 'Connect 2050' project, which builds on the 'Supply 2040' concept developed for WRMP19, allowing transfer of water across its supply area and accommodating different combinations of SROs and chalk groundwater abstraction reductions. This will be reported in the first half of gate-2, once the future demand configurations have been defined through WRSE and consultation with the EA. For gate-1, the AfW MISER was used to simulate the basic internal network enhancements that might be required to manage the SRO import.
- 4.11 The modelling identified that the GUC SRO would trigger at least some downstream network reinforcements (e.g. booster pumps, short trunk mains or twinning of existing mains) to enable the water to reach areas of demand. These reinforcements were included in the gate-1 costing. Investigation work will continue during gate-2 as part of the 'Connect 2050' project.

Operation and Maintenance

- 4.12 Different operating scenarios have been considered and are described in Chapter 6.
- 4.13 Flow will be transferred from Minworth WwTW to the GUC SRO via pipeline. It will then travel along the canal and through newly constructed bypass structures where required (at bridges, tunnels, and downhill locks). The bypass structures will keep velocities within acceptable limits and ensure that the increase in water levels does not stop boats from passing under bridges and through tunnels. Variable speed pumping stations will lift flow at uphill locks. We will continue to improve our understanding of how the system will work in gate-2 to confirm that such bypasses are feasible.
- 4.14 The GUC SRO will operate and be controlled so that the same volume of water received into the canal from Minworth SRO will be abstracted within AfW supply area. An allowance for losses will need to be determined and deducted from the abstracted flow.
- 4.15 At the selected abstraction point, a screened intake structure will transfer flow for raw water storage, followed by treatment and distribution to customers. Sufficient raw water storage will be required to balance the volume required for treatment with time taken to transfer flow from the source. The hydraulic modelling carried out for gate-1 indicates that flow velocities are likely to be in the order of 0.1 to 0.5m/s, and an allowance of at least two days' storage has been provided to reflect the resulting high-level estimate of travel time at this stage. During gate-2, we will assess the advantages and disadvantages of increasing the storage capacity to meet operational needs and requirements determined from the hydrological modelling, and to reflect resilience needs as defined through the WRMP24 'Connect 2050' project.
- 4.16 The design life of assets aligns with the ACWG cost assessment methodology, which specifies standard default values for pumps, treatment and other elements. We have assumed that canal refurbishment work has a 100-year design life. We recognise that the existing canal infrastructure may require upgrading, and this has been reflected in the costing and optimism bias.
- 4.17 Operation, inspection and maintenance of these assets will be provided by the Trust. For the purposes of gate-1, the Trust has provided an indicative price for the operational management of the transfer route along the canal, which includes maintenance and upkeep of existing assets.

Cost Estimates

- 4.18 Cost estimates are discussed in Chapter 10. Estimates for treatment works, pumping stations and pipelines are benchmarked from AfW cost curves, and those for embankment raising are based upon quantities and EA rates for flood defence embankment construction. Other canal infrastructure cost estimates are benchmarked from EA's recent flood defence work of similar construction methodology, scale and scope of work.

Initial Water Resource Benefit Assessment

- 4.19 The GUC SRO will improve the ADO of the AfW system by providing a drought-resilient supply source of 50 to 100MI/d which could be used year-round. As stated in Section 2.20, because of the summer demand driven nature of the AfW system, this constant fixed capacity should provide an ADO benefit of circa 45MI/d for the 50MI/d transfer option, and circa 90MI/d for the 100MI/d transfer option.
- 4.20 This assessment will be refined for gate-2 using the RSS behavioural model (which was completed prior to gate-1 and used to understand the nature of AfW's resources needs) and once final treatment processes (and hence treatment losses) are understood.

Initial Data Provided to Regional Groups

- 4.21 The following information was provided to WRSE for the March 2021 water resource modelling exercise:
- Cost information (CAPEX, OPEX);
 - Carbon information (embodied and operational);
 - Lead times (for construction);
 - Scheme capacity;
 - Resilience metrics (see Section 10.6 for details); and
 - Environmental data, assessed by the WRSE environmental team to determine environmental metrics.

5. Environmental and Drinking Water Quality Considerations

High Level Environmental Statement

- 5.1 The GUC SRO is in the early stages of development. While some SROs are supported by multiple years of environmental data, our data collection began in April 2020, with limited historic data existing before this.
- 5.2 Chapter 5 outlines the findings from our environmental investigations to date, and the outputs from the Invasive Non-Native Species (INNS) high-level screening, ACWG Treated Water Methodology, and ACWG Environmental & Raw Water Quality Methodology.
- 5.3 Throughout gate-1, we have undertaken an extensive environmental gap analysis and literature review and carried out initial ecological and water quality monitoring on the transfer route. We will carry out further in-depth environmental investigations for gate-2 to address the gaps. We recognise that we will only have one year of monitoring data by gate-2 for some environmental items, and that longer data sets are required to allow a full assessment. We are liaising with our National Assessment Unit (NAU) and Environment Agency (EA) colleagues to confirm the right duration of data collection to inform this scheme's feasibility (see key risks in Chapter 9).

Environmental Investigations

- 5.4 The ACWG Environmental & Raw Water Quality Methodology required Strategic Environmental Assessment (SEA), Habitats Risk Assessment (HRA), Water Framework Directive (WFD), Biodiversity Net Gain (BNG) and Natural Capital assessments. These have been completed for GUC SRO within Water Resources South East (WRSE) to drive efficiencies and consistency. The assessment outputs form a series of data tables which are summarised below.
- 5.5 Environmental investigations were carried out on the shortlisted sub-routes and abstraction locations.

Strategic Environmental Assessment

- 5.6 An SEA is a high-level appraisal that covers pre- and post-mitigation risks for the environment, as well as the social and economic effects of the scheme. The SEA looks at 14 criteria and scores them from 'Major Positive' to 'Major Negative', with 'Moderate', 'Minor' or 'Neutral' impacts also attributable.
- 5.7 The assessment had the same outputs for each of the sub-options in the northern and southern sections of the canal.
- 5.8 One 'Moderate Positive' impact was identified: deliver resilient and reliable water supplies, which is in line with the purpose of the SRO.
- 5.9 Five 'Minor Positive' impacts were identified: the resilience of the scheme to climate change; conserve and protect the landscape; benefits to the population and human health; benefits to tourism; and improvements to the canal network.
- 5.10 Two 'Moderate Negative' risks were identified:
- The operational effects on flora and fauna within the canal.
 - Section 5.17 discusses the ecological investigations that have been carried out during gate-1, and the work planned for gate-2. The work in gate-2 will enable a fuller understanding of the ecological environment within the canal and allow mitigations to be designed in to the scheme's development.
 - Changes to water quality and water levels in the canal and associated impacts on the environments.
 - Section 5.35 outlines our recommendations for further investigations into water quality and ways to reduce the risk of negative impacts.
- 5.11 11 'Minor Negative' risks were identified, all associated with the construction phase of the SRO. These will be taken into account as the scheme progresses to ensure mitigations are incorporated in the design.

Habitats Regulation Assessment

- 5.12 The WRSE HRA assessment identified two sites that the scheme will have an 'Uncertain Effect' on irrespective of which discharge or abstraction location is selected. We have carried out an 'Appropriate Assessment' which concluded:
- Upper Nene Vally Gravel Pits: no key risks to Habitats Sites were identified during construction or operation of these options.
 - Chiltern Beechwood Special Area of Conservation: no significant effects are foreseeable on the integrity of the Habitats Sites if the suggested mitigation measures are observed.
- 5.13 The HRA assessment will be refined and updated through gate-2 as our understanding of the canal environment improves and the engineering designs progress.

Natural capital and biodiversity net gain

- 5.14 The assessments for gate-1 apply the principles of biodiversity net gain and natural capital as set out in the Water Resource Planning Guidelines for WRMP24. These take a high-level, prescriptive approach to the habitat loss due to construction impacts and the expected time for the recovery of habitat loss.
- 5.15 The results show that all sub-options lead to a slight overall loss in ecosystem service provision, with the loss being greater for sub-options 3 and 6 due to the pipeline requirements. In the southern section of the GUC SRO, the Tring option has the greatest impact on biodiversity net gain and ecosystem provision, due to the route crossing pastoral land.
- 5.16 We will use the outputs of these assessments to minimise the impact of construction and to help with further optioneering in gate-2. They also provide a guide to the degree of offsetting that will be required for the chosen route to ensure at least a 10% net gain.

Ecological and INNS assessments

- 5.17 For the ecological assessment, two work packages were delivered for gate-1:

- ecological literature review and gap analysis; and
 - Phase 1 ecological monitoring.
- 5.18 These studies identified that a large environmental investigations programme is required for the GUC transfer. This Phase 2 work package commenced in Spring 2021 following consultation on the content with the EA, and will continue through to gate-2. A key area for future investigations is to understand the degree to which different sections of the canal are linked ecologically, and how freely water transfers between the canal and adjoining waterbodies.
- 5.19 The ecological literature review and gap analysis (14 topics plus summary report) did not identify any environmental concerns at a level that should stop the scheme progressing to gate-2.
- 5.20 We carried out a high-level INNS screening as part of the ecological literature review and gap analysis, meeting the gate-1 requirements of the NAU. We created heatmaps to show the likely prevalence of INNS within the transfer route, and identified key areas for targeted field surveys to address information gaps. This will allow a full pathway assessment to be carried out for gate-2.

Environmental net gain

- 5.21 The majority of the transfer route comprises canals owned by the Canal & River Trust (the Trust). We have a unique opportunity to build on work already undertaken, and to investigate opportunities for further benefits on assets owned by a project participant. We have carried out desk-based investigations focussing on the five key ecosystem services defined by the EA in their Water Resources Management Planning Guidelines: Biodiversity and Habitat, Climate Regulation, Natural Hazard Regulation, Water Purification and Water Regulation.
- 5.22 We have mapped all areas that could see environmental or biological net gain from the development of the GUC SRO. These were screened and ranked, using a monetised assessment where possible, giving a shortlist of opportunities to be developed through gate-2. This shortlist is shown in Table 5.1 alongside the societal and economic net gain opportunities.
- 5.23 Given the unique nature of the GUC SRO in utilising the already in-situ canal network, we examined how the enhanced canal asset could be utilised to reduce flood risks in surrounding water bodies. 204 locations were identified where flood risks existed along the transfer route. 64 of these could benefit from flood risk improvement through targeted interventions. We will build on this work in gate-2, as more details of the engineering design emerge, and will work with relevant stakeholders (EA, the Trust, local councils) to develop these opportunities.
- 5.24 For gate-2, it will be important to identify opportunities for offsite offsetting of environmental deterioration, where the design process indicates this is required to deliver environmental net gain, or where mitigation is not possible. The main areas of risk have been identified through the SEA process described in Section 5.6 above.

Societal and economic net gain

- 5.25 Following a mapping exercise, Table 5.1 outlines the potential opportunities for societal and economic net gain along the transfer route, including recreation and leisure boating, environmental benefits from flow support, flood mitigation opportunities and green energy generation (thermal energy abstraction, hydro-electric power generation). These potential opportunities will be further considered during gate-2.

Table 5.1 Environmental, societal and economic net gain benefit opportunities

Area	Topic	Benefit
Environmental	Flood risk mitigation	64 locations have been identified where interventions within the design and construction of the routes could reduce flood risk.
Environmental, societal, economic	Environmental benefits associated with flow support	Environmental benefits associated with flow support into designated sites and areas of wildlife habitat: for example, the Tring reservoir complex, an important Site of Special Scientific Interest (SSSI). There could also be biodiversity enhancements associated with improvements to banks along the route, and measures included in the designs around lock upgrades or bank raising.

Area	Topic	Benefit
Economic, societal	Employment	Additional employment opportunities, particularly around the Minworth WwTW site and the abstraction points.
Societal, economic	Leisure boating	At specific locations, where an increase in water levels on the GUC may lead to less risk of unplanned canals closures during dry spells.
Societal, economic	Wider recreation benefits	Arising from improved access and facilities.
Economic, environmental	Thermal energy abstraction	Associated with additional flows and potentially occurring all along the canal or pipeline route.
Economic	Economic activities	There may be economic benefit where the new works reduce the risk of flooding.

Carbon Assessment

5.26 The carbon ambition was set by an ACWG-led task-and-finish group, consisting of the water companies with SROs, Water UK, RAPID and Ofwat. The GUC SRO will be aligned with this stretching target. The ambition covers Scope 1, 2 & 3 carbon:

- Scope 1 & 2 aligns with the Water UK ambition to 2030.
- Scope 3 aligns to the UK's 2050 ambition, but recognises there is more to do on standardisation.

5.27 Calculation of the embodied carbon of this SRO has been carried out. The calculation takes into account the carbon embedded in construction, as well as operational carbon for the next 80 years. The carbon assessment work in gate-1 is for regional planning comparison purposes and is not intended to form a baseline against which design decisions are made. It therefore does not represent a carbon target for the project. We will look to establish a range of baseline carbon targets in gate-2.

Resilience

5.28 There is a high level of resilience associated with the treated wastewater from the Minworth WwTW that will be used to support this scheme, because wastewater will continue to be produced and directed to Minworth WwTW for treatment at all times. This provides a strong basis for a resilient water resource scheme.

5.29 The canals rely on their network of reservoirs, surface water and borehole abstractions to maintain water levels. This scheme could help the water resource position of the Trust by allowing further operational resilience and reducing the strain on their existing licenced supplies. The development of this potential benefit is being considered as a specific operational strategy during the gate-2 design process.

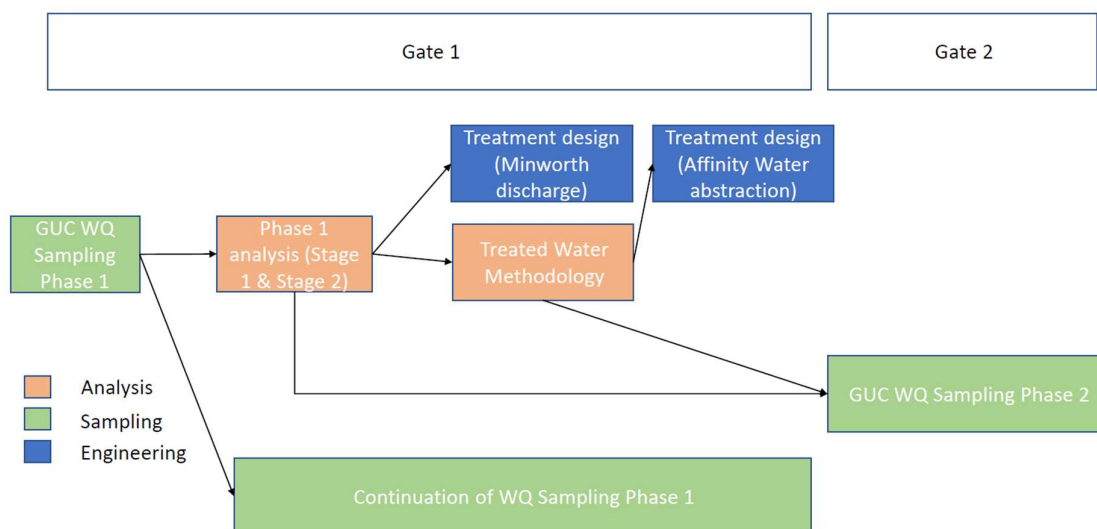
Water Quality Considerations

5.30 Due to the significant distance and potential for mixing, it is not expected that water from Minworth WwTW would be directly abstracted from the canal, although this will be the subject of further planned gate-2 water quality modelling. Given this assumption, it is important to risk assess and understand the quality of the water throughout the length of the canal, and how this could vary during periods of operation. The water quality monitoring programme for the scheme development has been divided into two phases:

- Phase 1 provides an early assessment of the water quality within the canal, informing both the WFD assessment and initial treatment design.
- Phase 2 builds on the first phase, but with a greater focus on drinking water requirements.

5.31 Figure 5.1 shows how this process has supported the gate-1 analysis, including the ACWG Treated Water Methodology evaluation, and feeds into the Phase 2 programme for gate-2.

Figure 5.1 Water quality monitoring workflow flow chart



- 5.32 Phase 1 of the water quality monitoring programme consisted of sampling 14 locations on a monthly basis. The monitoring parameters and locations were agreed collaboratively through a series of workshops with the EA. The findings of this programme, combined with the lack of historical data, means that the Phase 2 water quality monitoring programme needs to be significantly larger in scope than Phase 1.
- 5.33 Monitoring on the northern section of the canal, including the treated wastewater from Minworth WwTW, focussed on discharge locations associated with the longlist of six sub-option routes, now reduced to three sub-options (see Chapter 4). We carried out a comparison of the water quality in the canal at the discharge locations with the quality of treated wastewater from Minworth WwTW, giving early insight into the additional treatment processes required. See the Minworth SRO gate-1 submission for details.
- 5.34 Investigations in the southern section of the canal have focused on potential abstraction locations as well as areas of environmental sensitivity, such as interactions with other waterbodies (e.g. River Bulbourne) to enable better understanding of the baseline conditions. Further work will continue in gate-2.
- 5.35 The ACWG Treated Water Methodology assessment was completed in conjunction with technical experts from Affinity Water (AfW) and Severn Trent (STW), including treatment engineers and drinking water regulation teams, to ensure the source-to-tap water quality system has been considered. The assessment highlighted four parameters that present a risk and require further scrutiny in gate-2: Bromate, Nitrate, PFOS and Corrosivity. These are included in Phase 2 water quality monitoring, which was developed in consultation with the EA and Drinking Water Inspectorate (DWI). We will continue to update the assessment as our understanding of the canal water quality and its catchments develops.

WFD

- 5.36 We completed a two-level screening (Level 1 basic screening, Level 2 detailed screening) as set out by the ACWG Treated Water Methodology. The Level 1 assessment identified catchments at risk of deterioration due to the transfer, listing all 35 waterbodies as a medium risk for transfer of water via a river, canal or aqueduct.
- 5.37 The Level 2 WFD assessments were unable to rule out these potential risks at this stage, so further WFD assessment will be required for all of the sub-options recommended for progression to gate-2 and beyond. WFD assessment data requirements will be met by the data gathered to date, combined with the gate-2 work packages for design and water quality (see Chapter 15).

6. Initial Outline of Procurement and Operation Strategy

Procurement

- 6.1 Guidance provided by RAPID is that all schemes are assumed to meet the PR19 criteria for Direct Procurement for Customers (DPC). If they do not, this has to be explained¹.
- 6.2 DPC is a set of changes to a water company's conditions of appointment (Licence) to support the competitive procurement of infrastructure from a third party (the Competitively Appointed Provider or CAP). The CAP is awarded a contract to design, build, finance, operate and maintain (DBFOM) the asset for a set period of time, before the residual asset (if any) is taken in-house by the water company.
- 6.3 For gate-1, an initial assessment of potential procurement routes for the scheme was carried out. Initial evaluation of procurement options indicates that the DPC route may not be suitable for GUC SRO. This is not a definitive conclusion, and procurement options will continue to be examined in gate-2.
- 6.4 In terms of operation strategy, the GUC SRO will improve the ADO of the Affinity Water (AfW) system as it could be used year-round.

Assessment for DPC

- 6.5 Ofwat set out a methodology for assessing schemes for DPC in its guidance on what constitutes an eligible DPC project². The assessment is in three stages:
 - Test 1: Size – is the scheme above the £100m whole-life Total Expenditure (TOTEX) threshold?
 - Test 2: Discreteness – can the scheme be considered 'discrete'?
 - Test 3: Value for money – does the scheme delivered under DPC represent value for money against the 'in-house' delivery counterfactual?
- 6.6 In total, the GUC SRO has 18 potential combinations of options at gate-1, as shown in Table 2.1. For the size test, CAPEX estimates for these range from £300m to £650m. This indicates that the GUC will pass the size test under any combination currently under consideration.
- 6.7 For the discreteness test, we considered six criteria to determine the potential impact of a third party (the CAP) on existing assets and operations: the physical asset location; the number of interfaces; the overlap in processes; the impact on service delivery; the flexibility of the asset; and the control required over the asset.
- 6.8 Under the discreteness test criteria, there are concerns around the setting of the created assets – in particular, using the canal network managed by the Canal & River Trust (the Trust), and the number of interfaces this potentially involves. This is balanced somewhat by the relatively simple connections into the Severn Trent Water (STW) and AfW networks, but at this stage the scheme does not appear to pass the test. Once further technical work on the scheme has been undertaken to understand the potential impact on all stakeholders, the discreteness test can be reviewed at gate-2 to validate its results.
- 6.9 As agreed with RAPID, we have not undertaken the value for money test at gate-1.
- 6.10 Table 6.1 summarises the results of the initial assessment for DPC.

¹ <https://www.ofwat.gov.uk/publication/rapid-standard-gate-one-submission-template/>

² <https://www.ofwat.gov.uk/publication/delivering-water-2020-final-methodology-2019-price-review-appendix-9-direct-procurement-customers/>

Table 6.1: Results of initial assessment for DPC

Test 1: Size	Test 2: Discreteness	Test 3: Value for Money	Result: Suitability for DPC
Passes based on current information	Does not pass based on current information	Not undertaken in gate-1	Unlikely to be suitable for DPC based on discreteness

Tender point

- 6.11 Ofwat has identified four potential points in the scheme's lifecycle where it may be appropriate to put a DPC project out to tender: 'very early'; 'early'; 'late'; or 'split' with separate CAPs appointed at the 'early' and 'late' stage.³
- 6.12 Based on precedents from other infrastructure procurements, we consider that an 'early' or late' tender may be the most applicable models. An early tender may provide for greater innovation but comes with potentially longer lead times. A late tender may fit better with the current RAPID gate process. Further consideration as to the appropriate tender point will be given at future gates.

Alternatives to DPC

- 6.13 Should, ultimately, the GUC SRO not be considered suitable for DPC, we have considered a range of alternative procurement options:
- Non-DPC DBFOM: the scheme could be procured through a third party under a DBFOM contract but outside of the DPC framework.
 - New licensed entity: an alternative to a DBFOM contract (either DPC or non-DPC) could be the creation of a new licensed entity to finance, construct and operate the asset.
 - In-house delivery: the scheme could be procured by a water company, using existing procurement processes and funding arrangements.
- 6.14 In Chapter 3, we set out an indicative programme for procuring the scheme in-house. The appropriate procurement route and programme impact will be confirmed at gate-2, once further information is available on which schemes and options are being taken forward.

Ownership

- 6.15 For the GUC SRO, the water company whose customers benefit from the works (AfW) is joined by an additional water company to help facilitate the scheme (STW), along with the Trust, whose assets are required for the transfer. This gives rise to the question of ownership of the assets, or (if the asset is procured through a project company) which entity should contract the services the project company provides.
- 6.16 Under any of the procurement routes set out above, there are a number of possible alternative arrangements between the water companies for the GUC SRO. These include:
- Ownership/project company appointed by AfW: AfW or the project company may then contract with STW for any licences, works or other items it requires to help deliver the scheme.
 - Ownership/project company appointed by STW: AfW would pay STW for the total cost of the services provided by STW or the project company, potentially incorporated into any Bulk Supply Agreement.
 - Ownership/project company appointed by a Joint Venture (JV): AfW and STW could establish a JV to own the asset or contract with a project company, with AfW making payments to STW for any costs of the scheme directly incurred.

³ <https://www.ofwat.gov.uk/wp-content/uploads/2017/12/Appendix-9-Direct-procurement-FM.pdf>

- 6.17 In all cases, the contractual arrangements would need to be such that AfW customers ultimately pay for the full cost of the scheme.
- 6.18 An important additional consideration for the GUC SRO is the role of the Trust, whose assets are required for the scheme. To minimise interface risk, it may be most appropriate for the Trust to have a direct contractual relationship with the company delivering the works. The agreement with the Trust could potentially be in the form of a sub-contract or a licence. Any arrangement would need to allow both the Trust and the delivery company to meet their regulatory or contractual obligations.
- 6.19 These ownership options and their suitability will be explored in gate-2. Considerations will include the nature of the work being undertaken by each party, and the appropriate allocation of risk.

Operational Strategy

- 6.20 The GUC SRO has the potential to be developed on a modular basis, as described in Section 2.10. We will explore this further in gate-2 to understand how a modular build would impact on our ability to perform under each of the operating scenarios.
- 6.21 Five operating scenarios are currently being considered:
- Business As Usual (BAU)
 - Drought Resilience
 - Operational Resilience (in case of emergency need)
 - Strategy for Environmental Gain (e.g. used for canal 'top up' in place of groundwater or surface water sources)
 - Combined Strategy (a number of options at the same time).
- 6.22 There is some uncertainty around the frequency and duration of the use of the GUC SRO, as this depends on future changes in AfW's abstraction licences. The scheme is flexible enough to support all future scenarios.
- 6.23 For the WRMP, water companies are required to plan to meet future needs under more severe conditions than BAU, such as the 1 in 500-year drought resilience requirement. Minworth SRO provides a resilient water supply to the GUC SRO; even during dry periods, there has always been a substantial output (450MI/d average dry weather flow) from Minworth WwTW. The flow available to the GUC SRO will be dependent upon the environmental and hydrological requirements in the Rivers Trent and Tame, which will be further understood in gate-2.
- 6.24 The GUC SRO also has potential to help improve operational resilience for AfW, through its availability in the case of an incident that restricts supply from BAU sources. Summer peaks in demand, combined with the relative uncertainty around future climate change and the recent very high demands caused by the COVID-19 pandemic, highlight the additional risk of unplanned outage and the need for SRO support to meet demand.
- 6.25 The fourth scenario, Strategy for Environmental Gain, considers the possibility of operating the transfer when AfW does not require it, in order to realise wider additional environmental benefits. Currently, a series of Canal & River Trust sources (groundwater and surface water) are in place to 'top up' the canal system, ensuring the Trust meets its statutory navigation duties. Operating the transfer under this scenario could help to preserve these sources in the South East region.
- 6.26 The main period of operation for GUC SRO is likely to be during the summer high-demand period under dry-year or drought conditions. Water resource modelling has shown that the required annual ADO can be achieved through this mode of operation, meaning that it should be possible to operate the SRO during the same years as the South Lincolnshire Reservoir (SLR) SRO, despite both schemes relying on River Trent resources, as the SLR mainly abstracts water from the River Trent during the winter. The interaction between these two schemes will be investigated further during gate-2.
- 6.27 At this stage, it appears likely that the GUC SRO will be mutually exclusive with the Minworth SRO element of the Severn to Thames Transfer SRO, as the support water is required during the summer in both cases.

- 6.28 MISER modelling (water management tool) has been undertaken to support the operability of this SRO. AfW modelled each abstraction location (described in Chapter 4), simulating an additional 100MI/d entering the AfW supply network, to identify the upgrades needed in the network. This data has been fed into the AfW WRMP24 and the WRSE options appraisal. For gate-1, this work has been funded outside of the GUC SRO budget, but there will be more detailed work required as part of the gate-2 analysis. AfW will undertake this work, which will include combined Pywr/MISER/operational assessment across the SROs.
- 6.29 The raw water storage being considered post abstraction (see Chapter 4) allows for two days of operational resilience. Under our 'resilience scenario', this storage would allow immediate events such as outages or significant bursts to be managed, as well as providing operational headroom.

Supporting evidence:	References/hyperlinks only
1. https://www.ofwat.gov.uk/publication/rapid-standard-gate-one-submission-template/	2. https://www.ofwat.gov.uk/publication/delivering-water-2020-final-methodology-2019-price-review-appendix-9-direct-procurement-customers/
3. Ofwat, Delivering Water 2020: Our methodology for the 2019 price review, Appendix 9: Direct procurement for customers (December 2017)	

7. Planning Considerations

Key Planning Steps and Risks

- 7.1 The key planning steps for GUC SRO will depend upon whether or not the scheme is a NSIP. Development Consent Orders (DCOs) are required for designated NSIPs, rather than other consents such as planning permission. If the GUC SRO is not by definition a NSIP, it may still be possible for it to be delivered by DCO if this is considered advantageous.
- 7.2 The thresholds for NSIPs are set out in the 2008 Planning Act. The key steps in this process for the GUC SRO are therefore summarised below:
- Establish the preferred DO: the optimum scheme capacity has not yet been determined. It is possible that the DO may be less than 80MI/d, however where the maximum size of the transfer is planned at 80MI/d (or greater) the water transfer scheme is a NSIP and must be consented by DCO.
 - Establish the preferred route for project delivery: the current draft National Policy Statement for Water Resources Infrastructure (NPS) states that if the project is to be delivered by a party who is not a water undertaker (such as a DPC), the project will not be a NSIP. Legal advice given to this project expects the final NPS to address this point.
 - Should it be determined that the GUC SRO is not an NSIP, a DCO is not required and the scheme could be consented through planning permissions and with land secured by separate compulsory purchase orders where required.
 - Confirm with Defra:
 - Whether or not for a DO of less than 80MI/d the scheme should be designated as an NSIP; and
 - Whether or not a NSIP can be delivered by DPC.
- 7.3 It is possible that there may be some important changes between the draft NPS and its final version: for example, in relation to the promotion of an NSIP by a DPC/CAP and in relation to the pre-conditions for a scheme designated as an NSIP under Section 35 to the benefit of the NPS. Key planning risks are summarised in Table 7.1.

Table 7.1 Key planning risks

Planning Route	Key Risks
DCO with AD approach – under Planning Act 2008	<ul style="list-style-type: none"> Secretary of State may refuse a request for a direction to make the project qualify as a NSIP (where a solution does not automatically meet the threshold set out in PA 2008 e.g. 80MI/d). Likely to take longer to secure than planning permission (if no public inquiry and TCPA advisory timescales are met). Requires significant investment upfront (e.g. surveys, consultation with stakeholders and the community).
Planning Application - under TCPA 1990	<ul style="list-style-type: none"> Multiple planning permissions required due to the scale of the project, may present difficulties in terms of coordination of approach/lead authority. Public inquiry potentially lengthens consenting process and does not have defined duration. Increases the number of separate consent applications required. TCPA route is likely to be less costly overall. TCPA timeline will be often be faster, depending on complexity and stakeholder and community consultation.

Preferred Planning Route

- 7.4 Requiring planning permission from each local authority whose area the GUC SRO route passes through and obtaining separate compulsory purchase orders where required is likely to be a difficult process, which means that the DCO route is likely to be preferable to the Town and Country Planning Act (TCPA) route.
- 7.5 Where the project is not a NSIP, AfW and STW could choose to 'opt-in' to the NSIP regime by seeking a Section 35 direction from the Secretary of State to be treated as a NSIP. This would allow access to the range of powers which can be included in a DCO (such as compulsory purchase) and would allow the whole project to be consented through a single process.
- 7.6 The preferred planning route will be established during gate-2 for the following reasons:
- The DO of the scheme will be determined through a balance between the output, the scale and cost of works and environmental considerations, but most importantly the case of need as driven by the Water Resources South East (WRSE) regional plan. Only once the required DO is confirmed will it be known definitively whether the scheme has to be an NSIP, which is based on a total DO greater than 80MI/d.
 - It would be beneficial to have certainty from the final NPS as to whether a DPC-promoted scheme will satisfy NSIP definitions (and therefore will require a DCO). It is expected that the Final NPS will be published prior to completion of gate-2, although this is uncertain.
- 7.7 NSIP is likely to apply to the scheme as a whole (including potable water treatment works), because the threshold is based on DO. The scheme DO is effectively zero without the treatment works at the AfW end.
- 7.8 If the DO output is less than 80MI/d and hence below the NSIP threshold, discussions can take place with the Secretary of State to establish whether the development can or will be considered of national significance, and is therefore to be treated as requiring development consent under Section 35 of the Planning Act 2008 as a DCO.
- 7.9 During gate-2, we will understand the need from WRSE, whether the GUC SRO is selected, and at what volume. If 100MI/d is required of the scheme, we can proceed with the DCO. If less than 80MI/d is required by WRSE then we will consult with our legal team to better understand the timelines associated with the planning delivery options.

8. Stakeholder Engagement

- 8.1 This chapter summarises the results of the customer and stakeholder engagement conducted in gate-1.
- 8.2 We have met regularly with key stakeholders such as the Environment Agency (EA), Drinking Water Inspectorate (DWI) and the Canal & River Trust (the Trust) to share progress and enable input into our investigations, and have carried out customer engagement in partnership with Water Resources South East (WRSE).
- 8.3 Customers are supportive of using a current asset as a source of water, and welcome the added amenity value that canals bring in terms of recreation and wellbeing. Customers are, however, less supportive of inter-regional transfer options in general, preferring local transfers and storage options. Any plans for moving resources across regions should be well communicated and should be in the context of wider water resources planning.
- 8.4 The Trust, a partner on the GUC SRO, is very supportive of the option. As the project progresses, it will be important to engage more widely with the canal users and local community to understand any specific concerns and opportunities.
- 8.5 The EA has significant concerns regarding the interaction the canal has downstream with several rivers. We have provided regular updates to the EA, and will ensure their input into the ongoing programme of investigations as we progress towards gate-2.
- 8.6 The DWI has been positive about the GUC SRO, especially as a new potential input into the South East region, but requires greater understanding of the Minworth SRO source and the risk of emerging contaminants as the water moves downstream. Key to progression past gate-2 will be the water quality sampling programme and analysis of the findings, which will be shared with the DWI and EA at regular intervals.
- 8.7 Ongoing engagement with other stakeholders is at an early stage, including organisations such as Historic England, and although we have not identified any showstoppers, continued detailed engagement will be crucial as the schemes develop and we understand points of abstraction, storage, and treatment.

Listening to Customers

- 8.8 We participated in a research programme coordinated by WRSE, in collaboration with other SROs and involving ten water companies, to examine customers' understanding of water resources and the need for regional solutions. This approach ensured cost efficiency and comparability of feedback across regions and solutions. We sought feedback on the scope and approach from representatives from the participating water companies' Customer Challenge Groups (CCGs), CCW and RAPID. The programme comprised three parts:

Part A: Evidence Review	Part B: Deliberative Research	Part C: Customer Survey
<ul style="list-style-type: none"> Insights compiled from PR19, WRMP19 and recent customer research. 120 documents submitted by the ten companies. Consolidated view of the customer evidence structured around: (i) resilience outcomes; (ii) demand measures; (iii) supply side solutions; and (iv) the wider policy context. 	<ul style="list-style-type: none"> Conducted with household customers from all ten participating companies. Implemented online between August 2020 and January 2021 with approximately 80 customers. Range of discussion topics and exercises to understand views on: (i) water resources and the risk of emergency drought restrictions; (ii) resilience planning; (iii) supply and demand options; and (iv) sharing resources and strategic options. 	<ul style="list-style-type: none"> Representative online survey of customers in the WRSE region carried out in Autumn 2020 to measure preferences for: (i) demand and supply options; and (ii) alternative regional plan profiles. Approximately 2,300 household customers and 350 non-household customers. Results are a direct input to the WRSE regional plan investment model.

Customers' feedback – headline messages

- 8.9 The research provided evidence of customers' understanding of the need for regional water resource solutions, and the level of support, in principle, for sharing water resources and the GUC transfer.
- 8.10 Proposals to share water between regions are seen in a positive light by customers. It was highlighted by customers that they need to view SROs in the context of other options and schemes, and with a general understanding of the regional planning context.
- 8.11 Customers have a firmly established view of where transfer options rank in priority order for long-term planning. They are less favoured than either demand options or supply options such as reservoirs, which customers feel bring added value to the community.
- 8.12 Customers are more willing to see water transfers when there is a lower impact on themselves, and customers are less willing to see water transferred out of their region if the recipients (companies and customers) are more wasteful.
- 8.13 Water recycling schemes draw mixed views from customers. In general, the more informed customers become, the more they recognise the benefits. Even with a positive framing around recycling water, customers have concerns over impacts. There is a strong requirement to provide appropriate information and assurances that these issues will be addressed.
- 8.14 Transfer via river or canal is considered more appealing than via pipeline, because customers perceive them to have wider benefits and fewer negative impacts.

Stakeholder Engagement at a Regional Level

- 8.15 The GUC SRO is a key component of the work of Water Resources West (WRW) and WRSE regional plans. For gate-1, we have focused our stakeholder engagement on these regional groups to ensure stakeholders are fully informed of the wider context of the schemes, and to minimise stakeholder fatigue.
- 8.16 WRW is building an ambitious, long-term, multi-sector adaptive water resources plan that will be shaped by consultations with stakeholders and customers. It has developed an innovative online portal to facilitate ongoing consultations and gather quantitative and qualitative data. In 2020/21, this portal has been utilised to engage on the building blocks of the plan. Further consultation is planned throughout 2021/22.
- 8.17 WRSE has an ongoing engagement and consultation programme to support the development of the South East regional plan and South East water companies' WRMP24s. In 2020, the focus of the programme was on the building blocks of the plan (including planning policies and technical methods) and in 2021 broadened to focus on feasible solutions, the approach and tools to determine the best value plan. Public consultation on the draft is planned for early 2022.
- 8.18 Next steps for engagement as we progress towards gate-2 are detailed in Chapter 15.

9. Key Risks and Mitigation Measures

- 9.1 This chapter provides an assessment of the key risks to the solution's planned progress to completion. We have actively managed risk throughout this stage of the project and have not discovered any showstoppers.
- 9.2 Our approach to risk and opportunity 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 by the programme partners, and to ensure that all realised risks are tracked and managed through a proactive management process.
- 9.3 Risks and issues are monitored across the GUC SRO scheme via a Risks Assumptions Issues and Dependencies (RAID) log, which is updated as risks and issues arise, by notification to the scheme's PMO, and reviewed on a monthly basis at GUC SRO programme management board (PMB) meetings, attended by technical leads from the SRO scheme companies. PMB escalates risks and issues as necessary to the scheme's project steering group on a bi-monthly basis,

which operates a memorandum of understanding describing the governance structure for the scheme.

- 9.4 At this early stage of the project, with multiple high-level options still under consideration, it has not been possible to produce an accurate costed risk register. Cost uncertainty has been addressed via the optimism bias (OB) methodology, as approved by the ACWG. A costed risk register will be developed for gate-2.
- 9.5 The overarching RAID is reported to RAPID through the quarterly dashboard process. This provides a register of programme level risks to the overall delivery of the scheme or to the achievement of the strategic outcomes required by the programme. The SRO's RAID log categorises risks and issues through a Red, Amber, Green status as shown in Table 9.1.

Table 9.1: Risk Score Matrix

		Probability of risk occurring				
		1	2	3	4	5
Impact of risk occurring	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5

- 9.6 There are no red risks. Amber risks are provided in Table 9.2.
- 9.7 As shown in Table 9.2, the risks with the highest residual risk score after mitigation are:
- RSK006: The availability of water in the River Tame, and the downstream implications for the River Trent, are described in full in the Minworth SRO gate-1 submission. In brief, there are three SROs aiming to utilise the same resource (GUC SRO, Severn to Thames Transfer SRO and South Lincolnshire Reservoir SRO), but it may not be feasible to support this level of flow change in the River Trent. This issue cuts across three regional groups (WRW, WRSE and WRE), so represents a challenge to planning. We are mitigating this through close integration of water resources modelling across the schemes, and interactions through the Trent Working Group.
 - R-034: The lack of availability of historic data, which presents a risk to both environmental evaluation and water quality treatment assessment. This issue cuts across a number of the risks identified in the table below, and has been a focus of our mitigation activities, which include close liaison with environmental and drinking water quality regulators, and a robust and well-consulted Phase 2 monitoring programme.

Table 9.2: Key risks

Ref no.	Impact / Trend	Short description of barrier and plan to manage	Risk Score	Mitigating Actions	Residual Risk Score
RSK006 (Programme level)	Amber Stable	Regional plan reconciliation Risk that the regional plans will not align, and that a difference will exist in the selection of Strategic Resource Options across the regional plans. This is a gate-2 risk, but one we believe is essential to start thinking about now. Companies need to see and understand how the regional plans are going to link together, and the process to manage this.	16	Active engagement at monthly water regional group meetings and with stakeholders. This risk was discussed in our RAPID one-to-one meeting in January 2021 and J. Dennis highlighted that potential mitigation could come from the RCG (Regional Coordination Group) and its ongoing scenario planning.	16
R-034 (Scheme level)	Amber Stable	Duration of data collection The risk is that there is a current unknown with regard to the amount/duration of data collection required to satisfy the key environmental regulators. This may impact on our long-term ability to be construction ready.	20	Ongoing mitigation in the form of engagement with EA and DWI when compiling water quality and ecological monitoring scopes regarding frequency, location and parameters sampled. Further mitigation can come from escalation to NAU and then RAPID.	12
RSK022 (Scheme level)	Amber Increasing	Maturity of GUC SRO at gate-2 Environmental gap analysis at gate-1 has shown a lack of data associated with the canal. We think we may need several years' worth of environmental investigation before we reach parity with some of the other schemes.	12	1. Collaborative discussions with RAPID and NAU to ensure risk is known and understood, and find a solution. 2. Accelerating environmental programmes. 3. No current solution for lack of historic data, other than consistent data gathering over time. 4. Discussion to be started re: potential flexibility of gate-2 and/or later gates for GUC SRO to enable this risk to be mitigated.	9
R-036 (Scheme level)	Amber Stable	Water quality changes Currently monitoring the WQ within the canal as BAU, but to date (May 2021) we have not modelled the canal as a transfer. The risk is that this enables the movement of parameters/INNS to a greater extent than normal.	15	Our gate-2 modelling work package contains a WQ modelling component so that we can utilise the substantial amount of data being collected by simulating the transfer to understand how WQ parameters would move in the system. We also understand the EA are due to release a new INNS methodology that we will follow in gate-2 as a matter of priority.	8
RSK023 (Programme level)	Amber Emerging Risk	Impact of DPC/DCO on future gates Current timelines and gate requirements involved with potential DCO application may not align with gated process dates. The process will require significant resource, and there will be pressure on these resources, with multiple SROs requiring the same expertise from consultants.	20	1. Understand DCO timeline. 2. Ensure RAPID is aware of DCO timeline. 3. Discussion to be started re: potential flexibility of gate-2 and/or later gates for GUC SRO to enable this risk to be mitigated. Although at gate-1 it is deemed too soon to have a detailed planning strategy given existing uncertainties, a clear strategy will be required to mitigate this risk at gate-2.	8
RSK003 (Programme level)	Amber Stable	Geographical regulatory differences The stretch of Grand Union Canal, and its interacting rivers, that may potentially be impacted as a result of this scheme is wide reaching. As such, the 'transfer route' passes through several EA local offices. There is a risk that the individual local offices may not agree on an item or decision, introducing a major delay.	12	Ongoing close liaison with the EA via the NAU, and with other stakeholder groups via the All Company Working Group (ACWG). Scheme-specific weekly call with NAU rep. A key issue is the potential impact of the scheme on flooding. This is a key gate-2 activity and needs to be addressed both in terms of detrimental effects, but also flood alleviation potential.	8

Ref no.	Impact / Trend	Short description of barrier and plan to manage	Risk Score	Mitigating Actions	Residual Risk Score
R-035 (Scheme level)	Amber Decreasing	Unknown complexities in design At gate-1, our concept design contains several assumptions. There may be currently unknown complexities in the system that we need to consider at later stages.	16	Our gate-2 modelling work package includes a 'pound characterisation' as a first step. This will look at the system on a pound by pound basis, and allow us to target sections that appear problematic using the model derived in gate-1. We can then collect data through Summer/Autumn 2021 to reduce this unknown, and therefore the risk.	6
RSK004 (Scheme level)	Amber Stable	Water quality gate-1 Unknown water quality at this stage could delay the programme.	12	1. Baseline for WQ being gathered over 12-month period. 2. Water companies putting papers forward for the methodology to RAPID. 3. Continued stakeholder engagement with NAU/EA, DWI. 4. Phase 2 WQ monitoring procured to take into account developing guidance from regulators.	6
RSK009 (Scheme level)	Amber Stable	Delays from extended environmental investigations Due to the nature of the programme, there could be a requirement for extended environmental investigation, with an associated programme delay. Uncertainties could affect the viability of the scheme and its place in the WRSE regional plan.	12	1. Working closely with the EA through the NAU to minimise uncertainty. 2. Engagement of local EA resources along the route e.g. WQ and ecology. 3. Further mitigation can come from escalation to NAU and then RAPID.	6
RSK021 (Programme level)	Amber Stable	HS2 impact on route Gate-2 risk that engineering works on HS2 are so far advanced that certain pipeline routes from Minworth WwTW to GUC are not possible. North route and South location have differing risk profiles.	12	Impact and timescales for HS2 work to be reviewed to further understand the risk Link from Minworth WwTW to GUC: engineering outcomes to consider M42, HS2, M6 and M6 toll.	6
RSK010	Amber Stable	Potential revocation of ground water licence at Northchurch, reducing canal resilience The EA Water Industry National Environment Programme has indicated that it may withdraw the licence or reduce the permitted abstraction for two groundwater sources at Cow Roast and Northchurch, which are used by the Trust. This has not yet been enforced, and is currently under review. If implemented, the EA is liable to pay compensation. The Trust is working with the EA to outline affordable mitigation schemes (completed by Spring 21).	8	1. The Trust is working with EA to identify reduction mitigations. 2. Potentially, the transfer could support the maintenance of canal water levels (to be explored further in gate-2).	6

10. Option Cost/Benefits Comparison

- 10.1 This section outlines the initial comparison of the costs and benefits of sub-options under consideration within the GUC SRO. The sub-options, as shown in Table 2.1, are considered for the three potential routes for connecting the GUC to Minworth WwTW in the northern section, three abstraction points in the southern section, and two alternative sizes: 50MI/d and 100MI/d.
- 10.2 The cost estimates prepared for the scheme for gate-1 used the All Company Working Group (ACWG) methodology. They therefore contain a standardised optimism bias (OB) that will reduce as we gain more certainty through the gates. Scheme Average Incremental Costs range from 94 to 137p/m³ based on full utilisation.

Summary of Solution Costs

- 10.3 Table 10.1 gives a net present value (NPV) summary for the flow transfer options of 50MI/d and 100MI/d. All NPV figures are rounded to the nearest multiple of 10. These figures exclude third-party OPEX prices for Minworth WwTW source water and the Canal & River Trust (the Trust) assets. The benefit has been quoted to the nearest 10MI/d (i.e. 50 or 100MI/d), rather than as the quoted DO, as there is no specific limit on source availability, so transfer capacity could be readily increased by the required 10% to generate the equivalent DO without significantly impacting on our estimate of cost at this stage.

Table 10.1: Net present value cost summary for abstraction and treatment at Hemel Hempstead

Option name	Units	Sub-route 1		Sub-route 3		Sub-route 6	
Option benefit – additional resources or demand saved	MI/d	50	100	50	100	50	100
Total planning period indicative capital cost of option (CAP. NPV)	£ million	250	440	240	410	360	560
Total planning period indicative operating cost of option (OP. NPV)	£ million	260	490	260	480	270	600
Total planning period indicative option cost (NPV)	£ million	500	930	500	890	630	1,160
Average Incremental Cost (AIC) – Minimum Utilisation	p/m ³	76.40	65.99	74.14	63.66	103.19	87.15
Average Incremental Cost (AIC) – Maximum Utilisation	p/m ³	108.67	94.61	107.92	93.85	136.57	117.63

- 10.4 Treatment processes and site constraints are relatively similar for the potential abstraction sites; however, The Grove site would require greater expense to connect to the AfW existing network. All abstraction and treatment options include the cost of connection to a strategic service reservoir within AfW supply area. Cost estimates for treatment works, pumping stations and pipelines use AfW cost curves. Cost estimates for embankment raising use quantity estimates and Environment Agency (EA) rates for flood defence embankment construction. Other canal infrastructure estimates are benchmarked from EA's recent flood defence work of similar construction methodology, scale and scope of work. OPEX costs are based upon AfW OPEX cost data sheets. Whole-life costs are based upon an 80-year profile.

Summary of Solution Benefits

- 10.5 As well as the potential environmental and social benefits described in Chapter 5, there are additional benefits that this scheme can provide. These vary slightly according to transfer route, as shown in Table 10.2 below. All shortlisted options are included for flexibility, but we will make a decision in gate-2 to take one option forward. Only the Hemel Hempstead site has been put

forward for modelling in the Water Resources South East (WRSE) regional plan, as there is no significant variation in cost between sites. Benefits for sub-options have been assessed qualitatively on a 'colour code' qualitative basis, with dark green representing the highest benefit level.

Table 10.2: Summary of solution benefits

Nr	Benefits	Shortlisted Options					
		Minworth WwTW to GUC			Abstraction & Treatment		
		Sub-routes			Site Location		
		1 Canal/ Canal	3 Pipeline/ Canal	6 Pipeline/ Canal	The Grove	HH (note 1)	Tring
1	Drought Resilience:						
	Provides a high level of resilience of water supply to the AfW supply area during drought scenarios (Section 6.23)	All options equally increase the resilience of supply to customers, with a reliable Annual Average DO of at least 90% of the transfer capacity.					
2	Futureproof:						
	Option capacity can be expanded without significant capital investment	Pipeline routes are flexible and reduce the amount of canal infrastructure to be modified. Sub-route 3 is almost wholly rural and therefore easier to upgrade.			Tring site is constrained by main western railway and Grand Western Canal.		
3	Strategic Value & Connectivity:						
	Ease of distribution to supply	Not applicable			All sites are located within the part of the AfW central region most likely to be affected by sustainability reductions. Hemel Hempstead option is nearest to Boxted service reservoir.		
4	Flood Risk:						
	Areas of opportunity for flood risk management (Table 5.1)	From the initial 64 sites described in Chapter 5, there are 10 areas of opportunity for flood alleviation along sub-route 1, two along sub-route 3 and nine along sub-route 6.			Unlikely to offer enhancement opportunities.		

Note 1. HH = Hemel Hempstead

System Resilience Benefits

- 10.6 We carried out analysis of the system resilience benefits for each option with the regional modelling team. All sub-options for GUC have the same resilience metric scoring. From this assessment, we concluded that the key resilience benefits of the scheme include the reliable DO, the ability to build in a modular way and the fact that a significant part of the scheme (the GUC) is existing infrastructure.
- 10.7 The most significant resilience issue for the scheme relates to its relatively high complexity of operation. This will be reviewed with WRSE during gate-2 to determine if there are approaches to contractual arrangements and operation that can mitigate this risk. This could address lesser concerns over reliance on third parties to deliver the scheme, and the incorporation of additional bankside storage may help to address water quality incident risks.

Best Value for Customers

- 10.8 It is not currently possible to confirm which solution provides the best value for customers. The WRSE regional best value planning work is not available for gate-1, but the GUC strategic transfer was selected in the AfW WRMP19 and this conclusion has not been changed by any of the work undertaken for gate-1. WRSE's best value assessment is expected to be available in August 2021. It is expected that by gate-2, the WRSE regional plan will be available, informing how GUC SRO could help to meet the regional and national requirements as part of a preferred set of best value solutions for the South East of England.

11. Impacts on Current Plan

Impacts of Solution on Current Supply-Demand Balance Delivery Plan

- 11.1 The water available for supply in the AfW central region will reduce in the future because of climate change and the need to reduce the amount of water taken from aquifers in order to protect rare chalk stream habitats. In addition to reduced supplies, the water demand in the region is forecast to increase due to population growth.
- 11.2 WRMP24 and WRSE planning requirements have seen changes from the guidance that was used to publish the WRMP19 plans:
- now planning to a 1 in 500-year drought resilience, whereas WRMP19 planned to a 1 in 200-year;
 - uncertainty of COVID and working from home on water companies demand forecasts; and
 - the WRMP19 need for abstraction reduction driven by the Water Industry National Environment Programme (WINEP) only looked five years ahead to 2025, whereas the National Framework now requires companies to plan abstraction reduction scenarios for much further into the planning period.
- 11.3 The third item is particularly significant for AfW, so the ability to accelerate investment and potential for modular development of the scheme is important to WRMP24.
- 11.4 At this stage, the lead time is assumed to be the same as it was in WRMP19. The WRSE regional model could therefore still select GUC SRO for the same time period as in the AfW WRMP19 (2066/67), or it could select GUC SRO as early as 2033/34 (for the 50MI/d variant) or 2034/35 (for the 100MI/d variant). This would be the earliest the scheme could provide deployable output (DO) for the South East region.
- 11.5 The source water for GUC SRO is being considered as a separate SRO (Minworth SRO). The partner water companies are the same and we therefore have clear visibility over lead times for both SROs. The planning and construction requirements for Minworth SRO are much lower than for GUC SRO, and as such the lead time is much shorter, meaning there are no other option dependencies that could extend the GUC lead time.
- 11.6 The regional plans will not deliver modelling results until August 2021 at the earliest. Therefore, we are uncertain at gate-1 as to whether the scheme will be required immediately (2033-2035 for GUC SRO), later in the planning period, or not at all. Should the scheme be required, but not until later in the planning period, we would like to continue some environmental programmes in order to build the evidence base for this SRO.

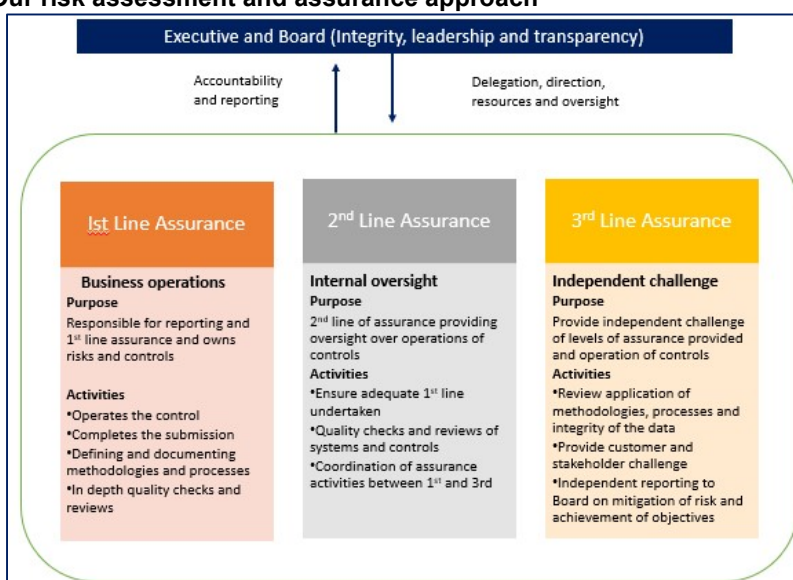
12. Board Statement and Assurance

- 12.1 The Board Statements are provided in the covering letter to this gate-1 submission. The boards support our recommendation for progression of this SRO. The views of the boards are aligned, as evidenced by their respective statements.

Assurance Approach

- 12.2 The assurance framework used for this submission has been developed jointly by Severn Trent Water (STW) and Affinity Water (AfW).
- 12.3 The risk-based assurance approach is consistent with that documented in the individual companies' statements of reporting risks, strengths, and weaknesses and our respective Business Plans for 2020 to 2025 (AfW: Appendix 11⁴, STW: Appendix A1⁵), and is based on a shared understanding of the three lines of assurance model shown in Figure 12.1.

Figure 12.1: Our risk assessment and assurance approach



- 12.4 It is also consistent with the assurance requirements laid out in Ofwat's Company Monitoring Framework⁶.
- 12.5 This approach provides an effective programme of assurance which considers areas that we know are of prime importance to our customers and regulators, or may have a significant financial value, alongside the likelihood of reporting issues. Areas of higher risk receive three lines of assurance while other areas, where the risk is lower, receive first and second line only.
- 12.6 Following a competitive tender we appointed an external assurer. The third-line assurance statement confirms it is satisfied that, on the basis of the evidence presented and the limitations and scope of the assurance activities, the submission is suitable for progression through gate-1. The board statement is supported by the assurance statement, and there are no outstanding

⁴ AfW: <https://www.affinitywater.co.uk/docs/corporate/plans/appendix-11-governance-and-assurance.pdf>

⁵ STW: STW: Risks, Strengths and Weaknesses in regulatory reporting and assurance plan; STW: 2020-2025 Business Plan: Appendix A12

⁶ The latest iteration of Ofwat's Company Monitoring Framework can be found on their website through the following link: <http://www.ofwat.gov.uk/publication/company-monitoring-framework-final-position/>

material issues to be resolved prior to gate-1. The company boards are satisfied that progress to date allows the scheme to be construction ready by AMP8. Our approach was augmented by experience that the companies gained through the PR19 assurance process and the sharing of best practice (e.g. use of the STW risk assessment framework).

- 12.7 We constantly look to improve our assurance approach and will conduct a 'lessons learnt' exercise before we finalise our assurance approach for gate-2.

Supporting evidence:	References/hyperlinks only
4. STW: https://www.stwater.co.uk/content/dam/stw/regulatory-library/stw-risks-strengths-weaknesses-assurance-plan-20-21-final.pdf	5. AfW: https://www.affinitywater.co.uk/docs/corporate/plans/appendix-11-governance-and-assurance.pdf
6. The latest iteration of Ofwat's Company Monitoring Framework can be found on their website through the following link: http://www.ofwat.gov.uk/publication/company-monitoring-framework-final-position/	

13. Solution or Partner Changes

- 13.1 There are no proposed changes to the scheme solution partner organisations.
- 13.2 There are no proposals for a solution substitution.
- 13.3 The key roles of our solution partners are summarised in Table 13.1.

Table 13.1 Key roles of solution partners

Solution Partner	Key Role
Severn Trent Water	Provider of resilient supply of water to the GUC SRO.
Affinity Water	Recipient of water supply from GUC SRO for treatment and distribution to customers.
Canal & River Trust	Maintenance and ownership of canal and assets for transfer of water to AfW's supply area.

14. Efficient Spend of Gate Allowance

Breakdown of Cost and Evidence of Efficiency

- 14.1 The Final Determination (FD) allowance for the GUC SRO was £18.0m (FY2017/18 base prices), split equally between Affinity Water (AfW) and Severn Trent Water (STW), with a 10% allocation to gate-1 equating to £1.8m (£0.9m per water company). It is anticipated that gate-1 outturn will be £1.70m, based on actual costs incurred to the end of May 2021 combined with forecast expenditure to June 30th 2021. This provides a saving of 5%. A breakdown of our costs against individual activities is illustrated in Table 14.1.

Table 14.1: Breakdown of costs against activities undertaken to gate-1

Workstream	Total Gate 1 Spend	20/21 Financial Year Spend		21/22 Financial Year Spend		% of Gate allowance
		20/21 prices	17/18 prices	21/22 prices	17/18 prices	
Engineering (excl Modelling)	£ 368,156	£ 281,378	£ 268,969	£ 86,779	£ 81,580	20%
Engineering Modelling	£ 198,906	£ 87,954	£ 84,075	£ 110,952	£ 104,306	11%
Environment Breakdown below	£ 504,258	£ 313,480	£ 299,656	£ 190,778	£ 179,350	28%
Environmental Assessment Reports (SEA/HRA/WFD)	£ 63,402	£ 4,702	£ 4,495	£ 58,700	£ 55,184	4%
Ecological Assessments	£ 135,085	£ 115,085	£ 110,010	£ 20,000	£ 18,802	8%
Water Quality Monitoring	£ 144,106	£ 110,216	£ 105,355	£ 33,890	£ 31,860	8%
Non Water Resources Benefits SRO leadership, technical integration and tri-partite co-ordination	£ 43,406	£ -	£ -	£ 43,406	£ 40,806	2%
DWSP - Water Quality Sampling Programme	£ 118,259	£ 83,477	£ 79,796	£ 34,782	£ 32,699	7%
DWSP - Water Quality Sampling Programme	£ 217,954	£ 31,722	£ 30,323	£ 186,232	£ 175,077	12%
Workstreams less than £100k spend individually:						
Stakeholder Engagement	£ 191,749	£ 52,835	£ 50,505	£ 138,914	£ 130,593	11%
Procurement & Operations Planning & Consent Strategy Report Assurance and Board Statement						
Programme Management	£ 222,992	£ 98,176	£ 93,846	£ 124,816	£ 117,340	12%
Total Gate 1 cost forecast	£ 1,704,015	£ 865,545	£ 827,374	£ 838,471	£ 788,246	95%
Gate 1 Allowance @ 17/18 prices	£ 1,800,000					
Efficiency	£ 95,985					5%
Third Party Costs (EA/NAU, Natural England, Canal & River Trust) Included in costs, but shown here for transparency	£ 106,754	£ 37,585	£ 35,928	£ 69,169	£ 65,026	6%

14.2 In delivering this submission, we have adhered to the criteria provided by RAPID for efficient expenditure, namely that activities should be relevant, timely, complete and of high quality, and that this should be backed by benchmarking and assurance. We believe our expenditure to gate-1 has been efficient, evidenced by the following:

- We have ensured that any monies spent (e.g. on surveys or resources) is focussed and relevant for this stage of the project. Only the expenditure relevant to delivering work packages to produce the gate-1 submission have been included in our gate-1 budget.
- Costs for procured services have been benchmarked where possible, and care has been taken to ensure efficient spend on agreed, appropriate activities to advance the development of this project through gate-1.
- Working with three partner companies has required effective lines of communication, decision making and governance across the companies. A core programme team of company representatives, supported by an independent programme manager, has managed this process. From gate-2, implementation of this solution will require us to adopt more formal relationships between the partner companies.
- We have driven efficiencies through the utilisation of the core programme team, supported by technical experts procured through existing framework agreements. 75% of gate-1 costs were competitively tendered, of which 99% were let via 'mini-bids' within company frameworks. Prices were externally benchmarked to ensure value for money for our customers.
- 25% of the gate-1 costs could not be competitively tendered: for example, work undertaken by the three companies and the costs of regulators such as the EA, NAU, Natural England and WRSE.
- We have delivered economies of scale by partnering with other organisations to procure packages of work with common scope and objectives: for example, partnering with regional WRSE customer preference surveys. We have actively engaged with the All Company

Working Group (ACWG) to partially fund projects to ensure a consistent approach across SROs.

- As an SRO, we have reviewed existing data sources and undertaken gap analysis to ensure we have not duplicated existing research, and have instructed our partners to do the same.
- There were no activities in the planned expenditure to gate-1 that were not carried out.

Forecast Spend to Gate-2

14.3 Our FD allowance to gate-2 is £2.7m, based on a 15% allocation of £18m total funding. A detailed programme for gate-2, based upon a number of assumptions, dependencies and risks (Chapter 9), can be viewed in Chapter 15. Our forecast spend for gate-2 is provided in Table 14.2.

Table 14.2: Gate-2 forecast spend

Workstream		Forecast Budget £M	% of gate allowance
A	Engineering	0.15	6%
	Data Collection	0.08	3%
	Modelling	0.15	6%
	Operational strategy - BAU, Drought, Operational Flexibility.	0.02	1%
	Modelling (Water Quality)	0.03	1%
B	Environmental Assessment Reports SEA, HRA, WFD (updated)	0.06	2%
	Ecological Monitoring	0.19	7%
	Non-Water resource benefits	0.08	3%
	Other targeted initial baseline desk-top studies (Socio-economic impacts on urban areas, Arboriculture, Landscape, Heritage, Noise, Air quality, Ecology and Hydrology, Transport impacts)	0.04	1%
	WQ monitoring Phase 2	0.40	15%
C	DWSP	0.02	1%
D	Stakeholder Engagement (Customer)	0.04	1%
E	Procurement & Operational Strategy	0.03	1%
G	Planning & Consent Strategy	0.07	3%
H	Assurance & Board Statement	0.08	3%
	Programme Management	0.45	17%
	Third-party costs (EA/NAU, Natural England, Canal & River Trust)	0.19	7%
	SRO leadership, technical integration and tri-partite co-ordination (STW & AfW)	0.41	15%
	Sub Total	2.47	91%
	Contingency = 8% of Sub Total	0.20	8%
	Total	2.67	99%
	Budget	2.70	100%
	Variance	0.03	1%

Assurance of Current and Forecast Spend

- 14.4 We can confirm that our gate-1 expenditure and forecast gate-2 expenditure has been assured by our external assurance providers, who found that spend on the GUC SRO was both relevant (focusing on critical areas) and appropriately efficient.

15. Proposed Gate-2 Activities

- 15.1 Our work in gate-1 has identified gaps in our understanding that will be addressed in gate-2. This will include a targeted, integrated approach to water quality and hydraulic/hydrological model upgrades. This will be used to refine the design, environmental mitigation and costing of the transfer and treatment infrastructure, and to confirm the preferred option for minimising environmental risk to the rivers downstream of the AfW abstraction point.
- 15.2 The work required to address gaps in gate-1 understanding is iterative and integrated, and designed to deliver conclusions as and when required. Gate-2 work aims to achieve the goals summarised below.

Proposed Gate-2 Outcomes

- 15.3 The appraisal work completed for gate-1 has shortlisted options for transfer of flow from Minworth SRO to the GUC SRO in the northern section, and for the location of abstraction and treatment facilities in the southern section. In the middle section, the GUC carries water to AfW's supply area. The outcome of gate-2 will include a concept design report for the scheme that identifies the optimum solution and establishes key design information to a level suitable for including in the final regional plan.
- 15.4 At this stage, results arising from the hydraulic/hydrological modelling should be considered indicative only. Our studies in gate-1 have identified gaps in the model itself and in the information used to develop it. We will address these gaps in gate-2, including gathering targeted topographical and hydraulic data through field-based surveys. The ultimate objective of this integrated design approach is to efficiently determine the scale and nature of the engineering enhancement or operational changes required to accommodate the optimum transfer capacity. From this we will provide updated, accurate and consistent CAPEX and OPEX cost estimates and carbon estimates, in accordance with best practice, for each option, enabling an updated comparison for gate-2.
- 15.5 This design schedule is conceptualised as a phased study, focusing modelling and engineering effort towards those areas where issues are most complex. The work will include data collection to reduce gate-1 design uncertainties, enable an assessment of drinking water quality considerations, and establish an appropriate assessment for environmental and wider benefits.

Proposed Gate-2 Activities

- 15.6 Proposed activities for gate-2 are summarised below.

WBS	Task Name	Start	Finish
1	Integrated Design	Fri 07/05/21	Thu 04/08/22
1.1	Engineering Design	Fri 25/06/21	Thu 04/08/22
1.1.1	Appoint Consultant	Fri 25/06/21	Fri 25/06/21
1.1.2	Desk study of abstraction and treatment sites.	Fri 25/06/21	Thu 08/07/21
1.1.3	Desk study of pipeline routes incl. topographical.	Fri 25/06/21	Thu 08/07/21
1.1.4	Update gate-1 scheme cost in line with ACWG methodology	Fri 09/07/21	Thu 30/09/21
1.1.5	Consider environmental sensitivities	Fri 09/07/21	Thu 22/07/21
1.1.6	Targeted initial baseline desk-top studies - socio-economic, landscape, noise, heritage, air quality, ecology, transport impacts.	Fri 23/07/21	Thu 19/08/21
1.1.7	Initial Concept Design	Fri 20/08/21	Thu 14/10/21
1.1.8	Input into pound characterisation and data collection	Thu 22/07/21	Thu 22/07/21

WBS	Task Name	Start	Finish
1.1.9	Interface with the Trust - operational and asset condition	Fri 15/10/21	Thu 11/11/21
1.1.10	Optioneering to meet one single solution design.	Fri 12/11/21	Thu 06/01/22
1.1.11	Iterative design with modelling team	Fri 18/02/22	Thu 07/07/22
1.1.12	Wider scheme benefits	Fri 27/05/22	Thu 07/07/22
1.1.13	Costed risk register	Fri 18/02/22	Thu 07/07/22
1.1.14	Update programme timeline for design, construction and commissioning.	Fri 15/04/22	Thu 07/07/22
1.1.15	Engineering CDR	Fri 08/07/22	Thu 04/08/22
1.2	Modelling	Fri 28/05/21	Thu 04/08/22
1.2.1	Appoint Consultant	Fri 28/05/21	Fri 28/05/21
1.2.2	Pound characterisation	Fri 28/05/21	Thu 22/07/21
1.2.3	Specification of targeted data collection	Fri 11/06/21	Thu 05/08/21
1.2.4	Aquator model upgrade	Fri 28/05/21	Thu 22/07/21
1.2.5	Model verification & QA	Fri 23/07/21	Thu 02/09/21
1.2.6	Model updates in line with targeted data collection	Fri 29/10/21	Thu 23/12/21
1.2.7	Model scenarios and QA scenario outputs	Fri 24/12/21	Thu 17/02/22
1.2.8	Iterative model design with engineering consultant	Fri 18/02/22	Thu 07/07/22
1.2.9	Water Quality Modelling	Fri 25/06/21	Thu 28/04/22
1.2.9.1	Pound Characterisation	Fri 25/06/21	Thu 22/07/21
1.2.9.2	Model Development (WQ & Sediment Mobilisation)	Fri 30/07/21	Thu 23/09/21
1.2.9.3	Scope Additional WQ Data Collection	Fri 09/07/21	Thu 22/07/21
1.2.9.4	Model Enhancement	Fri 04/02/22	Thu 28/04/22
1.2.10	Modelling CDR	Fri 08/07/22	Thu 04/08/22
1.3	Data Collection	Fri 07/05/21	Thu 28/10/21
1.3.1	Appoint Consultant	Thu 05/08/21	Thu 05/08/21
1.3.2	Hydrological surveys (level, flow, velocity)	Fri 06/08/21	Thu 28/10/21
1.3.3	Topographical surveys	Fri 06/08/21	Thu 28/10/21
1.3.4	Gauging at critical calibration points	Fri 06/08/21	Thu 28/10/21
1.3.5	Permeability assessment	Fri 06/08/21	Thu 28/10/21
1.3.6	Sediment sampling analysis	Fri 07/05/21	Thu 29/07/21
2	Water Quality Monitoring Programme	Mon 15/02/21	Thu 31/03/22
2.1	Appoint Consultant	Mon 15/02/21	Mon 15/02/21
2.2	Water quality monthly sampling	Mon 29/03/21	Fri 11/03/22
2.3	Analysis of water quality sampling	Mon 29/03/21	Fri 11/03/22
2.4	Update DWSP	Mon 14/03/22	Fri 25/03/22
2.5	Additional WQ sampling for modelling (if required)	Fri 23/07/21	Thu 31/03/22
3	Water quality monthly sampling (continued)	Mon 14/03/22	Fri 16/12/22
3.1	Procure services	Mon 14/02/22	Fri 11/03/22
3.2	Appoint Consultant	Mon 14/03/22	Mon 14/03/22
3.3	Data Collection	Mon 14/03/22	Fri 16/12/22
4	Ecological Monitoring	Fri 07/05/21	Thu 10/03/22
4.1	Appoint Consultant	Fri 07/05/21	Fri 07/05/21
4.2	Planning	Fri 07/05/21	Thu 03/06/21
4.3	Data Collection	Fri 07/05/21	Fri 22/10/21
4.3.1	Fish Population assessment	Mon 30/08/21	Fri 22/10/21
4.3.2	CPET	Fri 07/05/21	Thu 23/09/21
4.3.3	Macrophytes	Fri 07/05/21	Thu 26/08/21
4.3.4	Macro-inverts	Fri 07/05/21	Thu 26/08/21
4.3.5	INNS monitoring	Fri 07/05/21	Thu 26/08/21
4.4	Reporting	Mon 25/10/21	Fri 28/01/22
4.4.1	Interpretation and Recommendations	Mon 25/10/21	Fri 31/12/21
4.4.2	Review Period	Mon 03/01/22	Fri 28/01/22
4.5	Data Collection (continued)	Mon 25/10/21	Thu 10/03/22
4.5.1	Procure services	Sun 13/02/22	Thu 10/03/22
4.5.2	Appoint Consultant	Thu 10/03/22	Thu 10/03/22
4.5.3	Data Collection	Mon 25/10/21	Fri 17/12/21
5	Environmental Assessment	Mon 12/07/21	Thu 30/03/23
5.1	Appoint Consultant	Mon 12/07/21	Mon 12/07/21
5.2	Infill gaps in gate-1 Gap analysis (to feed into single solution design)	Mon 12/07/21	Fri 01/10/21
5.3	Statutory Reports	Fri 05/08/22	Thu 01/09/22
5.3.1	SEA update to ACWG Methodology (including Net Gain & Nat Capital)	Fri 05/08/22	Thu 01/09/22

WBS	Task Name	Start	Finish
5.3.2	HRA update AA as required (linked to gate-2 design)	Fri 05/08/22	Thu 01/09/22
5.3.3	WFD assessment update in accordance with ACWG methodology & WQ sampling.	Fri 05/08/22	Thu 01/09/22
5.4	Collated Environmental Report	Fri 16/09/22	Thu 13/10/22
5.5	EIA Requirements	Thu 28/04/22	Thu 30/03/23
5.5.1	Collate Data Assembled to date	Thu 28/04/22	Thu 28/04/22
5.5.2	Assess Data	Fri 29/04/22	Thu 26/05/22
5.5.3	Consultation with LPA	Thu 26/05/22	Thu 26/05/22
5.5.4	Additional Data Requirements	Fri 27/05/22	Thu 02/03/23
5.5.5	Non-statutory consultation	Fri 03/03/23	Fri 03/03/23
5.5.6	EIA Report	Fri 03/03/23	Thu 30/03/23
5.6	Consenting	Thu 01/09/22	Thu 01/09/22
5.6.1	WwTW discharge	Thu 01/09/22	Thu 01/09/22
5.6.2	Abstraction	Thu 01/09/22	Thu 01/09/22
6	Procurement Strategy	Fri 27/08/21	Fri 19/08/22
6.1	Appoint Consultant	Fri 27/08/21	Fri 27/08/21
6.2	Evaluate and consider different procurement strategies	Fri 24/09/21	Thu 07/10/21
6.3	Outline Procurement Strategy	Fri 07/01/22	Thu 20/01/22
6.4	Procurement Strategy Decision Point	Fri 04/03/22	Fri 04/03/22
6.5	DPC revised discreteness test	Fri 08/07/22	Thu 21/07/22
6.6	Compilation of procurement strategy	Fri 22/07/22	Fri 19/08/22
6.6.1	Procurement route	Fri 22/07/22	Thu 04/08/22
6.6.2	Procurement timeline	Fri 05/08/22	Thu 18/08/22
6.6.3	Finalise Engagement & agreement	Fri 19/08/22	Fri 19/08/22
7	Planning Strategy	Fri 01/10/21	Fri 09/09/22
7.1	Appoint Consultant	Fri 15/10/21	Fri 15/10/21
7.2	DCO / Planning next steps	Fri 01/10/21	Fri 09/09/22
7.2.1	Review engineering & concept design	Fri 15/10/21	Thu 04/11/21
7.2.2	LPA engagement on concept design	Fri 05/11/21	Fri 05/11/21
7.2.3	Strategy for SoS direction on NSIP status for scheme (Section 35 direction)	Fri 01/10/21	Thu 21/07/22
7.2.3.1	Initial Consideration	Fri 01/10/21	Thu 07/10/21
7.2.3.2	Confirm Strategy	Fri 08/07/22	Thu 21/07/22
7.2.4	Define the project for DCO and EIA purposes, including project area (red-line boundary)	Fri 08/07/22	Thu 21/07/22
7.2.5	Refine the outline programme to align with WRMP24 and WRSE	Mon 15/08/22	Fri 26/08/22
7.2.6	Gate-2 technical report	Mon 29/08/22	Fri 09/09/22
7.2.7	Stakeholder engagement as a pre-cursor to DCO	Mon 29/08/22	Fri 02/09/22
8	Stakeholder Engagement	Mon 05/07/21	Mon 31/10/22
8.1	Workshops	Mon 05/07/21	Mon 31/10/22
8.1.1	Workshops with EA, DWI, NE, HE, RAPID, LPAs, NAU	Mon 05/07/21	Mon 31/10/22
8.2	Input into WRSE consultation (Jan 2022)	Mon 24/01/22	Mon 24/01/22
8.3	WRSE - reconciliation with integrated design (Quarterly)	Fri 01/10/21	Fri 24/06/22
8.3.1	Autumn 21	Fri 01/10/21	Fri 01/10/21
8.3.2	New Year 22	Fri 07/01/22	Fri 07/01/22
8.3.3	Early summer 22	Fri 24/06/22	Fri 24/06/22
8.4	Engagement	Fri 23/07/21	Mon 05/09/22
8.4.1	Canal community - areas of concern and opportunity	Fri 07/01/22	Fri 07/01/22
8.4.2	Customer engagement on recreational benefit	Tue 01/03/22	Tue 01/03/22
8.4.2.1	Customer feedback	Tue 01/03/22	Tue 01/03/22
8.4.3	Planning Engagement	Fri 23/07/21	Mon 05/09/22
8.4.3.1	Detailed engagement with Historic England	Fri 07/01/22	Fri 07/01/22
8.4.3.2	Planning Authority engagement - transfer, abstraction and treatment sites	Fri 23/07/21	Fri 23/07/21
8.4.3.3	Planning engagement - site selection	Fri 05/11/21	Fri 05/11/21
8.4.3.4	Planning engagement - EIA requirements	Fri 27/05/22	Fri 27/05/22
8.4.3.5	Pre-DCO application engagement	Mon 05/09/22	Mon 05/09/22
8.5	Surveys	Mon 20/09/21	Fri 31/12/21
8.5.1	Potential source change and impact on water quality	Mon 20/09/21	Fri 31/12/21
8.5.1.1	Acceptability of Recycling	Mon 20/09/21	Fri 29/10/21
8.5.1.2	Impact of the scheme (construction, environmental & opportunities	Mon 20/09/21	Fri 29/10/21
8.5.1.3	Test the proposed water aesthetics (taste, odour, and hardness) with customers	Mon 22/11/21	Fri 31/12/21
9	Water Company Activities	Mon 15/08/22	Mon 13/03/23
9.1	Draft Water Resource Management Plan	Mon 15/08/22	Mon 15/08/22

WBS	Task Name	Start	Finish
9.2	Statement of Response	Mon 13/03/23	Mon 13/03/23
9.3	Revised Draft Water Resource Management Plan	Mon 13/03/23	Mon 13/03/23
10	WRSE Delivery Timeline	Fri 27/08/21	Mon 15/08/22
10.1	Sight of Draft Plan	Fri 27/08/21	Fri 27/08/21
10.2	Draft Regional Resilience Plan Published	Mon 10/01/22	Mon 10/01/22
10.3	Revised Draft Regional Resilience Plan Published	Mon 15/08/22	Mon 15/08/22
11	Assurance & Board Statement	Fri 22/10/21	Thu 13/10/22
11.1	Appoint Consultant	Fri 22/10/21	Fri 22/10/21
11.2	Familiarise with workstream scopes	Mon 14/02/22	Mon 14/02/22
11.3	Gate 2 - 3rd line assurance.	Mon 03/01/22	Thu 13/10/22
11.3.1	Integrated Design (modelling)	Fri 05/08/22	Thu 18/08/22
11.3.2	Integrated design (engineering)	Fri 05/08/22	Thu 18/08/22
11.3.3	WQ Modelling	Mon 28/03/22	Fri 08/04/22
11.3.4	Ecological Monitoring	Mon 03/01/22	Fri 14/01/22
11.3.5	Environmental Assessment	Fri 02/09/22	Thu 15/09/22
11.3.6	Procurement	Fri 22/07/22	Thu 04/08/22
11.3.7	Planning	Fri 22/07/22	Thu 04/08/22
11.3.8	Gate 2 Paper	Fri 30/09/22	Thu 13/10/22
12	Gate 2 Submission	Fri 02/09/22	Mon 31/10/22
12.1	Gate 2 Paper	Fri 02/09/22	Thu 29/09/22
12.2	Gate 2 submission date	Mon 31/10/22	Mon 31/10/22

Penalty Assessment Criteria, Incentives and Consideration of Solution Delay Impact

- 15.7 We do not propose any changes to the penalty assessment structure for gate-2.
- 15.8 The project is currently running to programme and on-track to deliver the scheme by the required dates. However, as discussed in Chapter 3, there are a number of critical assumptions and dependencies that may impact upon the successful commissioning of the scheme. These risks will be explored further in gate-2 for clarity and detailed mitigation plans.

16. Conclusions and Recommendations

Conclusions

- 16.1 This is one of the more complex SROs, both operationally and in terms of procurement, due to the use of existing assets that are owned by the Trust, and the multiple companies involved.
- 16.2 GUC SRO offers drought resilience by utilising treated wastewater from Minworth WwTW, and also provides an alternative water supply in the event of an incident affecting supplies from the River Thames.
- 16.3 If needed, the GUC SRO could be built in a modular way to enable an early start. The optimum transfer capacity will be better understood in gate-2, as we continue to progress initial designs and enhance the hydrological and hydraulic models for the GUC.
- 16.4 The project will be construction ready in AMP8, in line with RAPID requirements, with an earliest DO of 2034/35 for 50MI/d.
- 16.5 The GUC SRO would improve the ADO of the AFW system as it could be used year-round. The scheme could be operated as some or all of the following operating scenarios:
- BAU
 - Drought Resilience
 - Operational Resilience (in case of emergency need)
 - Strategy for Environmental Gain (e.g. used for canal 'top up' in place of groundwater or surface water sources)

- Combined Strategy (a number of options at the same time)

Recommendation

- 16.6 Through gate-1 we have not discovered any issues that threaten the validity of the scheme and recommend this SRO proceed to gate-2.
- 16.7 The boards of SRO partners support the recommendation for solution progression made in this submission.
- 16.8 The following options are recommended for further refinement in gate-2:
- the three route options shortlisted for the transfer of water from Minworth WwTW to the GUC;
 - the three locations shortlisted for siting abstraction and treatment facilities; and
 - a scheme transfer capacity, envisaged to be between 50MI/d to 100MI/d.
- 16.9 In the middle reaches of the GUC route, further canal model development is scheduled to enable improved understanding of engineering solutions and environmental risk. From this, initial designs can be prepared, and cost estimates refined so that the optimum scheme capacity can be determined.
- 16.10 We propose that further ecology and water quality monitoring is carried out in gate-2 to address the gaps identified through gate-1 work.

Table 16.1: Resolution of risks and barriers

Nr	Risk	Resolution
1	Our work in gate-1 has shown that there is a complex interaction with the environment, and environmental data on the canal network is not as readily available as it is for rivers. Therefore, on certain environmental parameters, we will have less data than other SROs at gate-2.	Key investigation activities are needed to generate the level of certainty in scheme design required for gate-2. Water quality monitoring should continue for a longer period to build a dataset over several seasons, in order to assess the concentrations of hazardous substances against Environmental Quality Standards (EQS) and establish evidence that the transfer will not lead to deterioration in WFD status over time. We are working closely with the EA through the National Assessment Unit to minimise the uncertainty that remains at gate-2, and will need to work closely with RAPID and the EA towards the end of the gate-2 investigation process to determine if those uncertainties affect the viability of the scheme and its assessed place in the WRSE regional plan.
2	The gate-1 GUC SRO modelling has identified gaps in information and knowledge that lead to uncertainties in the model outputs and, at this stage, results should be considered indicative only. Head loss and velocity within the canal under larger scheme operating capacities may limit the scheme capacity.	We are proceeding with our targeted, integrated approach to water quality and hydraulic/hydrological model upgrades and engineering design. This work will be used to refine the design and costing of the transfer and treatment infrastructure, and the preferred option for minimising environmental risk to the rivers which interface with the canal along its route and downstream of the AfW abstraction point. We will refine our understanding of the scale and localised effects of where the GUC SRO will change canal hydraulic behaviour and use this as the basis for the refinement of the elements of mitigation design that are required to protect existing canal assets. We will assess the response time for water moving along the canal, and better understand the way water from Minworth SRO travels along the canal system and how that might afford opportunities for environmental and operational risk mitigation.

- 16.11 A detailed programme of work has been prepared for gate-2, aiming to resolve outstanding risks and barriers.