River Severn to River Thames Transfer (STT)

Strategic regional water resource solution

Gate 1 submission

July 2021

Contents

1.	Executive summary	1
2.	Solution description	3
3.	Outline project plan	7
4.	Technical information	9
5.	Environmental and drinking water quality considerations	11
6.	Initial outline of procurement and operation strategy	16
7.	Planning considerations	18
8.	Stakeholder engagement	20
9.	Key risks and mitigation measures	23
10.	Option cost/benefits comparison	25
11.	Impacts on current plan	27
12.	Board statement and assurance	29
13.	Solution or partner changes	31
14.	Efficient spend of gate allowance	31
15.	Proposed Gate 2 activities and outcomes	34
16.	Conclusions and recommendations	35

Glossary and Abbreviations

Glossary and Abbreviations	
Glossary	
Cotswold Canals	Partially refurbished canal network and associated infrastructure (including pumping stations, bypass pipework, treatment plant, and pipeline) with a design capacity of 300Ml/d to convey river water from River Severn to River Thames.
Deerhurst Pipeline	Pipeline and associated infrastructure (including pump station, treatment plant, break pressure tank) with a design capacity of 300/400/500Ml/d to convey river water from River Severn to River Thames.
Interconnector	Term used to describe infrastructure required to convey river water from River Severn to River Thames. The Interconnector options are the Deerhurst Pipeline or Cotswold Canals.
Interconnector design capacity	Raw water volume abstracted from the River Severn at the start of the Interconnector. Not the volume delivered to the River Thames at the end of the Interconnector and not the deployable output of the STT system.
Minworth Effluent	Minworth WwTW effluent inter-catchment transfer (covered under Severn Trent Minworth Effluent SRO developed by Severn Trent and Affinity Water). This has the capacity to release up to 115Ml/d into the STT scheme.
Mythe Abstraction Licence	Mythe Water Treatment Works (WTW) source support element (covered under Severn Trent Sources SRO developed by Severn Trent Water). Unused abstraction licence transfer has the capacity to release 15Ml/d into the STT scheme.
Netheridge Wastewater Treatment Works	Netheridge Wastewater Treatment Works (WwTW) source support element (covered under Severn Trent Sources SRO developed by Severn Trent Water). Effluent diversion has the capacity to release up to 35Ml/d into the STT scheme.
Source support elements	Elements that have the potential to make additional raw water resources available for abstraction at the start of the Interconnector.
STT scheme	Comprises the Interconnector, the River Vyrnwy Bypass Pipeline, and conveyance of the source support elements through the river systems (Vyrnwy, Severn, Avon, and Thames).
STT system	Comprises the STT scheme plus STT source support elements that are required to form an operational system.
STT system operating strategy	Description of contribution/operation of source support elements to form an operational system.
Vyrnwy Mitigation – River Vyrnwy Bypass Pipeline	Pipeline from the Raw Water Vyrnwy Aqueduct (which feeds Oswestry Water Treatment Works) to the lower River Vyrnwy. The pipeline is a mitigation measure to the River Vyrnwy from the Vyrnwy Release source support element. The pipeline has the capacity to convey up to 80Ml/d. Capacity linked to Shrewsbury Redeployment.
Vyrnwy Mitigation – Shrewsbury Redeployment	Shrewsbury Redeployment is facilitated by a supply from the Oswestry WTW. This allows the reduction of the intake at Shelton WTW of 25Ml/d. This mitigation allows the reduction in the size of the River Vyrnwy Bypass Pipeline by 25Ml/d.
Vyrnwy Release	Lake Vyrnwy source support element (covered under Vyrnwy Reservoir SRO developed by United Utilities). This source has a capacity of up to 180Ml/d. A release of a minimum of 75Ml/d into River Vyrnwy has been agreed with the Environment Agency.
Abbreviations	
ACWG	All Company Working Group
AMP	Asset Management Plan
CAP	Competitively Appointed Provider
CAPEX	Capital Expenditure
DCO	Development Consent Order
DPC	Direct Procurement for Customers
EA	Environment Agency
HRA	Habitat Regulations Assessment
Ml/d	Mega litres per day
NRW	Natural Resources Wales
NSIP	Nationally Significant Infrastructure Project
OPEX	Operational Expenditure

Glossary and Abbreviations	
RAPID	Regulatory Alliance for Progressing Infrastructure Development
SEA	Strategic Environmental Assessment
SESRO	South East Strategic Reservoir Option
SRO	Strategic Resource Option
STT	Severn to Thames Transfer
WFD	Water Framework Directive
WQRA	Water Quality Risk Assessment
WRMP	Water Resource Management Plan
WRSE	Water Resources South East
WRW	Water Resources West
WTW	Water Treatment Works
WwTW	Wastewater Treatment Works

1. Executive summary

1.1 The River Severn to River Thames Transfer (STT) was selected by Thames Water in their Water Resources Management Plan (WRMP) 2019 and was included as a Strategic Resource Option (SRO) in the Price Review 19 Final Determination for Thames Water, Severn Trent Water, and United Utilities. The project is now advancing through the Regulators' Alliance for Progressing Infrastructure Development (RAPID) gated process and is jointly developed by the three water companies. This SRO is endorsed by all three water company Boards and is recommended to proceed to Gate 2.

1.2 This is an ambitious, strategic project to provide additional capacity of 300 to 500Ml/d of raw water to the South East of England during drought events. At the project's heart is the Interconnector which enables the transfer of raw water from the River Severn to the River Thames.

1.3 Due to the risk of concurrent droughts in both river catchments, additional sources of water, apart from those naturally occurring in the River Severn, have been identified to augment the baseline flows. These multiple diverse sources of additional water provide resilience in the provision of raw water flows to the River Thames.

1.4 The scheme capacity of 300 to 500Ml/d equates to a Dry Year Annual Average Deployable Output benefit of 250 to 400Ml/d to the South East. The regional planning process will determine the volume, timing, and utilisation of water to be transferred. The regional plans will be available for public consultation in January 2022. The diversity of sources means they can be developed in a phased manner to meet the ultimate demand profile as determined by the regional planning.

1.5 These additional sources of water are being provided by United Utilities and Severn Trent Water who are working in collaboration with Thames Water to develop this solution. The additional four sources are:

- **Lake Vyrnwy**: Utilisation of up to 180Ml/d of water licensed to United Utilities from Lake Vyrnwy by three separate means
  - A direct release of 75Ml/d of water into the head of the River Vyrnwy.
  - A release of 80Ml/d of water into the existing Vyrnwy Aqueduct with a new bypass pipeline that connects it to the lower River Vyrnwy, thus mitigating any environmental impacts upstream.
  - The provision of 25Ml/d of treated water supply to Shrewsbury from the Vyrnwy Aqueduct via Oswestry WTW. This will release flows into the River Severn that were previously abstracted to supply Shrewsbury.
- **Mythe**: Temporary transfer of 15Ml/d of Severn Trent Water licensed abstraction at Mythe, thus releasing flows to the River Severn;
- **Minworth**: The transfer of 115Ml/d of a treated wastewater discharge from Severn Trent Water's Minworth Wastewater Treatment Works (WwTW) to the River Severn via the River Avon; and
- **Netheridge**: The transfer of 35Ml/d of a treated wastewater discharge at Severn Trent Water's Netheridge WwTW to a new location upstream of the current discharge to the River Severn

1.6 The initial assessment of the volume of Lake Vyrnwy water permitted for direct release into the River Vyrnwy concluded that at least an additional 75Ml/d can be released. Further work will investigate opportunities to increase this volume. Should direct releases increase, then the capacity of the bypass may reduce accordingly.

1.7 There are two options to transfer flows between the River Severn and the River Thames: a pipeline Interconnector and a canal Interconnector. Both options include a treatment plant to mitigate potential impacts on water quality or from invasive species on the River Thames. We will continue to investigate these options in Gate 2 to give greater definition and to determine a preferred Interconnector option.

1.8 To ensure that the required volume of water can always be transferred, a 'put and take' arrangement has been agreed in principle with the Environment Agency (EA) and Natural Resources Wales (NRW). This agreement will need to be formalised through a review of the river regulation of the River Severn. The agreement in principle means that if additional source water is 'put' into the river then the Interconnector can 'take' that volume, less River Severn catchment losses, regardless of the baseline flows in the River Severn itself. These losses have been estimated based on physical trial water releases into the River Severn system and on River Avon modelling. The losses now proposed

represent a slight reduction when compared to the WRMP19 position, but further work is required in this area.

1.9 We have examined the available evidence and data to determine the potential environmental effects of implementing and operating the STT scheme, consistent with the All Company Working Group (ACWG) methodologies. Where the assessments identified the potential for adverse effects, we have proposed mitigation measures. Several major beneficial effects have been identified in respect of providing additional water resources, and creating significant opportunities for enhanced biodiversity value, and/or economic co-benefits. Further monitoring, assessment, and ongoing dialogue with stakeholders during Gate 2 will provide more confidence in the assessment outcomes.

1.10 This is a complex solution in which many elements need to be coordinated and managed. Developing a system such as this across three companies brings additional challenges and interfaces. We have worked effectively and collaboratively together and made sure the work is appropriate, of a high standard, and delivered efficiently.

1.11 The project finances have been carefully managed through Gate 1. This has been done by adopting a lean core management team, competitive tendering, and partnering with others to procure work with common scope and objectives. This cost-efficient approach has resulted in a 33% saving when compared to the budget.

1.12 We applied the ACWG cost methodology and have estimated the capital costs for the bypass and Interconnector options. The capital and operating costs have been benchmarked with a variance of less than 10%.

1.13 Our review of the planning and procurement requirements on the project have highlighted that the Interconnector can be advanced through a DCO planning route and is suitable for procurement through a DPC model.

1.14 A viable, robust commercial model to deliver this SRO will need to be developed for Gate 2. This model will need to recognise the complex physical and potentially phased nature of the STT system, be attractive to stakeholders and investors, and will need to address issues of ownership, financing, and funding.

1.15 This SRO can be “construction ready” in 2028. The Interconnector has the longest lead time of all the elements of the system and can be constructed and commissioned with an earliest deployable output in 2033.

1.16 Our customer and stakeholder engagement to date has concluded that there is support in principle for transferring water to the South East in times of drought. Continued engagement is important as it will help to shape and challenge each stage of the scheme development. It will also ensure a scheme is developed that is both feasible and supported by the customers and stakeholders it affects.

1.17 An external third line assurance review was carried out in the context of RAPID’s assessment criteria for robustness, consistency, and uncertainty. They concluded that the STT submission satisfies the Gate 1 criteria.

1.18 The solution offered is robust, flexible, adaptable, and resilient because of its diverse sources, the potential for phasing the development of those sources and the agreement in principle for a ‘put and take’ arrangement with the EA and NRW. No material issues have been identified for this scheme. The Interconnector is suitable for DPC delivery to achieve a deployable output by 2033.

1.19 This SRO is supported by the board of each of the partner companies and we are therefore recommending that this proposal and its options (pipeline and canal) should proceed to Gate 2.

2. Solution description

Outline of the solution

2.1 The Severn to Thames Transfer (STT) scheme forms part of the STT system. The scope of the scheme includes:

2.2 An Interconnector to transfer water from the River Severn to the River Thames:

- A pipeline option from Deerhurst to Culham has been considered with alternative capacities of 300Ml/d, 400Ml/d, or 500Ml/d; and
- An option to reinstate parts of the Cotswold Canals and augment with pipelines and pumping stations from Gloucester Dock to Culham to provide a capacity of 300Ml/d;
- A pre-treatment plant at the head of the pipeline at Deerhurst or at the end of the Cotswold Canals at Culham;

2.3 Mitigation works associated with the release of water from Lake Vyrnwy, including:

- the River Vyrnwy Bypass Pipeline; and
- Shrewsbury Redeployment.

2.4 These elements of the STT scheme are jointly promoted by Severn Trent Water, United Utilities and Thames Water.

2.5 These elements of the system have no resource benefit. Resource benefit comes from the baseline flow in the River Severn (unsupported flow) and the related source SROs providing supported flow. The source SROs are:

- Vyrnwy Aqueduct and United Utilities sources (these facilitate the release from Lake Vyrnwy);
- Minworth Effluent; and
- Severn Trent Sources (Mythe Abstraction Licence and Netheridge Wastewater Treatment Works).

2.6 The concept designs for each of the source elements are described in their own Gate 1 submissions.

2.7 Collectively the Interconnector, treatment plant, mitigation works, the source SROs and conveyance of the source support elements through the river systems (Vyrnwy, Severn, Avon and Thames) form the elements of the STT system.

2.8 This STT Gate 1 submission relates to the Interconnector options including treatment, mitigation works, the unsupported element and the overall STT system's operation.

2.9 The Interconnector will transfer treated unsupported flow from the River Severn to the River Thames when there is a need. When the flow in the River Severn is insufficient or is below the hands-off flow then a proposed 'put and take' arrangement will operate. Under this arrangement, water from the other source support elements will be 'put' into to the River Severn and the Interconnector will 'take' the flow for transfer to the River Thames. The Interconnector will 'take' the equivalent volume that is 'put' into the system less losses in the rivers. Source inputs will be varied according to need and in accordance with best value.

2.10 There will be losses within the system. These are being assessed for each part of the river system. Final results will be provided in Gate 2.

2.11 Figure 2-1 shows the elements of the STT system geographically.

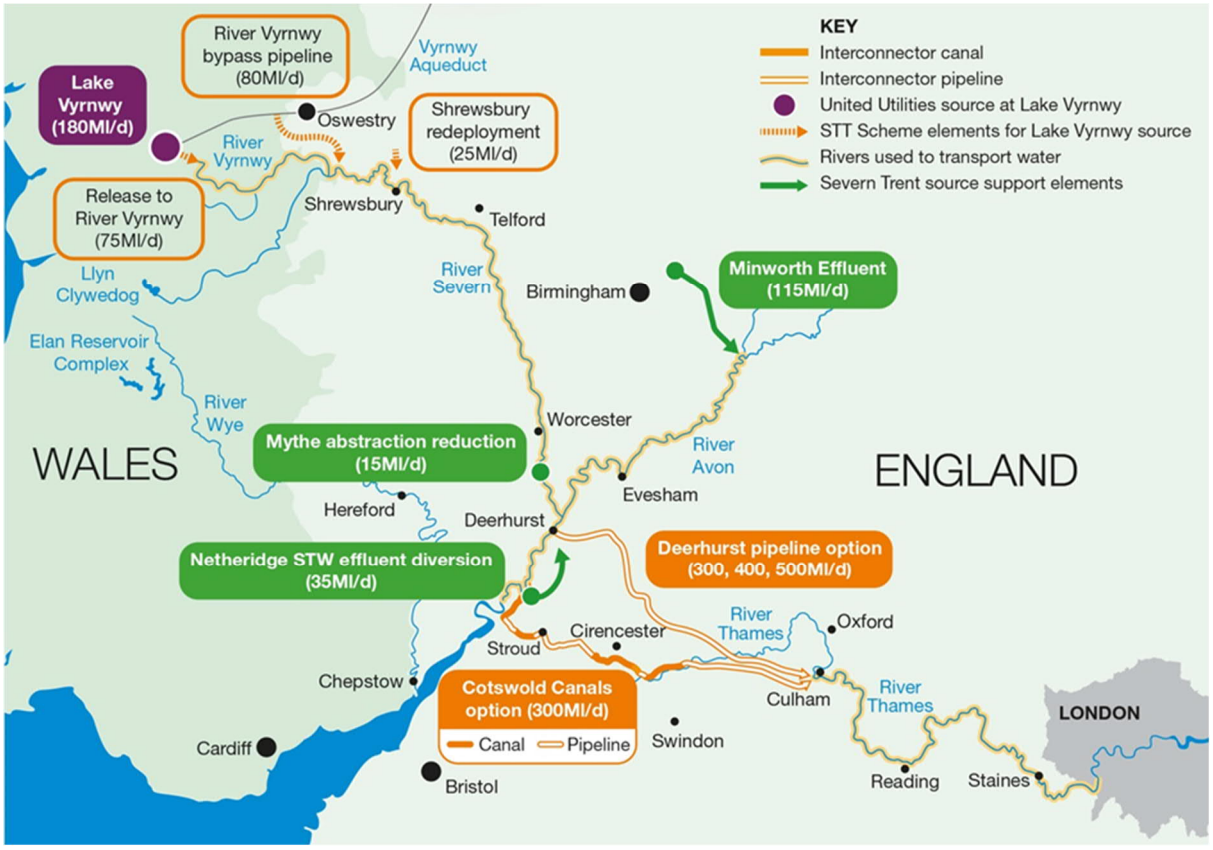

Figure 2-1: Elements of the STT system

Resource benefit

2.12 For the different Interconnector options that are being considered, the total deployable output benefit derived from WRSE deployable output modelling is shown in Table 2-1.

Table 2-1: WRSE determined deployable output

Transfer capacity	Total Dry Year Annual Average deployable output benefit
300Ml/d	290Ml/d
400Ml/d	338Ml/d
500Ml/d	386Ml/d

2.13 The deployable output benefit for STT is divided between unsupported and supported flows based on a regression equation. This has been developed from multiple assessments of pipe sizings and support flow volumes. The details of this work are summarised in the Thames Water technical note Severn-Thames Transfer Deployable Output Assessment.

2.14 The deployable output benefit for the source elements of STT have been reviewed and approved for submission to WRSE. However there is uncertainty associated with the most recent deployable output figures and to mitigate this the WRSE will undertake runs using both the new and old data. Further work will be undertaken in Gate 2 to finalise these values.

Configurations

2.15 We have undertaken optimisation modelling of the source support and mitigation elements based on costs, deployable output, and various demand profiles. This has identified the optimal phasing. Optimisation has been based on least cost and reviewed against environmental and resilience metrics. There are a number of configurations for how the Interconnector options and source elements could combine. The source elements can be introduced in a phased manner in response to an increasing deficit. To further enhance adaptability, the Vyrnwy Release of 180Ml/d can be broken down into five

steps to reflect the work required to replace this flow to United Utilities customers. There are two options for the Netheridge element, depending on the selected Interconnector.

2.16 For this Gate 1 submission, we have determined that a minimum of 75Ml/d (steps 1 and 2) of the total Vyrnwy Release can be released via the existing sluice directly into the River Vyrnwy. We will continue to liaise with NRW to explore and confirm what release is acceptable from an environmental impact perspective. The final release volume will be confirmed at Gate 2.

2.17 A new bypass from the Vyrnwy Aqueduct (the Vyrnwy Mitigation River Vyrnwy Bypass Pipeline) would add 80Ml/d of capacity, for a total of 155Ml/d (steps 3 & 4). The additional 25Ml/d would be provided as the 5th step by an alternative supply to Shrewsbury from Oswestry WTW (Vyrnwy Mitigation Shrewsbury Redeployment). This Shrewsbury Redeployment would allow the existing abstraction from the River Severn at Shelton WTW to be reduced thereby increasing the benefit to the river accordingly.

2.18 The Water Resources South East (WRSE) Regional Investment Model will inform the decision on the preferred options for the Regional Plan and therefore select the capacity of the Interconnector and treatment works. This work is not available for this Gate 1 submission.

2.19 The optimisation modelling revealed a sensitivity to phasing between the Bypass and Minworth options. Therefore, they have both been identified as phase 7. The final deployable output profile from WRSE will determine which is implemented first (i.e. which will rank 7th, and which will rank 8th).

2.20 The phasing differs between the pipeline and canal Interconnector in terms of when Netheridge is selected. Netheridge is less expensive to deliver via the canal route and is therefore selected sooner with the canal Interconnector. There is no difference in the order of options for different pipe diameters as their relative costs do not change with this parameter.

2.21 Table 2-2 shows the optimal phasing for the different Interconnector options.

Table 2-2: Initial optimised phasing of STT elements

Phase	Pipeline Interconnector	Canal Interconnector
1	Unsupported flow	Unsupported flow
2	Mythe Abstraction Licence	Mythe Abstraction Licence
3	Vyrnwy Release step 1	Netheridge Wastewater Treatment Works
4	Vyrnwy Release step 2	Vyrnwy Release step 1
5	Netheridge Wastewater Treatment Works	Vyrnwy Release step 2
6	Shrewsbury Redeployment step 5	Shrewsbury Redeployment step 5
7	Minworth Effluent	Minworth Effluent
7	Build River Vyrnwy Bypass Pipeline (80Ml/d) and Vyrnwy Release step 3	Build River Vyrnwy Bypass Pipeline (80Ml/d) and Vyrnwy Release step 3
9	Vyrnwy Release step 4	Vyrnwy Release step 4

Costs

2.22 The costs associated with the STT scheme are detailed in Chapter 10 of this report. The CAPEX Nett Present Value (NPV) of the options varies between £783m and £1,145m and OPEX NPV varies between £81m and £122m. All costs are presented in 2020/21 prices. Operational Expenditure (OPEX) costs include staffing, operational maintenance, electricity, power, and chemicals. All CAPEX and OPEX costs have been benchmarked and the findings are detailed in Chapter 4.

2.23 Costs associated with source elements are presented in the WRSE model as fixed OPEX and variable OPEX as these are trades of water from one company to another. While these costs can only be indicative for options appraisal purposes, the detailed costs of these source elements are treated as commercially sensitive and are included in the respective source SRO Gate 1 submissions.

2.24 The budget to each gateway is shown in Table 2-3 with a breakdown of Gate 1 expenditure, and the proposed budget for Gate 2 is discussed in Chapter 14.

Table 2-3: Summary of budget funding for each gateway

	Gate 1	Gate 2	Gate 3	Gate 4
Ofwat allowance for each gate	£6.66m	£9.99m	£23.31m	£26.64m

*All figures are 2017/18 cost base

Drinking water quality considerations

2.25 We have applied the All Company Working Group (ACWG) water quality assessment framework to the STT system. This considers water quality risks to human health and acceptability of water to customers. The differential water chemistry between the Severn and Thames catchments drives the treatment requirements for the raw water. Pre-treatment of the raw water from the River Severn is proposed before transfer via the pipeline or at the downstream end of the canal before entering the River Thames. The aim of the treatment is to ensure that there is a barrier to invasive non-native species and that there is no deterioration of the raw water in the River Thames as a result of the transfer. Further treatment to drinking water quality standards will occur at points of abstraction from the Thames and this is discussed in Chapter 5

Summary of social, environmental, and economic assessment and wider resilience benefits

2.26 Our environmental appraisals and stakeholder engagement have confirmed that the scheme is feasible and is supported by our customers. No 'material issues' have been identified for the STT scheme. Environmental assessment of the scheme is detailed in Chapter 5. Chapter 8 details stakeholder engagement and Chapter 10 the cost/benefit of the scheme.

2.27 Each of the four Interconnector options considered would provide at least 250Ml/d deployable output benefit to South East England. This would provide a number of major beneficial effects – it would provide additional water resource, contribute to a resilient water supply, help to support a sustainable socio-economy, and reduce the vulnerability to drought risks associated with climate change, by improving resilience.

2.28 Some of the potential impacts identified are temporary in nature and largely unavoidable while construction works take place. Some exist as a result of the scale of the proposed works, while others may be able to be mitigated with investigation of further measures.

Interactions with other solutions

2.29 As well as the dependencies on the United Utilities and Severn Trent source SROs the STT scheme links a number of other SRO's.

2.30 The potential for the South East Strategic Reservoir Option (SESRO) and STT to operate together to increase the deployable output benefit is being explored as part of the SESRO SRO.

2.31 The Severn Trent Water Minworth SRO is being evaluated to see if it can transfer raw water to Affinity Water via the Grand Union Canal. The WRSE model will evaluate whether Minworth will transfer to the STT, the Grand Union Canal, or both.

2.32 WRSE regional modelling will explore whether water can be transferred from Thames Water to Southern Water and/or to Affinity Water (potentially making use of surplus water from STT). The outcome of the regional modelling for both WRSE and Water Resources East will not be available in time to inform the Gate 1 submission, and so will be considered as part of the Gate 2 submission for STT.

Meeting the National Framework requirements

2.33 The STT system solution is a complex strategic option, which draws together United Utilities, Severn Trent Water, and Thames Water to deliver and operate a major transfer of water from one catchment to another. This will allow water to be moved to where it is needed to deliver resilience to the 1 in 500-year drought in accordance with the National Framework.

2.34 The STT system configurations will be reflected in the regional plans for the donor region (Water Resources West (WRW)) and the recipient region (WRSE). It could provide benefits beyond Thames Water, by supporting the Thames to Affinity transfer and the Thames to Southern transfer.

3. Outline project plan

Introduction

3.1 The scheme's development is proceeding to plan with all key milestones met to date, including regional submissions earlier in 2021 and the submission of this Gate 1 report to the Regulatory Alliance for Progressing Infrastructure Development (RAPID).

3.2 On the basis water that the resources plan requires the scheme, then it is on track to proceed through the gated process to allow construction to start during Asset Management Plan (AMP) 8, 2025 to 2030.

3.3 Figure 3-1 at the end of this chapter provides a schematic representation of the overall STT project plan, including the relationship with the United Utilities and Severn Trent Water source SROs and River Vyrnwy mitigations. The Interconnector is the longest lead activity. The plan indicates an earliest start for the Interconnector design and construction contract award to a Competitively Appointed Provider (CAP) (or equivalent) is Q1 2028. Construction completion, commissioning and a deployable output to the Thames for the Deerhurst Pipeline Interconnector is Q4 2033 and for the Cotswold Canals Interconnector is Q3 2034. The plan is indicative and will be developed as the scheme progresses.

Phasing of key activities and decisions

3.4 Our plan illustrates timescales for an earliest deployable output date assuming the scheme is selected to progress beyond Gate 2 and Gate 3 in accordance with the RAPID gated timeline.

3.5 The earliest deployable output dates of the source support elements and Vyrnwy mitigations are between three and five years earlier than the Interconnector. However, in practice, the consenting of the sources may link to the consenting of the Interconnector. Also, source support elements may not all be required on day-one, but instead, source support elements could be developed progressively to meet supply needs.

3.6 At this stage, the critical path is through the design, consenting, procurement, and construction of both the Interconnector and the United Utilities Sources and Vyrnwy enabling works.

3.7 The combined duration of Gate 3 and Gate 4 is around 21 months from November 2022 to summer 2024. This includes a period for the regulatory decision-making process at the start of each of the gates as to whether the scheme progresses to the next gate. These periods align with the publication of draft and final WRMPs by the water companies.

3.8 Our understanding[1] is that the duration of Gate 3 and Gate 4 is flexible depending on the complexity of the consenting and procurement activities of each SRO. Initial analysis indicates the timescales for Gate 3 and Gate 4 will need to be extended to incorporate the STT consenting and procurement activities. It may be possible to partially mitigate this by, with agreement, bringing forward Gate 3 activities into Gate 2.

3.9 We will work with RAPID during Gate 2 to agree durations and milestones for the post-Gate 2 process including any mitigation that can be undertaken in Gate 2.

3.10 Other key regulatory decisions relate to the commercial aspects of the scheme, the procurement model (e.g. Direct Procurement for Customers (DPC)), commercial operation rules ('buying and selling' framework) and the ultimate asset ownership. These commercial aspects are complex for a major transfer and bulk water supply scheme such as STT.

3.11 Early progress and agreements with the regulator in relation to the commercial aspects are critical to the scheme's timely progression beyond Gate 2. This includes scheme 'promotion' at Gate 3 and identifying the scheme 'appointee' for DPC and 'applicant' for the Development Consent Order (DCO), with the scheme 'promoter' identified and established ahead of the start of Gate 3.

3.12 The principle of a 'put and take' operating regime has been formally agreed and signed off at Gate 1 by the EA and NRW, with the 'put and take' rules to be incorporated into revised River Regulation for the River Severn should the scheme proceed. The detail of the operating rules may require a change to the River Regulation appendices or the act itself. The nature and timing of this will be reviewed at subsequent gates but at this stage is not considered material to the overall timeline even if a change to the Act were required.

[1] RAPID engagement 22 February 2021

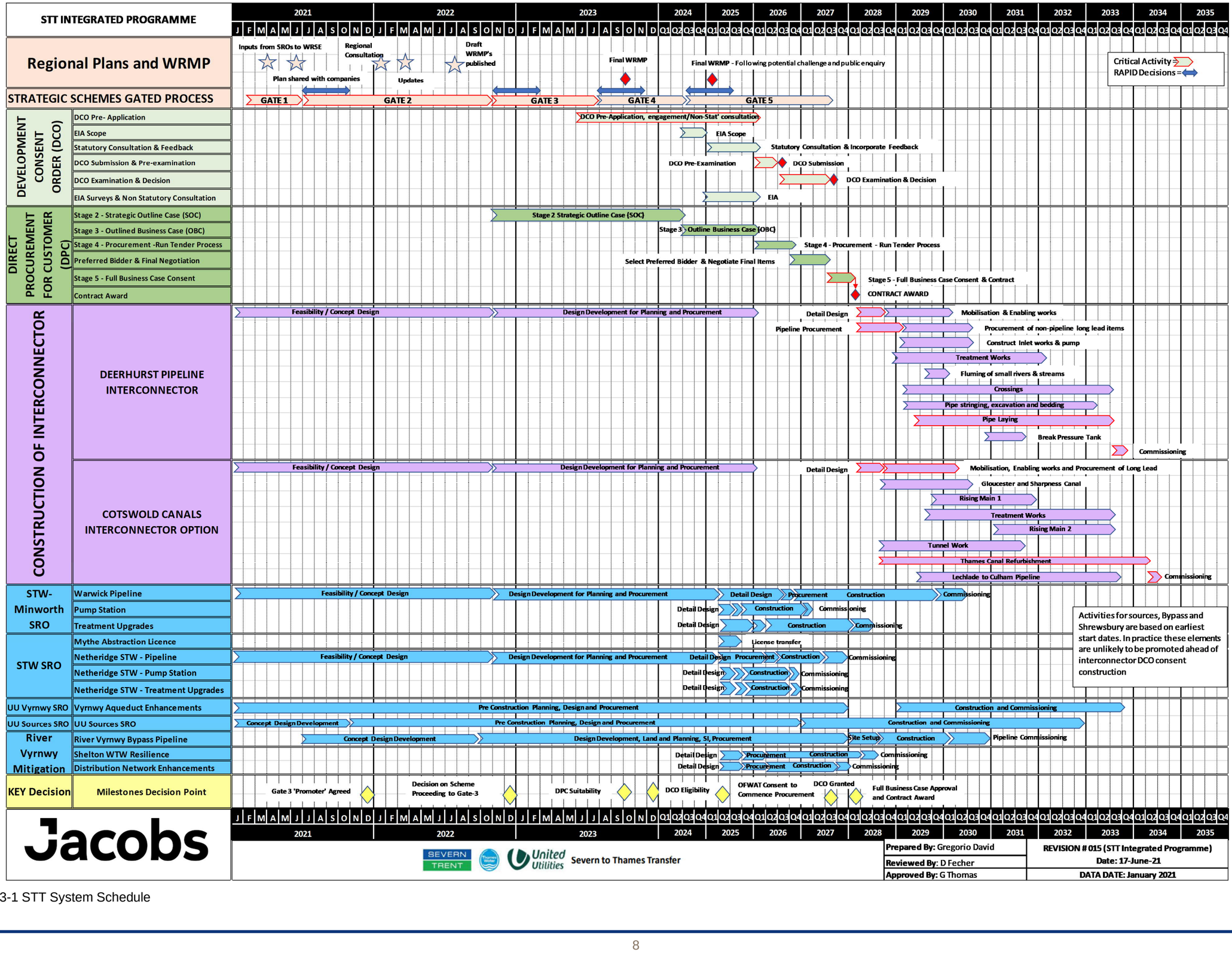

Figure 3-1 STT System Schedule

Assumptions and dependencies

3.13 The programme is based on the following key assumptions:

- The National Policy Statement for Water Resources is approved with the STT qualifying as a Nationally Significant Infrastructure Project through the approval of WRMP24 plans ahead of Invitation to Tender and DCO applications.
- Environmental appraisals and engagement with NRW, EA, Natural England, and the Drinking Water Inspectorate continue to progress with no 'material issues'.
- The programme allows enough time for revised River Severn Regulation (i.e. operating rules for the river including reservoir releases) incorporating 'put and take' to be put in place with the EA and NRW ahead of key procurement and consenting milestones.
- The programme assumes that the canal option will take longer to construct due to the non-standard refurbishment and reconstruction works, bridge works, lock works, and difficult pipelaying in confined areas required to implement this option compared to the standard pipelaying works.
- Decisions on commercial scheme promotion, procurement, commercial operation, and ownership are made early with the agreement of the Regulator, so they do not delay the scheme.
- Planning consent for the Interconnector is granted through the DCO process, and the Interconnector will use DPC procurement routes, whereas the Vyrnwy Bypass and Shrewsbury Redeployment will follow the Town and Country Planning Act consenting process. Planning consents and procurement routes will be subject to further development at Gate 2.
- Issues and concerns arising from key stakeholders identified during Gate 2 and Gate 3 engagement and consultation can be addressed and mitigated within the gated timescales ahead of the DCO application.
- There is a risk that the company WRMPs will be subject to Public Inquiry. The DCO activities have been phased to accommodate a potential inquiry.
- There are no legal challenges or judicial reviews (successful or otherwise).
- The DCO is granted first time, and within prescribed determination timescales, by the Planning Inspectorate and Secretary of State.
- Source programmes are shown with earliest deployable output date, but in practice sources would not be consented or constructed ahead of the Interconnector. The relationship between sources and Interconnector consenting will be developed further at Gate 2.

4. Technical information

Initial configurations/sub-options

4.1 Chapter 2 sets out the possible configuration of the elements of the STT scheme and also describes alternative options for the Interconnector and the Vyrnwy Mitigation works. The source elements will be brought online in a predetermined phased manner to ensure the requirements in the Thames are met. The Interconnector will transfer and treat the Severn flows to ensure that the water quality requirements match those of the Thames.

Operation and maintenance

4.2 The operation and maintenance of the elements of the STT scheme will have their own specific requirements. However, they must be considered in the context of the STT system due to the interdependencies between both.

4.3 The Vyrnwy Mitigation River Vyrnwy Bypass Pipeline is a gravity pipeline and is contained within the licence area of Severn Trent Water. This will require limited operation and maintenance apart from an annual walk over inspection.

4.4 The Interconnector has inbuilt operational complexities as it involves pumping, treatment, and the retention (within the piped elements) of significant volumes of water. Therefore to ensure the assets are kept in good working order and that the water quality does not deteriorate, it will need to keep moving. Therefore a minimum base flow will be required throughout its operating life and this flow is referred to as the sweetening flow. The Interconnector crosses the Severn Trent Water and Thames Water areas of supply and is for benefit of water companies and customers in the South East. Therefore the ownership and operation are not so readily determined. In addition, for the Interconnector to operate

effectively, coordination will be required for how and when the source support elements are brought online. This will ensure an efficient and cost-effective transfer regime. This will require cooperation and coordination across the three partners for this SRO.

4.5 The nature and structure of the owner/operator model for the STT is not yet known, and therefore the full extent of the operation and maintenance has not yet been determined. The requirement for the transfer to come into operation will be determined based on monitoring of reservoir levels in Thames Water, weir levels on the Thames (likely linked to the Lower Thames Operating Agreement), and long-term weather forecasting.

4.6 The lead-in period needed to start a transfer from the system has not been established yet but will be around two to six weeks depending on the quantity required. The source support elements will only be operated when required and will need some commissioning so they can be operated at full capacity (e.g. priming the Minworth rising main). The Interconnector as currently designed will always operate on a low-level sweetening flow from the unsupported element. However, the treatment works on the Interconnector will need time to ramp up to the required output capacity. The source support elements will be brought online in accordance with the optimisation phasing identified in Chapter 2, and a control system will need to be put in place so that they can be operated correctly.

4.7 The elements of the operation and maintenance that we have determined at this stage are detailed in Table 4-1. We will finalise the precise details of how they will work together as the scheme develops

Table 4-1: Operation and maintenance of STT elements

Element	Operation and maintenance
River Vyrnwy Bypass Pipeline	Gravity pipeline that will require an annual walk over.
Deerhurst Pipeline to Culham	Full operation and maintenance of pumping stations. Annual walk over and exercising of valves, and inspection of abstraction, break pressure tank and discharge structures.
Cotswold Canals to Lechlade	Full operation and maintenance of pumping stations. Annual inspection of all bypass pipelines and pumping station valves, and inspection of abstraction and discharge structures.
Cotswold Canals pipeline to Culham	Full operation and maintenance of pumping stations. Annual walk over and exercising of valves, and inspection of break pressure tank and discharge structure.
Water Treatment Works	Full operation and maintenance of the facility, including preventative and reactionary maintenance, chemical handling, sludge handling and water quality monitoring.

4.8 The design life for various assets that will be constructed as part of the scheme is detailed in Table 4-2.

Table 4-2: Design life of assets

Element	Design life
Concrete structures (e.g. break pressure tanks, intakes, outfalls)	80 years
Pipelines	100 years
Treatment plant and pumping station civil works	60 years
Pumps	Overhaul or replacement at 20 years
Canal	100 years
Mechanical and electrical elements	20 years
Instrumentation	10 years
Buildings	60 years

Initial cost and benchmarking

4.9 Initial Capital Expenditure (CAPEX) and OPEX for the Vyrnwy Mitigation River Vyrnwy Bypass Pipeline and the Interconnector are detailed in Chapter 10.

4.10 We have benchmarked the CAPEX costs of the various elements of the Interconnector and the River Vyrnwy Bypass Pipeline. The benchmark was carried out using data from UK water companies and building costs from first principles where data were unavailable.

4.11 The results show the figures generated by the STT team are between 2% and 10% higher when compared to the independent benchmark. The main differences in the costs would appear to be in the pipeline rates, with some variations in assumptions, and these will be investigated further in Gate 2. Figures within 10% are deemed acceptable for a benchmark and the figures are reasonable for this stage of the project. Costs associated with source elements are presented to the WRSE model as fixed OPEX and variable OPEX as these are trades of water from one company to another. The detailed costs of these source elements are commercially sensitive and are not included in this Gate 1 submission document.

4.12 OPEX benchmarking is traditionally a difficult task to undertake due to the differences that can occur in working practices, staffing levels, approach to risk for maintenance activities and regional power costs. A high-level comparison has been generated for the treatment and pipeline capacity 300Ml/d (as this was deemed reflective of the other options). The OPEX benchmark compares well with the STT partner outputs and figures are within acceptable ranges (10%). The OPEX for the bypass pipeline is small and this has not been included in the benchmark.

Water resources benefit and utilisation

4.13 Chapter 2 sets out the initial assessment of deployable output benefit for the STT. Deployable output benefit is based on the need in the South East which is moderated by flows in the River Thames. When flows are high in the Thames there is no need for a transfer of water.

4.14 We have examined the utilisation of this scheme to establish its mode of operation. It is difficult to assess the utilisation against the dry year annual average as that has not been defined in terms of return period. The scheme has been proposed as a response to drought events as opposed to dry year annual average. Therefore we have examined the requirements of the project when viewed in the context of the last 100 years. Information was assessed for the 300Ml/d Interconnector capacity over the period from 1920 to 2010, to understand how often and to what extent the water would have been provided from the STT in that period. This indicates that, while sweetening flows will be required at all times, the full capacity would only be required for 14% of the time in that period. In certain decades the scheme would have been required almost annually and in others there are periods in excess of 5 years where there was no requirement for the capacity beyond sweetening flow. In addition, we would note that, due to the complexity, co-ordination, and timescale to bring this scheme into full operation, this scheme should not be viewed as a response to an incident or emergency unless that were to continue over a number of months. However, the opportunity exists in the future to diversify the utilisation of this asset beyond support to the Thames to maximise the return on this investment during periods when the transfer is not required.

Initial data provided to WRSE

4.15 The WRSE model input template has been populated with both the Cotswolds Canal and Deerhurst pipeline options and with a phased source element solution. This allows for an initial construction of the Interconnector with a starting flow of water from the unsupported River Severn flow. Additional water from the support options can be brought online in the order as indicated in Table 2-2 of Chapter 2. There will be four mutually exclusive sets of options to align with each of the connectors, as the amount of deployable output benefit for unsupported and supported flows changes with the size of the Interconnector. This may change as source options mature and the WRSE requirements are better defined.

5. Environmental and drinking water quality considerations

Introduction

5.1 This chapter sets out a summary of the environmental assessments undertaken and their findings. The focus at Gate 1 is to identify potential environmental risks, and in-combination effects, that may require mitigation through the ongoing STT development programme of design and costing.

5.2 Each of the source elements is described in their own Gate 1 submissions. This STT Gate 1 submission relates to the Interconnector options, including pre-treatment, mitigation works associated with Vyrnwy,

the unsupported element, and the overall STT system's operation including assessment of the operational impacts from the sources on the river system.

5.3 To ensure a robust approach to the Gate 1 environmental appraisals, we have extensively engaged with multiple stakeholders. Monthly meetings and regular workshops have been held between the appraisal team and the environmental regulators: the EA National Appraisal Unit, NRW, and Natural England. Further to this, we engaged with multiple groups, including river partnerships, regional resource groups (WRSE, WRW), the Drinking Water Inspectorate, Cotswold Canals Trust, and technical working groups.

5.4 This engagement has helped to shape and challenge the environmental assessments and further work required, to ensure that the STT scheme is feasible and supported by stakeholders. In this way it also ensures the best value outcomes, and opportunities to provide social and environmental benefits.

High-level overview

5.5 The environmental appraisals have not identified any 'material issues', i.e. any unsurmountable obstacles that mean the scheme is unfeasible due to environmental reasons, at this stage.

5.6 Environmental stakeholders and regulators who have participated in workshops and discussed the assessment results have commented that there is no reason not to progress to Gate 2.

5.7 Both beneficial and adverse effects have been identified, which is to be expected given the scale of the scheme. Where assessments have identified the potential for adverse effects, mitigation measures have been proposed that would negate the risk of these adverse effects happening. Most measures that can be deployed are mature in concept and can be applied with full confidence in their ability to mitigate any adverse effects. Other measures will be further defined through Gate 2 after we have collected and analysed additional data and evidence and through ongoing dialogue with regulators and other stakeholders.

Approach taken

5.8 We have carried out a large number of assessments to identify the effects of the scheme on environmental aspects. These environmental assessments have been undertaken using the methodology and guidance published on behalf of the ACWG[2]. This methodology is aligned to the Water Resources Planning Guideline: Working Version for Water Resource Management Plan 2024 (WRMP24) so that there is a consistent approach to evaluating potential effects on environmental aspects, and drinking water quality in particular.

5.9 The assessments completed for the STT Gate 1 submission first examined the available evidence and data, for each environment topic explored, to establish a baseline understanding of the environment. We then evaluated the scheme against the baseline for each topic, to determine the potential effect of implementing and operating the scheme at the option-level. The need for further data collection and evaluation was noted, together with uncertainties due to evidence gaps. These needs have informed the recommendations for Gate 2, particularly a monitoring programme and where further assessment is required.

5.10 The findings were used to produce the assessments needed to meet local requirements and comply with future statutory assessments for the scheme: a Strategic Environmental Assessment (SEA); a Habitats Regulations Assessment (HRA); and a Water Framework Directive (WFD) Regulations assessment.

5.11 The SEA examines the potential positive and adverse effects of the scheme on a range of environmental assets and social considerations. An HRA is needed as the STT scheme may affect designated European protected sites. The first stage of the HRA required for Gate 1 is to perform a screening appraisal to determine whether the proposal may cause any 'likely significant effects', alone or in-combination, on any European site(s). If it does then further evaluation is needed, termed an 'appropriate assessment'. The WFD Regulations assessment explores the effect of the scheme on water bodies that connect with the scheme, plus any linked ones, to assess if the scheme will cause, or contribute to, any deterioration of status and/or jeopardise the attainment of achieving good status.

[2] Mott MacDonald Limited (2020). All Companies Working Group WRMP environmental assessment guidance and applicability with SROs. Published October 2020

5.12 As well as informing the Gate 1 submission, the environmental assessments have informed the WRSE regional planning process.

Best value to customers and the environment

5.13 As mentioned above, the scheme could have both beneficial and adverse effects given its scale. The precise significances of potentially beneficial and adverse effects vary with the geographical setting of the element and its proximity (or otherwise) to sensitive environmental, human, and built environment receptors. Following initial assessment, the solution design will be adapted to avoid adverse environmental effects.

5.14 Some of the potential adverse effects are temporary in nature, occurring while construction works take place. Some exist as a result of the scale of the proposed works and so are largely unavoidable, while other effects can be mitigated.

5.15 The STT would provide several major beneficial effects in respect of providing additional water resources. These include:

- Greater resilience to climate change and enhanced reliability of water supplies;
- Supporting economic and population growth by improving the reliability of regional water supplies;
- The opportunity for co-benefits, for example, enhanced biodiversity value, recreational and/or educational benefits;
- Contributing to a more sustainable water resources management system; and
- Creating local economic and employment opportunities during construction works.

5.16 Working with WRSE, we have reviewed and provided feedback on the environmental metrics it has produced for the STT scheme. There are some differences in approach between the WRSE methodologies and the ACWG methodologies used for Gate 1 and by working together with WRSE, we have ensured the WRSE outputs across the range of metrics are broadly consistent with the assessment of STT reported for Gate 1. We will continue to work with the regional groups and update information as required throughout Gate 2.

Vyrnwy Reservoir release and mitigation works

5.17 The environmental appraisal work has concluded that a release from Lake Vyrnwy directly into the River Vyrnwy, immediately downstream of the reservoir, of 75Ml/d (in addition to the 45Ml/d compensation flow) can be used as the basis of the operation of the STT scheme.

5.18 This result means that a release from Lake Vyrnwy of 75Ml/d could be used as a basis for STT operation all year round (i.e. on top of the compensation flow, so a potential total of 120Ml/d). Lake Vyrnwy releases above 75Ml/d, up to 180Ml/d, would be achieved via a bypass pipeline (of which there are various capacity and route options) in addition to a further option for a Shrewsbury Redeployment of 25Ml/d.

5.19 The Gate 1 HRA screening for the Vyrnwy Release showed it could cause adverse effects on European designated sites, so it was taken through to a more detailed assessment. This was due to the potential risk on habitats and species of the Severn Estuary Special Area of Conservation and Ramsar site, and where mitigation measures might be required. The mitigation works associated with the release of water from Lake Vyrnwy are the River Vyrnwy Bypass Pipeline and the Shrewsbury Redeployment option.

5.20 The mitigation measures also require further investigation to ensure WFD Regulations compliance. This is for direct reservoir releases and releases through the bypass outfall in the lower River Vyrnwy.

5.21 There are also potential benefits which should be investigated in terms of achieving improvements to the environmental flow regime, given the existing sub-optimal flow regime baseline of the River Vyrnwy.

5.22 There is a need for further assessment and monitoring in Gate 2 to provide quantitative evidence of velocity and aquatic habitat changes at different flows, to better understand the potential effects of the operational regime of an STT release to the middle and lower reaches of the River Vyrnwy, in the context of the Severn regulation regime. Depending on the results, it may be possible to increase the 75Ml/d release volume, and also consider variable flow releases, which account for seasonal and river regulation requirements. This would be explored with, and is subject to, the agreement of NRW and the EA.

STT source support elements

5.23 The Gate 1 HRA screening for the Minworth WwTW diversion element was also taken through to an appropriate assessment. This concluded that 115Ml/d was unlikely to result in adverse effects on the site integrity of European sites when mitigation measures are implemented. These include tertiary treatment of WwTW discharge before it is released into the River Avon and operational rules to avoid the upstream migration period of anadromous fish.

5.24 Additional water quality monitoring and analysis in Gate 2 will help determine the appropriate tertiary treatment required so that the water released is WFD Regulations compliant.

5.25 There is uncertainty on whether the use of WwTW discharge will affect migratory cues (chemical) for migratory fish returning to spawn. We will engage further with the regulators in Gate 2 to explore this more fully.

5.26 The change triggered by the STT support releases could cause a major negative flow effect in the 48km reach of the River Avon from the transfer outfall near Warwick to Evesham. The change in flow volume would trigger changes in the availability and characteristics of the available wetted habitat leading to potential effects on fish communities and other aquatic species. This effect would reduce in the reach of the lower River Avon from Evesham to the River Severn confluence, and further reduce in the River Severn. Further investigation is needed to increase the confidence in this assessment.

5.27 Therefore, as above, there is a need for further assessment and monitoring in Gate 2 to quantify the changes arising from the additional water in terms of velocity and aquatic habitat in the affected water bodies, and the effect on aquatic species. Likewise, more information is needed on the aquatic habitats and species of the River Avon and River Severn, their buffering capacity to accept STT support releases alone and at times of other regulation releases from Vyrnwy Reservoir, and on physical barriers to fish passage.

5.28 We will carry out further data gathering and analysis in Gate 2 to confirm the magnitude of potential effects and give greater confidence in the initial impact assessments. This work will also help to confirm WFD Regulations compliance and/or identify mitigation actions.

Interconnector options

5.29 The environmental assessments have concluded that the interconnection options are unlikely to result in adverse impacts to the Severn Estuary Special Area of Conservation and Ramsar site during construction and operation. This is due to the embedded and additional mitigation measures identified in the scheme design. The mitigation measures include adhering to best practice guidance for pollution prevention and biosecurity incidents; avoiding night-time works; using directional and/or baffled lighting when required; installing fish screens to exclude fish; and implementing a hands-off flow volume at the intake sites. Another mitigation measure is that, when flows are below the hands-off flow, the STT scheme will deploy a ‘put and take’ arrangement using raw water from other appropriate option elements.

5.30 The further work needed in Gate 2 involves additional monitoring to determine whether suitable silt bed habitat for river lamprey and sea lamprey ammocoetes is present within or close to the intake sites for both interconnection options. This will help give greater confidence in the Gate 1 assessment outcome and help identify any further mitigation measures needed.

5.31 In addition, further water quality monitoring is required to fully characterise the River Severn, downstream of the Avon confluence, so that we can conduct a detailed assessment of likely water quality effects from the STT[3] and ensure it is WFD Regulations compliant.

5.32 For both Interconnector options, the effects on the River Thames have been assessed as WFD Regulations compliant, in part due to the treatment systems included before discharge into the River Thames.

[3] United Utilities (2021). Severn to Thames Transfer SRO downstream River Avon confluence to the tidal limit. Report by Ricardo Energy and Environment.

Initial risk assessment for drinking water quality considerations

5.33 A Strategic Water Quality Risk Assessment (WQRA) was carried out using the ACWG methodology[4] to assess the treated water quality risks associated with the STT. We have worked with the Severn Trent Water, Bristol Water, Affinity Water and Thames Water Drinking Water Quality teams throughout the assessment, culminating in workshops to review and agree the draft WQRA spreadsheets. Consultation was held with the Drinking Water Inspectorate to outline the approach to the assessment on the 7th of December 2020 and to present draft assessment findings on the 5th of March 2021. Based on available water quality data, the WQRA identified a set of water quality parameters that pose a risk to drinking water quality (termed 'Limiting Hazards') for each of the existing Drinking Water Safety Plans for surface water intakes that would be in the flow pathways of an operational STT. Those are the existing Affinity Water and Thames Water intakes in the lower River Thames, and the Bristol Water Purton intake in the Gloucester and Sharpness Canal.

5.34 These assessments included the identification of, and agreement on, a range of Limiting Hazards in the catchment, and following their risk through the safety planning process until these were identified as reducing to the current level of risk. Planned mitigation actions include the Gate 1 design of tertiary treatment units at Minworth WwTW prior to discharge to the River Avon; design of tertiary treatment at Netheridge WwTW prior to discharge to the River Severn; and the design of treatment units to treat water transferred inter-catchment from the River Severn to the River Thames via a pipeline or canal Interconnector.

5.35 The WQRA identified that Limiting Hazards relating to microbiological, natural occurring chemicals and industrial chemicals, which potentially affect water intakes in the lower Thames, would be dealt with at the catchment stage, and not pose an additional risk to drinking water quality. Limiting Hazards from rural and agricultural chemicals would be dealt with by the treatment stage and not pose an additional risk to drinking water quality. The WQRA identified that the STT could change the corrosivity, hardness/alkalinity and source of water; parameters affecting water distribution and customer acceptability. This might pose a low risk to the distribution network and be noticeable to the customer, so further consideration is needed in Gate 2 as to the scheme's operating pattern and its potential effects on these aspects. The current Gate 1 water quality monitoring programme will be used to validate the identified Limiting Hazards in the Gate 2 assessment.

5.36 The WQRA identified that, for STT, all Limiting Hazards relating to Bristol Water's Purton intake would be dealt with at the catchment or treatment stage and do not pose an additional risk to drinking water quality.

5.37 We also held discussions with Severn Trent Water operations on the risks to the distribution network and customers from changes in source water for its customers served by Shelton WTW, which would arise from the Shrewsbury Redeployment. We will further assess this aspect in Gate 2.

Biodiversity Net Gain, natural capital and carbon

5.38 For Gate 1, we have carried out a desk based appraisal using open source data, to determine the impact on biodiversity and natural capital, i.e. the provision of ecosystem services. We have also provided a broad summary of options that the STT Scheme could consider to support embedded and operational carbon emission reduction commitments.

5.39 For Gate 1, the appraisal has identified where key habitats will be lost during the construction of the STT scheme; where there may be opportunities to mitigate the loss of these habitats; and, at a high level, areas where it may be possible to deliver a 10% increase in biodiversity, i.e. a 'net gain'. In addition, we have assessed other ecosystem services, namely air quality, recreation and tourism, water purification, natural hazard (flood) regulation, climate regulation, and carbon sequestration. These metrics have been included in the assessment to support the Welsh goals of sustainable management of natural resources, and wellbeing, which are important considerations across the whole STT system.

5.40 The results show that each Interconnector option performs differently with advantages and disadvantages for either one.

5.41 Without mitigation, the Deerhurst Pipeline Interconnector has a smaller overall loss in natural capital compared to the Cotswold Canals Interconnector. However, the construction of the pipeline would result

[4] All Company Working Group (ACWG) (2021) Strategic WQ Risk Framework – FINAL Report, B19589BJ-DOC-001|06, 19/01/2021, Jacobs.

in a greater loss of habitat that is considered 'unacceptable' to harm, and would therefore need a large bespoke mitigation strategy. Due to its larger footprint, the Cotswold Canals Interconnector would need a greater habitat uplift to deliver a net gain in biodiversity. This may lead to the Cotswold Canals Interconnector having a greater increase in natural capital ecosystem service provision than the pipeline, including carbon sequestration, once the mitigation measures have been implemented. This option also has the potential for improving social, economic and environmental aspects, plus cultural well-being in the future. The pipeline is not expected to have any of these advantages. These benefits have not been quantified in Gate 1 as further information is needed. We will collect evidence during site visits that will take place in Gate 2.

6. Initial outline of procurement and operation strategy

Introduction

6.1 This chapter outlines the initial assessment of the STT system's suitability for DPC. It also considers alternate methods of procurement, the anticipated operational utilisation of the scheme and considerations surrounding operation and ownership models.

Assessment of the suitability for Direct Procurement for Customers (DPC)

Overview

6.2 The characteristics of the STT system were compared against the DPC criteria set out in Ofwat's PR19 Final Methodology. The assessment first considered the suitability of the STT system as a single DPC submission, and then evaluated the Interconnector and River Vyrnwy Bypass Pipeline separately, considering the respective interdependencies with source support elements (including the Shrewsbury Redeployment). Our review included an evaluation of total whole-life expenditure and a qualitative judgement of the technical characteristics determining project 'discreteness', which included the degree of separability from the existing network, scope for economies of scale, and the commercial appeal and risks to prospective CAPs.

6.3 Our assessment for Gate 1 concludes that the STT system is not suitable for procurement through a single DPC submission, particularly given the links to existing operational assets, differences in timing for commissioning, the complexities involved and geographical dispersion, among other considerations. However, evidence suggests that DPC is likely to be a suitable procurement model for the Interconnector element of the STT scheme if procured as a pipeline, subject to the development of suitable commercial agreements and the mechanism for cost recovery. While the Vyrnwy Bypass and Shrewsbury Redeployment involve similar considerations, individually, these elements may not pass the £100m whole-life total expenditure threshold. Further stakeholder collaboration is needed in future periods to shortlist options for the design of the STT scheme, the role of SROs and how they should be procured.

Assessment findings

6.4 Several characteristics were identified which may render DPC unsuitable should the STT system be procured through a single submission. These included the difference in timing for commissioning of elements of the STT system, their geographical dispersion and technical complexity of operations, including linkages to existing operational assets. For example, source elements that supply the Interconnector would need to be procured through a phased approach, a process that would continue after development of the Interconnector element. Together, these factors limit project discreteness, reducing the scope for benefits from the DPC process.

6.5 When considering the Interconnector element as a single submission, the size of the project would exceed the £100m whole-life total expenditure threshold. Expenditure is also likely to be comprised of significantly large capital outlays relative to the operational expenditures required to run the scheme. In conjunction with the long expected useful life of the Interconnector, the contract length with a prospective CAP would be long term. Together, our review finds that these elements align with the DPC criteria.

6.6 Furthermore, the Interconnector is considered to play an important role in organising capacity between multiple appointees, enhancing resilience, and increasing the opportunity to trade bulk supplies over time. Together, these factors are likely to increase the desirability for delivery by a third party, and the overall extent of project discreteness.

6.7 However, it is noted that commercial agreements, including bulk water trading arrangements and other mechanisms for cost recovery, are still to be established. The commercial attractiveness and suitability of the project for DPC will depend on the development of, and assurances over, such agreements being put in place. Considerations would also differ should the Interconnector be developed via a canal, as opposed to a pipeline.

6.8 With regards to other elements of the STT scheme, namely the Vyrnwy Bypass and Shrewsbury Redeployment, these may each fall below the whole-life total expenditure threshold of £100m applicable for DPC. The development of these elements, by mitigating the flow of raw water into the River Vyrnwy, would also need to be closely linked with development of the Lake Vyrnwy source. Therefore, it is likely that such elements would be constructed further in the future, after the Interconnector and alternative sources have been developed. The Shrewsbury Redeployment would also be linked to existing operational assets. We will explore the procurement methods for these elements, together with the SROs that supply the necessary water resources, further in future gate submissions.

Consideration of alternative methods of procurement

6.9 Our review evaluated three alternative methods of procurement. These included regular investment by appointees for future AMP periods using existing in-house capabilities, contractual and commercial routes, the use of a regulated third-party company (i.e. to finance, build, maintain, operate and own the asset), and additional infrastructure delivery models such as Build, Own, Operate, Transfer. Our assessment considered, among other factors, the potential impact on delivery, the implications for financing, the apportionment of risk among relevant parties and the implications for regulatory oversight.

6.10 The Gate 1 review considered that the regular investment by appointees in future AMPs may be more suited for significant but smaller-scale investments linked to existing operational assets, whereby discrete project components can be outsourced. Alternatively, it may be better to use a third-party regulated company and Build, Own, Operate, Transfer models where incumbents have otherwise large capital works programmes, and where delivery and operational risks can be outsourced effectively. The final design of the scheme will determine which of these alternative models is best.

Options for models of ownership

6.11 In addition to alternative procurement models, our review considered ownership models including ownership and operation by a single appointee, with assets included within the Regulatory Capital Value (RCV); a joint venture between two or more appointees (split RCV); and ownership by a third-party regulated company. The key factors in deciding which ownership model is best are the extent of the capital works programmes already being undertaken by appointees, their level of gearing, and the extent to which the asset can generate revenue streams through ongoing usage and bulk water trading.

6.12 The Gate 1 review found that ownership by a third-party company could deliver benefits through leveraging external expertise and resources in developing strategically important assets and could reduce financing costs from institutional investors. The utilisation of the scheme which will at the core of any commercial model is discussed in Chapter 4. However, further work is required to determine the viability of commercial agreements and which party should ultimately promote the scheme. We will analyse ownership options, promotion of the scheme and the attractiveness of commercial models in more detail once the options for the STT scheme have been further developed as part of the gated process.

Concluding remarks

6.13 Water transfer schemes will play a vital role in delivering network resilience across the sector in coming years. However, schemes of this nature are inherently complex, requiring widespread stakeholder coordination and consideration of the interdependencies between infrastructure and source options. These schemes may, by their nature, exhibit characteristics deemed less suitable for DPC, under the current framework.

6.14 We therefore believe this represents an opportunity for RAPID, Ofwat and the industry to discuss, adapt and evolve the procurement processes to meet these required solutions. This could include, for example, developing wider regulatory incentives and establishing a standardised framework for bulk water trading and similar commercial agreements.

7. Planning considerations

Introduction

7.1 We have considered a provisional consenting strategy for the STT scheme. At this stage, we believe the most efficient, optimal consenting strategy would be for the Interconnector to be authorised by a DCO. In respect of the Bypass and Shrewsbury components, it is considered that consents under the conventional town and country planning regime should be pursued, either as permitted development or express planning permissions (or a combination of the two).

7.2 It should be noted that this is subject to review and change as the development of the STT scheme progresses and will also need to be considered alongside the wider consenting strategy for the other STT system elements.

Proposed consenting strategy

7.3 There are two routes that can be used to obtain the primary consents needed to construct and operate large-scale water resources infrastructure – a DCO made under the Planning Act 2008, or planning permission given under the Town and Country Planning Act 1990, either expressly following an application or granted on a general basis as 'permitted development'.

7.4 Various criteria and thresholds apply for a development comprising water resources transfer infrastructure to be classified as a Nationally Significant Infrastructure Project (NSIP) under the Planning Act 2008. The development must:

- Be in England;
- Be carried out by one or more water undertakers;
- Have a 'deployable output' (as defined in the Planning Act 2008 – this is distinct from the term 'capacity' used in this document) of more than 80Ml/d; and
- Enable the transfer of non-drinking water between river basins or water undertakers' areas in England.

The Interconnector

7.5 Having regard to the above, based on current information the working assumption is that both the Interconnector pipeline and canal options could meet the DCO criteria and thresholds and therefore be automatically classified as an NSIP, meaning a DCO will be required. However, this is based on certain assumptions that require further analysis (e.g. that both options would have an ‘unsupported’ deployable output of over 80Ml/d when operations start – this would be increased as other source SROs that form part of the overall STT system come forward).

7.6 One point to note is that the delivery model for the STT scheme could have a bearing on the application of the NSIP thresholds. Should, for example, a third-party CAP be responsible for delivering the STT scheme, there could be an argument that it is not being 'carried out' by a water undertaker. It is understood that the Department for Environment, Food and Rural Affairs’ view is that such a CAP would be undertaking works on 'behalf of' a water undertaker, so the NSIP thresholds would still apply. However, this potential uncertainty in the regulatory regime needs to be considered further ahead of Gate 2. The potential delivery model for the STT scheme is explored further in Chapter 6 of this submission.

7.7 If it turns out that the Interconnector does not constitute an NSIP, we currently believe that a DCO would still be the optimal consenting route, given the range of powers and consents a DCO can include (for example, in respect of the compulsory acquisition of land). As such, in this scenario, we consider that a Section 35 Direction could be sought for the Interconnector. The factors the Secretary of State will take into account in determining whether a particular project is of national significance are not prescribed. However, based on previous policy statements and consultation materials published by the Government, it is considered that a case could be made in this context that the Interconnector is 'nationally significant'.

Bypass and Shrewsbury components

7.8 The River Vyrnwy Bypass Pipeline and Shrewsbury Redeployment elements of the STT scheme need to be carefully considered, in consenting terms, particularly given that there is some uncertainty as to

when they would come forward compared to the Interconnector, as they are linked to the phasing of supported flows from Lake Vyrnwy source.

7.9 Depending on the precise nature of the works required, there would be scope to rely on planning permission automatically granted as a result of permitted development rights under the General Permitted Development Order. This is particularly the case for works that are largely below ground or comprise the construction of plant, machinery or pumping stations on a water company's 'operational land', as may be the case for elements of the Shrewsbury works.

7.10 However, some elements are likely to be captured by the Environment Impact Assessment regime. This would effectively remove the availability of permitted development rights, subject to a screening opinion from the local planning authority. Should a screening opinion confirm that the element in question is "Environmental Impact Assessment development", an express planning application, accompanied by an Environmental Statement, would need to be submitted to the relevant local planning authorities. Under these circumstances, the relevant legal tests applicable to artificially 'slicing' up a project to avoid Environmental Impact Assessment would have to be carefully considered.

7.11 In reality it is likely that any strategy relying on the conventional planning regime would need to rely on a combination of express planning permissions and permitted development rights.

7.12 An alternative would be to consider whether the Bypass and/or Shrewsbury elements could be 'wrapped up' within any DCO for the Interconnector as 'associated development'.

7.13 Finally, there would also be scope for a Section 35 Direction to be sought for the Bypass so it would then be consented by a DCO (which could be the same DCO as for the Interconnector). Given its nature, this is not considered a feasible option for Shrewsbury as it is unlikely to be considered 'nationally significant'.

7.14 The final optimal strategy will need to be concluded at a later stage. However, at this stage we consider the best option to be to pursue consents for the Bypass and/or Shrewsbury elements through planning permission and/or permitted development, as it fundamentally allows the most flexibility.

Benefits and risks

7.15 The benefits of pursuing a DCO for the Interconnector mainly relate to the wide scope of powers and consents that can be included within a DCO and the fact there would be a single decision-maker. The Interconnector is a proposed large piece of new infrastructure situated over a large geographic area; being able to deal with a large number of matters (which would otherwise have to be pursued separately) as part of a single consent is a compelling, significant benefit. In addition, the Interconnector would benefit from the express policy backing in the National Policy Statement for Water Resources Infrastructure (currently in draft form) for projects set out in WRMPs.

7.16 There are a number of benefits to pursuing consents for the Bypass and/or Shrewsbury elements through planning permission and/or permitted development. It (a) allows the Interconnector to be dealt with on its own under a DCO; (b) removes potentially intensive pre-application DCO activities for the Bypass and/or Shrewsbury components; (c) allows for suitable and flexible phasing of activities, with the Bypass and/or Shrewsbury potentially coming forward sometime after the Interconnector; and (d) allows for the Bypass and/or Shrewsbury consenting to be undertaken separately.

7.17 The options for the proposed consenting strategy have some risks, although we believe these can be suitably managed and mitigated. Selected key risks are presented in Table 7-1.

Table 7-1: Key planning risks

Key risk	Mitigation
Difficulties creating a clear narrative between the different STT elements	Quality of all consultation engagement. Develop a consistent narrative forming a 'golden thread' to encompass regional planning, WRMP24, the optioneering process, assessments and appraisals (including environmental) and the consenting process.
Uncertainties associated with the phasing of STT system components	Early consideration of phasing, devising adaptive consenting strategy, with flexibility around consent for later components. Engage with and seek support from planning authorities.
Planning permission decisions –potential delays, process inconsistency, conditions or refusal and a planning appeal	Engage with the local planning authorities during the pre-application stage. Application needs to be fully formed and developed, with realistic time allocated for pre-application and 'back-checking' the submission. Suitable pre-application

Key risk	Mitigation
	consultation, engagement and coordination with the public and key statutory stakeholders.
Multiple decision-makers for planning applications and other consents	Engage with the local planning authorities and other regulators and ensure consistency of approach in submissions and conditions. This will help avoid any inconsistencies.
Refusal of DCO application	Ensure early engagement and front loading with key stakeholders allowed for the DCO application (including any necessary mitigation) to be fully formed, to limit scope of contentious matters and objection during examination as far as possible.
Onerous conditions or requirements attached to DCO or planning permission	Planning permission: early engagement with local planning authority and fully formed submissions. Could involve agreeing a process for considering and agreeing draft conditions through Planning Performance Agreements. DCO: draft requirements appropriately, provide robust evidence to the Secretary of State as to why more onerous requirements are not necessary.
Legal challenges to consenting decisions	Proactively obtain legal advice at all stages of the development, to ensure applications are robust.

7.18 Broader aspects in relation to stakeholders are discussed in Chapter 8, and the DCO consenting timeline is summarised in Chapter 3 integrated programme.

Conclusion

7.19 At this stage, we believe the most efficient, optimal consenting strategy would be for the Interconnector to be authorised by a DCO. We believe the Bypass and Shrewsbury elements should be consented through the conventional town and country planning regime, either as permitted development or express planning permissions (or a combination of the two). It should be noted that this is subject to review and change as the development of the STT scheme progresses.

8. Stakeholder engagement

Our approach to stakeholder engagement

8.1 Collaboration has been key to our approach to stakeholder engagement across the water companies, regulators, and regional planning groups – Water Resources West (WRW) and Water Resources South East (WRSE). Our principles for engagement are:

- To build on the engagement undertaken through WRMP19s and regional planning, taking into account the issues and concerns raised by stakeholders and local communities;
- To ensure the entirety of the scheme is understood – this includes the sources of water, the transit via the River Severn and the conveyance into the Thames catchment;
- To fit with the regulatory processes established under the guidance of RAPID; and
- To ensure consistency and coordination with regional and company water resource planning.

8.2 As a steering group, we agreed and adopted a tiered approach to engagement as illustrated in Figure 8-1. The focus for Gate 1 has been on Tier 1.

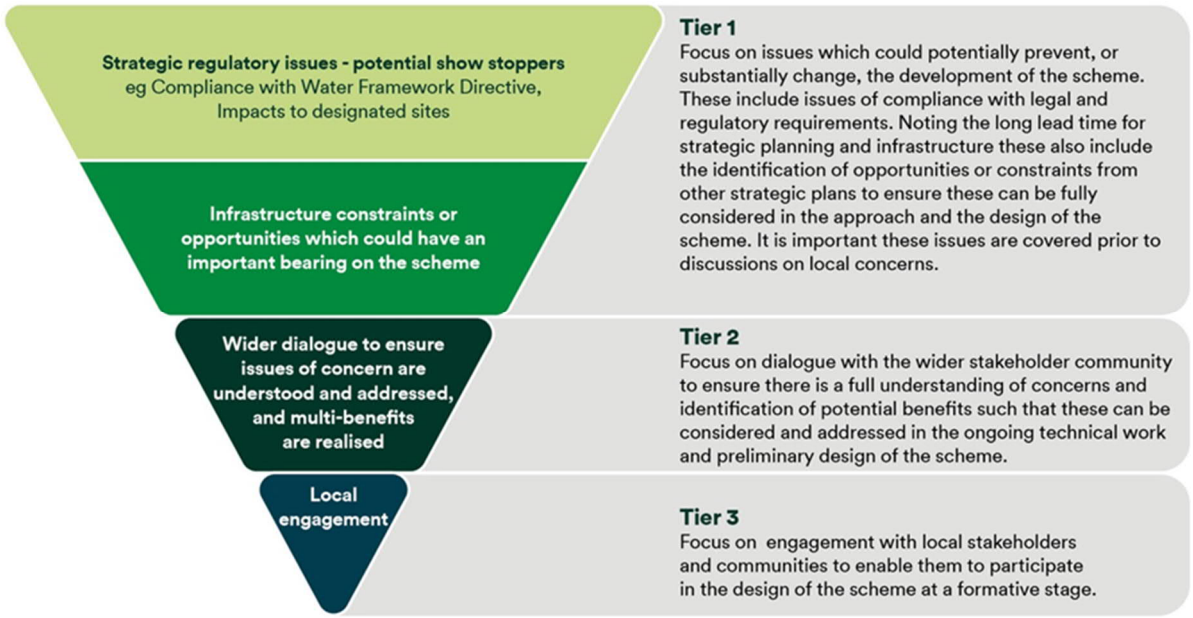

Figure 8-1**:** Tiered approach to stakeholder engagement

Overview of stakeholder activity to date

8.3 For Gate 1, our focus for scheme-specific engagement has been on regulatory, policy and strategic issues which could potentially prevent, or substantially change, the development of the scheme. Alongside the scheme-specific discussions, we have also engaged via WRW and WRSE to ensure stakeholders understand how the STT, and other SROs, fit within the strategic planning framework. We have set out our engagement plan which provides an overview of the engagement we have carried out and key points of discussion. A summary of some of the key discussion points is presented in Table 8-1.

Table 8-1: Discussion points

Topic	Stakeholder
A comprehensive “gap analysis” was undertaken early in Gate 1 which served as the foundation for the agreed environmental investigations and monitoring plan. Regular engagement with all parties through monthly meetings, multiple stakeholders that attend the River Severn Working Group, to review progress, investigation briefs and reporting outputs ahead of Gate 1.	EA, NRW, Natural England, National Appraisal Unit
Close working between all three parties to agree a regulatory principle of a ‘put and take’ operational arrangement, which is fundamental to the operation of supported flows for the transfer. Agreement formalised with a joint EA/NRW letter.	EA, NRW, National Appraisal Unit
Focused study and reporting on the effects of the Lake Vyrnwy source water on the River Vyrnwy habitats to ensure protection of the environment and mitigation including limiting direct river releases and the need for a bypass.	NRW
Focus on ensuring regulatory compliance, alignment with Drinking Water Safety Plans including the monitoring and assessment programme. Plus need to ensure customer acceptability of potential changes to water quality.	Drinking Water Inspectorate, Water Companies
Collaborative activity to complete flow trials and understand losses in the Rivers Vyrnwy and Severn.	EA, NRW
Ongoing consideration of Interconnector options. Dialogue to ensure interested stakeholders are aware of work ahead of Gate 1 and provide opportunity to input to the assessments and to inform the scope for Gate 2.	Cotswold Canals Trust/Canal & River Trust
Need for planned, timely and well-managed engagement with local communities and compliance with legal requirements.	Welsh Government, NRW
Engagement on the regulatory process, requirements, and outputs to ensure “no surprises” at Gate 1. In addition to quarterly reporting and engagement, several STT-specific meetings were held as well as pan-SRO discussions through the ACWG and other forums.	RAPID

Stakeholder engagement

8.4 Overall, most stakeholders are positive or neutral towards the current proposals for an inter-regional transfer. Many are engaged with helping shape how the STT progresses and are contributing to the work. While there is more to do before we have the full support of stakeholders, we believe that they support the STT in principle. When we have finished the feasibility studies, there will be more clarity to allow organisations to engage more fully. Continued engagement with stakeholders is key to taking them on the journey with us. This will help to shape and challenge each stage to ensure we have a scheme that is both feasible and is supported by the stakeholders it affects.

Introduction to customer engagement

8.5 STT participated in a research programme coordinated by WRSE, in collaboration with other SROs, to examine customers' understanding of water resources and the need for regional solutions. This approach ensured feedback was comparable across regions and solutions and was cost efficient. We sought feedback on the scope and the approach from a coalition of representatives from the participating water company's Customer Challenge Groups, Consumer Council for Water and RAPID.

8.6 The programme comprised three parts:

- An evidence review to compile insights from companies' PR19 and WRMP19 research to ensure we were fully utilising available information and building on this.
- Qualitative research to test customers' broad priorities – this included the proposals for sharing water between each company.
- Quantitative research to gather preferences for demand and supply options as well as the principles underpinning the regional plan – this included intra- and inter-regional transfers.

8.7 A summary of the main findings from the research, with a specific focus on sharing water and the STT, and an outline of further work planned to Gate 2, is presented here.

Customers' feedback – headline messages

8.8 The research provided us with evidence on customers' understanding of the need for regional water resource solutions and the level of support in principle for sharing water resources and the STT scheme.

- Overall customers are positive towards investment in strategic water resource solutions and understand the rationale for sharing water but more detailed information on the STT is required for customers to determine if it is one of their preferred water resource solutions.
- When considering a range of potential solutions, transfer options are ranked towards the lower end of the scale, reflecting a preference for self-reliance within the water company over a perceived riskier strategy of long-term dependence on sources from outside the water company.
- Customers are less willing to see water transferred out of their region if the recipients (companies and customers) are more wasteful in their water use.
- Customers are more willing to support water transfers when they experience less individual impact.
- Points raised in relation to the STT and the scheme design focused on cost, disruption from construction, environmental impacts, energy use, lack of benefits to local communities, and deteriorated service levels for donor customers. Previous research by companies has found that transfer via river or canal is more appealing than via pipeline because of perceived wider benefits (e.g. social and economic).
- Broadly, Thames Water customers, as the direct recipients, were most supportive of the STT proposal. Severn Trent Water customers were also supportive if helping others came with no or little detriment to them, as were United Utilities customers who raised concerns around deteriorated service levels and the possibility of changes to the taste and hardness of their water.

9. Key risks and mitigation measures

Introduction

9.1 Risk assessments have been completed for the STT scheme and source SRO elements which have then been used to quantify 'costed risk' within the various cost estimates. STT scheme and overarching STT system delivery risk assessments have also been completed, with the output of these risk assessments reported to RAPID within the quarterly reports.

9.2 At Gate 1, we agreed with the EA and NRW the principle of a 'put and take' operation, where water provided ('put') into the River Severn by the sources during transfer operations can be abstracted ('taken') less losses for transfer into the River Thames. This 'put and take' principle is fundamental to the operation of the transfer. The formal agreement in principle to 'put and take' with the regulators mitigates a significant risk to the scheme's viability.

9.3 The principal and most complex area of risk for the STT system relates to the development, in collaboration with RAPID, of a viable, robust commercial model early in Gate 2. This commercial model needs to:

- Recognise the complex physical and potentially phased nature of the STT system to operate within the regulatory framework and expectations;
- Be attractive to stakeholders providing a long-term value proposition to customers, 'buying and selling' companies and investors; and
- To address issues of ownership, financing and customer funding and trading, with a fair apportionment of risk between parties.

9.4 We carried out some initial work on the commercial model in Gate 1. To mitigate this risk, we hope to appoint an STT commercial adviser at or ahead of Gate 2 and work with stakeholders to develop the commercial model further.

Approach to risk – Interconnector, scheme, and system

9.5 The output of risk assessments completed for the source support elements are reported under the separate United Utilities and Severn Trent Water SRO Gate 1 reports. Costed risks were incorporated into the source support element indicative prices offered by United Utilities and Severn Trent Water. These prices were input into the regional modelling.

9.6 We have assessed risks in two separate ways for the STT SRO:

- A Costed Risk Register which is produced by the technical workstreams. This provides the detailed breakdown of technical and construction phase risks that could have a material impact on the costs of the scheme. This element forms a key component of the overall scheme costs, as reported elsewhere in this report and which feeds into the WRSE regional water resource modelling process.
- The overarching Programme Risk Register, as reported at high-level to RAPID through the quarterly reporting process. This provides a register of programme level risks to the overall delivery of the scheme. It includes risks associated with the STT system where these would not otherwise be dealt with at a scheme level.

9.7 The top 10 overarching programme risks, as presented in the RAPID quarterly report, are summarised in Table 9-1.

Assumptions and dependencies

9.8 At this stage of development, we had to make a wide range of high-level assumptions until we can carry out further monitoring, data collection, analysis, and verification during Gate 2.

9.9 These assumptions range from delivery aspects associated with use of DPC and DCO through to assumptions on losses within the river system, the operation of the scheme under drought conditions and the allowable discharge into the head of the River Vyrnwy. Where key assumptions are made, these are highlighted within the relevant chapters of this report.

Table 9-1: STT Programme Risk Register

Short description / name	Category	Impact rating*	Detailed description including plan to manage
RSK002: Delays from community and wider stakeholder challenge	Stakeholder	Amber	We are developing engagement and consultation plans to ensure local community members and wider stakeholders are engaged, and we address their concerns as best as possible in our preferred plan. We are aligning the Regional/WRMP24 plans and the SRO stakeholder engagement plans, with a focus on Welsh stakeholders and the Well-being of Future Generations (Wales) Act 2015. We are also participating in the River Severn Working Group. However we recognize that as the scheme develops new issues will emerge and our engagement with stakeholders will increase
RSK005: Joint procurement for Gate 2 activities	Commercial	Green	To ensure procurement compliance, services for Gate 2 may need to be procured using a new STT 'joint procurement' framework with supporting legal collaboration agreement. The STT partner companies have reviewed and will be using the existing Gate 1 arrangements for the start of Gate 2. A change to a 'joint procurement' process is however likely to be required during Gate 2 and will definitely be required at Gate 3. This will be done without adversely affecting Gate 2 delivery and efficiency. The issue has the potential to affect other multi-partner SROs.
RSK008: Scheme procurement strategy development	Commercial	Amber	For Gate 3 (October 2022), the scheme 'promoters' for DPC and DCO need to be in place. To achieve this, the procurement strategy including the scheme 'promoter' and asset ownership and commercial operation model need to be well understood by the end of 2021. This will enable time to set-up company arrangements ahead of the start of Gate 3. We are looking to procure commercial advice early and to work with RAPID to mitigate programme risk.
RSK019: Water trading and commercial operation	Commercial	Amber	The mechanism for buying and selling between the STT partners is complex. In the short term, there is a risk regarding the consistency of price submissions for regional options appraisal. In the long term, commercial terms between STT partners need to be understood going into Gate 3 to mitigate the risk of programme delay. We are engaging with RAPID to agree how this can be progressed to meet programme milestones.
RSK009: Interconnector option development for Gate 1 and Gate 2	Technical	Amber	The Interconnector Cotswold Canals and pipeline options assessment is ongoing. Both options have been included for WRSE March 2021 regional appraisal upload. Gate 1 recommends further investigation and assessments are progressed into Gate 2 for STT options appraisal and selection of a preferred Interconnector option. The risk for this item related to providing an optioneering appraisal that will be robust and achieving this in the timescales required by WRSE.
RSK010: STT system modelling and appraisal	Technical	Amber	We are leading the 'STT system' development including the configuration and operational aspects of the source support elements and the STT scheme as an integrated system. This system modelling is complex and requires significant interface with WRW, WRSE and between partner companies. STT system pre-optimisation has been completed ahead of the March 2021 regional inputs. The potential scope of a Gate 2 'system model' is being developed and the need, funding and integration with the regional processes for the system modelling is being finalised. Model development in time to feed into the January 2022 WRSE update regional plan is challenging. To mitigate the risk of programme delay we are working with RAPID to agree for model development to start ahead of Gate 2.
RSK015: Risk of River Severn losses trials not happening in 2020 or not providing definitive data	Technical	Amber	Wet weather restricted the work on River Severn losses, which involved trial releases from Lake Vyrnwy during the summer of 2020. Despite challenging weather, two of the three planned releases (10-day and 2-day) were undertaken. We are now collecting and analysing the data, with results due to be shared March 2021. The analysis has taken significantly longer than planned and was available for WRSE March21 with update ahead of Jan 2022 required. We are determining whether further trials are needed during summer 2021
RSK021: Alterations to River Severn Regulations	Technical	Green	Risk on timing of the potential Act of Parliament required to amend the River Severn Regulation. Further work required at Gate 2 to understand the impact of STT operation on river regulation and any changes required to it as a consequence of STT.
RSK017: Development post WRSE March submission results in significant solution changes	Programme	Amber	STT scheme/sources development is at varying levels of maturity. Solution development after March regional submissions may introduce material changes in scope/costs/prices and metrics that will need to be fed back in WRSE Jan22 window. Potential risk to regional/WRMP timeline. Looking to get submissions into WRSE right first time if possible and then establish process to provide early warning to WRSE/WRW of any significant changes during 2021 Gate 2 design development.
RSK020: Gate 3 and Gate 4 durations	Programme	Green	Gate 3 and Gate 4 duration is around 21 months, completing summer 2024. This may not be long enough to achieve DCO application or a DPC invitation to tender. Depending on decision-making process on which schemes proceed at the gates may also affect timing of these gates. We will engage with RAPID to understand later gate expectations.
* Impact rating reflects the current risk status reported in accordance with RAPID quarterly reporting.			

10. Option cost/benefits comparison

Introduction

10.1 We developed the costs for the STT scheme elements in accordance with the ACWG Cost Consistency Methodology. Costs for source support elements developed under separate SROs were provided to us as a "price to supply the STT". The combination of source support elements offering the best value to customers was determined by optimisation modelling. We have benchmarked all costs to assure their validity.

10.2 A comparison of CAPEX and OPEX for the Interconnector elements demonstrates the Deerhurst Pipeline currently offers the best value to customers as demonstrated in Table 10-1. The Interconnector has the longest lead time and, if selected, can be constructed and commissioned by 2034. Further work will be complete during Gate 2 to value the benefits associated with each Interconnector option.

10.3 A unique challenge associated with the STT SRO is the need for three partner companies to collaborate and share information which is required to inform regional modelling while ensuring commercially sensitive information remains confidential. We successfully implemented additional protocols, file sharing services, and cross-company agreements to allow commercial data to be shared, overcoming the cost and programme pressures during Gate 1.

Interconnector element offering the best value to customers

10.4 A comparison of CAPEX, OPEX, costed risk and optimism bias costs for Interconnector options demonstrates that the Deerhurst Pipeline currently offers the best value to customers. A comparison was completed at WRMP19 which resulted in the Cotswold Canals element being screened out. Following stakeholder feedback to WRMP19, further assessment of the Cotswold Canals has been completed during Gate 1.

10.5 The assessment completed during Gate 1 involved updating the WRMP19 stage three assessment criteria to reflect the latest understanding of both Interconnector elements. Figure 10-1 illustrates the interaction between the work completed at WRMP19 and the work completed during Gate 1. The aim of the assessment was to determine if further investigation of the Cotswold Canals during Gate 2 would represent an efficient use of allocation. Following this assessment, we have decided that further work is needed for Gate 2 to determine a preferred Interconnector option.

10.6 Both the Deerhurst Pipeline and Cotswold Canals Interconnectors can be construction ready during AMP8, if selected. The Deerhurst pipeline can be built and commissioned by 2033 and the Cotswold Canals commissioned by 2034.

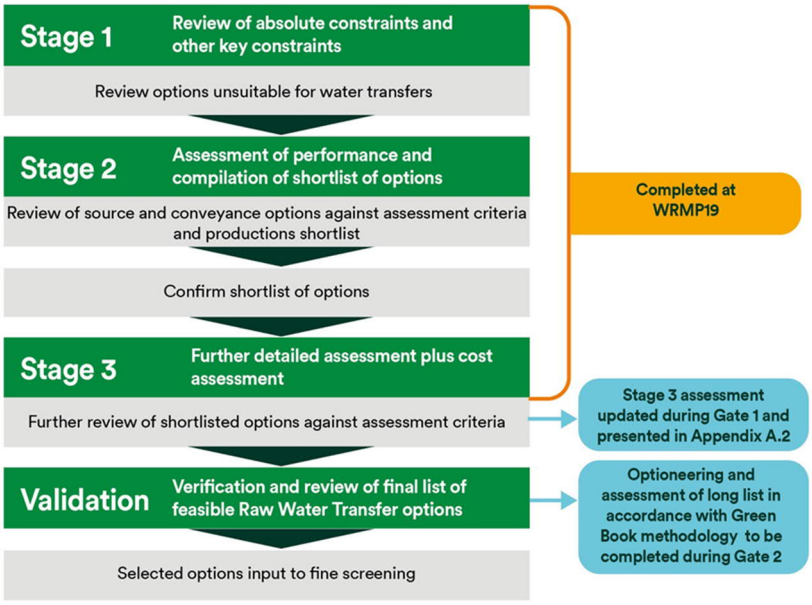

Figure 10-1: Relationship of Gate 1 assessment activity and WRMP19 assessment

Vyrnwy Mitigation elements offering the best value to customers

10.7 Trial releases from Lake Vyrnwy, environmental assessments, and river modelling were completed during Gate 1 to determine the mitigation required to protect the River Vyrnwy from Lake Vyrnwy releases. We determined the combination of River Vyrnwy mitigation measures which offer the best value for customers following optimisation modelling. The modelling demonstrated the Shrewsbury Redeployment mitigation element should be selected before the River Vyrnwy Bypass Pipeline.

10.8 The Interconnector has the longest lead time of all the STT system elements, so neither the River Vyrnwy Bypass Pipeline nor the Shrewsbury Redeployment are on the STT system critical path. If selected, the River Vyrnwy Bypass Pipeline can be constructed and commissioned by 2030 and the Shrewsbury Redeployment by 2029.

Source support elements offering the best value to customers

10.9 The same optimisation model which was used to determine the hierarchy of Vyrnwy mitigation measures was also used to determine the hierarchy of source support elements that offer the best value to customers. The input to the model was a "price for supply" which was provided by Severn Trent Water and United Utilities. None of the source support elements covered under separate SROs has a longer lead time than either Interconnector element, and so would not affect the STT critical path.

Solution costs

10.10 CAPEX and OPEX for the River Vyrnwy Bypass Pipeline, Shrewsbury Redeployment and Interconnector were produced in accordance with the ACWG Cost Consistency Methodology Revision C, issued August 2020. Due to commercial sensitivity, the Shrewsbury Redeployment costs were provided as a "price for supply" only.

10.11 CAPEX costs were generated using United Utilities, Thames Water and Severn Trent cost databases for the River Vyrnwy Bypass Pipeline, Interconnector and Shrewsbury Redeployment respectively. The approach to CAPEX costing used at Gate 1 was consistent with the approach used at PR19 and WRMP19. Optimism bias was calculated in conjunction with a Quantitative Risk Analysis as detailed in the ACWG Cost Consistency Methodology, resulting in a scaled-back optimism bias figure.

10.12 OPEX costs resulting from the CAPEX were generated for each element. OPEX included labour, power, chemicals, and an allowance for operational maintenance.

10.13 Construction CAPEX and OPEX costs have been used to generate the NPV values for the elements using the Treasury Green book with a declining schedule of discount rates (Annex 6, Table 8) and an 80-year period. The estimated NPV and AIC for each of the options are shown in Table 10-1 below.

Table 10-1: Net Present Value and Average Incremental Costs for each of option

Option name	Units	Option 1 Pipeline 300Ml/d	Option 1B Pipeline 400Ml/d	Option 1C Pipeline 500Ml/d	Option 2 Canal 300Ml/d	Vyrnwy Bypass 80/90 Ml/d	Shrews-bury Source 25Ml/d
Option benefit	Ml/d	294	392	490	285	80	25
Total planning period option benefit (NPV)	Ml	2,127,813	2,837,083	3,546,354	2,062,675	745,670	216,840
Total planning period indicative capital cost of option (CAPEX NPV)	£m	783	903	1,013	1,145	65	-
Sweetening Flow							
Total planning period indicative operating cost of option (OPEX NPV)	£m	81	103	122	87	2	107

Option name	Units	Option 1 Pipeline 300Ml/d	Option 1B Pipeline 400Ml/d	Option 1C Pipeline 500Ml/d	Option 2 Canal 300Ml/d	Vyrnwy Bypass 80/90 Ml/d	Shrews-bury Source 25Ml/d
Total planning period indicative option cost (NPV)	£m	864	1,005	1,135	1,232	67	107
Average Incremental Cost (AIC)	p/m³	40.6	35.4	32.0	59.7	8.9	49.4
Maximum Flow							
Total planning period indicative operating cost of option (OPEX NPV)	£m	424	560	693	409	2	429
Total planning period indicative option cost (NPV)	£m	1,207	1,462	1,706	1,554	67	429
Average Incremental Cost (AIC)	p/m³	56.7	51.5	48.1	75.3	8.9	197.9
Carbon							
Embodied Carbon	tCO2e	198,423	233,242	266,353	260,289	24,360	489
Operational Carbon - max flow	tCO2e	36,465	48,639	60,717	34,069	4.25	0
Operational Carbon - Sweetening flow (10%)	tCO2e	3,647	4,864	6,072	3,407	4.25	0

10.14 It should be noted that these costs do enable comparison between options, but do not take account of the holistic costs of the scheme, as they exclude the costs of the source SROs hence should not be used for decision making in isolation.

11. Impacts on current plan

Introduction

11.1 STT is a solution drawing on elements from three water companies, and as such, it could affect all three WRMPs. We are working together to further develop the jointly promoted elements of the STT scheme and are individually working on their associated source SROs. It is noteworthy that the alignment of all regional models during 2021 will build on the WRMP19 work and will make clear the need for the strategic options.

Thames Water WRMP19

11.2 The Thames Water WRMP19 was developed based on achieving resilience to the 1 in 200-year drought and the planning period extended to 2100. It includes two SRO schemes within the preferred plan – the South East Strategic Reservoir Option (SESRO) and STT. SESRO was shown to be needed from 2038 and STT from 2083.

11.3 Since the publication of the WRMP19, there is now a need to plan for resilience to the 1 in 500-year drought. Thames Water has reviewed the implications of this and taken account of other changes, including:

- A marginal reduction in the long-term central population forecast;
- Growth in the Oxford-Cambridge corridor;
- Expectation for significant environmental enhancement, e.g. vulnerable chalk streams and other sensitive watercourses; and
- Potential need to consider raw water quality within the planning process.

11.4 The net effect of these changes potentially increases the deficit. In time, it is possible that all SROs will be needed and means the STT could be needed much sooner. Preliminary work by Thames Water since WRMP19 to investigate 1 in 500-year drought impacts shows that the STT may now be needed from the 2040s.

11.5 SESRO and STT along with the London Effluent Reuse SRO (Beckton, Mogden, Teddington) are being reviewed and further developed through the gated process and will be evaluated in the WRSE regional investment model. The results of this will indicate the impact on the WRMP19 preferred plan and the order of the strategic resource options.

11.6 There will be no change in the preferred plan for the initial AMP7 period.

11.7 At WRMP19, the Interconnector canal option was screened out at the fine screening stage. RAPID requested this option be reconsidered for this Gate 1 submission. Further work on this option has been carried out in Gate 1 and will continue in Gate 2 to determine the preferred proposal for the Interconnector.

Severn Trent Water WRMP19

11.8 The Severn Trent Water WRMP19 looked at the 25-year period to 2045 and was based on resilience to the 1 in 200-year drought. STT was not included in the preferred plan for this WRMP19 as it was not selected as a preferred option by Thames Water before 2045 (i.e. as noted above, the STT was shown to be needed from 2083).

11.9 The components that make up STT were considered as feasible options in the development of the WRMP. The draft WRMP highlighted that options to utilise Vyrnwy releases to the River Severn could prove cost-effective solutions for Severn Trent Water's WRMP. However, the final WRMP recommended a preferred plan that assumed these sources were allocated to the Thames WRMP. Severn Trent Water tested multiple potential planning scenarios and demonstrated that the decision around STT components was not material to the short- to medium-term decisions recommended in its WRMP.

11.10 Since the 2019 WRMP, Severn Trent Water has continued to update its understanding of future supply and demand pressures and has aligned these with the wider WRW group of companies. These updated needs include:

- Revised population and housing growth projections to reflect the latest planning guidance;
- Adopting a 1 in 500-year drought resilience standard;
- Adopting a new, more ambitious environmental ambition;
- Updating its assessment of possible climate change impacts, utilising the latest UK Climate Projections 2018 datasets and methods.

11.11 In WRW's updated Resource Position Statement (February 2021), the latest assessment for the region is that even after the current AMP7 water resource improvements are accounted for, the region faces a supply deficit of at least 200Ml/d to 500Ml/d. Through the regional water resources planning reconciliation process, WRW will be working with the other regional planning groups to develop the evidence needed to demonstrate whether the STT provides better value to WRSE or to WRW.

United Utilities WRMP19

11.12 The United Utilities WRMP19 considered the 25-year planning horizon, was based on resilience to the most severe historical drought on record and had only a small deficit at the end of the period under the baseline scenario. This was addressed in the preferred plan with a range of leakage reduction and water efficiency options. Note that these options were also selected in response to Ofwat's challenge on leakage and water efficiency, and as such created a significant resultant surplus. The final plan was then tested using a wide range of stochastic hydrological data to demonstrate that it was robust to droughts with a severity of at least 1 in 200 years (the actual simulated level of resilience was much higher).

11.13 The WRMP19 explored the potential to export water from the region from Lake Vyrnwy to other water company regions. While water trading was not selected in other water companies' preferred plans during the 25-year planning horizon, the strategy to facilitate a potential future trade as an adaptive pathway was fully explored in the United Utilities WRMP19.

11.14 United Utilities is working with Thames Water and Severn Trent Water to further develop the STT scheme for it to be considered in the WRSE regional modelling.

Consistency between company plans and with regional plans

11.15 All three WRMP19 plans were consistent in their consideration of STT.

11.16 For WRMP24 this will again be the case. All parties are working collaboratively on further developing the STT scheme for input to WRSE modelling. WRSE modelling will consider how to address the regional deficit arising from resilience to the 1 in 500-year drought and increased environmental ambition. The modelling will determine if and when the STT scheme should be brought online and whether this should be in a phased manner. It is anticipated that the regional modelling will show that all strategic options are needed within the period to 2100. STT will likely be needed in the 2040s. We are committed to ensuring that our individual WRMP24 plans are consistent with the WRSE regional plan.

11.17 The planned consultation and liaison between WRSE and WRW will ensure the regional plans are also aligned.

11.18 The work undertaken for this Gate 1 submission demonstrates that the STT scheme is on track for construction to start during AMP8 with the earliest operation likely to be in 2034.

11.19 WRW are reviewing implications of planning for the 1 in 500-year drought event and are engaging with the EA on drought impacts on the west and the revised water stress assessment. This will be reported on at Gate 2.

12. Board statement and assurance

Assurance approach

12.1 The assurance framework used for this submission has been developed jointly by Thames Water, United Utilities and Severn Trent Water and, to ensure that we stayed aligned in our approach, the Assurance Leads for the three companies met on a weekly basis during the production and assurance of the WRSE and Gate 1 material.

12.2 The risk-based assurance approach is consistent with that documented in the individual companies' statements of reporting risks, strengths, and weaknesses[5][6][7] and final assurance plans for 2020-21 and is based on a shared understanding of the three lines of assurance model shown in Figure 12-1. It is also consistent with the assurance requirements laid out in Ofwat's Company Monitoring Framework[8].

[5] Thames Water: https://www.thameswater.co.uk/media-library/home/about-us/investors/our-results/current-reports/statement-of-reporting-risks-strengths-and-weaknesses.pdf
[6] Severn Trent: https://www.stwater.co.uk/content/dam/stw/regulatory-library/stw-risks-strengths-weaknesses-assurance-plan-20-21-final.pdf
[7] United Utilities: https://www.unitedutilities.com/globalassets/documents/pdf/consultation-on-risks-strengths-and-weaknesses-statement-and-draft-assurance-plan-2020-21.pdf/download
[8] 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/

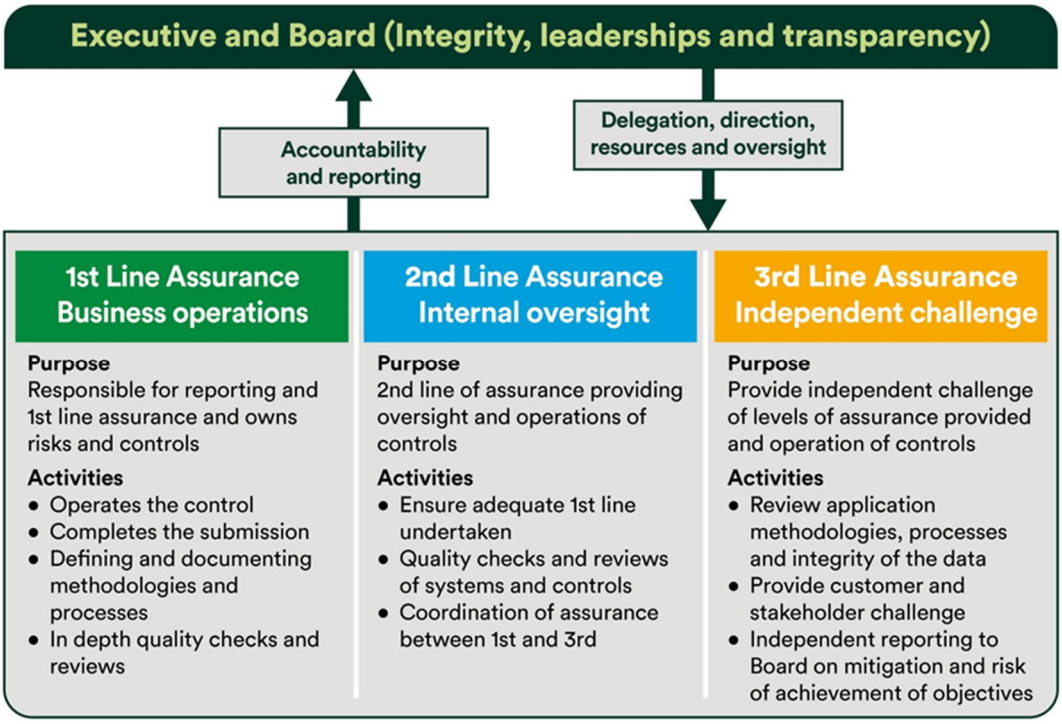

Figure 12-1: Risk assessment and assurance approach

12.3 This approach provides an effective programme of assurance. It 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 received three lines of assurance, while other areas, where the risk is lower, were targeted with first and second line assurance only.

12.4 Our approach was augmented by experience that the companies gained through the PR19 assurance process and the sharing of best practice (e.g. the use of an independent information declaration form developed by Thames Water, and the Severn Trent Water risk assessment framework which was used by the United Utilities assurance team who led the risk assessment process).

Items to highlight and any points for future gates

12.5 External assurers were appointed and their key findings are provided below

12.6 The specific objectives of the third line assurance relating to the development of the STT concept design and decision-making have been to:

- confirm that the requirements set out in Ofwat's Final Determination and subsequent additional feedback from Ofwat have been met
- confirm that the companies comply with RAPID's reporting requirements and guidelines
- ensure that the companies' material assumptions and methodologies have been disclosed and explained
- be satisfied that the work that has been carried out is consistent with the stated methods, procedures, policies, and assumptions
- has been subject to sufficient processes and internal systems of control to ensure that the information on design, costs and benefits contained in this submission is reliable
- has been appropriately assured to give STT's stakeholders, including customers, trust, and confidence in the Gate 1 submission

12.7 Based upon their audits and review of the information provided, they concluded that the STT submission satisfies the Gate 1 criteria. It was accepted and understood that there is much still to do at Gate 2 and beyond. They noted that they received appropriate evidence to support our assertions and have noted that non-evidenced assertions and as yet unfilled gaps in evidence are presented as uncertainties to be resolved at Gate 2. Our documentation was consistent with national policy, guidance, and recognised methodologies and consistent with other relevant plans and solutions. The resolution of the identified uncertainties has been built into the plans for Gate 2 and beyond.

13. Solution or partner changes

Partner changes for Gate 2 delivery

13.1 We have worked effectively and collaboratively together to progress the scheme through Gate 1. There are no proposed changes to the STT scheme solution partner organisations, with United Utilities, Severn Trent Water and Thames Water all proposing to continue to work together to progress the scheme development through to Gate 2. There are no proposals for a solution substitution.

Partner changes for Gate 3 delivery

13.2 At Gate 3, the scheme, if selected, would begin delivery of planning consents and scheme procurement. This would include starting formal public consultations as part of the DCO process and investor market engagement as part of developing the DPC Strategic Outline Case.

13.3 At Gate 3, we believe the ultimate scheme 'promoter' (DCO applicant and DPC appointee) should be established to enable timely and appropriate management, direction, and governance decisions and to provide confidence in dealings with stakeholders, customers and potential investors.

13.4 For the appropriate partners to execute this phase, it is likely they would need to form new legal agreements between them under a joint venture agreement.

13.5 As part of the Gate 2 development, we will investigate the scheme promotion, procurement mechanisms and ultimate asset ownership and commercial operational model. In consultation with RAPID, we will review if it is appropriate, efficient and in the interests of both customers and companies for the three partner organisations to continue to jointly participate in the delivery of Gate 3 consenting and procurement activities, or alternatively whether a change in partners organisations would be recommended at Gate 3.

14. Efficient spend of gate allowance

Gate 1 allowance

14.1 The Final Determination allowance for the STT was £66.6m, split equally between United Utilities, Severn Trent Water and Thames Water, with a 10% allocation to Gate 1 equating to £6.66.m (£2.22m per water company).

14.2 We anticipate that our Gate 1 outturn will be £4.49m based on actual costs incurred to the end of March combined with forecast expenditure to the end of Gate 1, with 2017/18 price base factors applied. This provides an underspend of £2.17m (33%) which can be returned to customers.

14.3 The Gate 1 expenditure has been subject to both internal and external third-party assurance which has verified the efficient and relevant expenditure for Gate 1 activities.

14.4 A breakdown of our costs against individual activities is illustrated in Table 14-1.

14.5 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 evidenced with benchmarking and assurance.

14.6 The three partner companies are jointly responsible for the Gate 1 expenditure. At the end of each quarter, the costs incurred by each of the three companies were reviewed, challenged and reconciled to provide a record of what the expenditure had been undertaken. This validated the appropriateness of the spend and provided a running record of how monies would need to be allocated between the companies at the end of the Gate 1 activities.

Efficient spend

14.7 We believe our expenditure to Gate 1 has been efficient and is evidenced in this chapter.

14.8 Proposed packages of work have only been approved if they support delivery of the Gate 1 requirements outlined in the Final Determination. This includes activities to ensure timely delivery of Gate 2 such as seasonal environmental surveys and other specific activities critical to delivery at Gate 2. This has been evidenced through a mapping exercise of Final Determination requirements to project deliverables.

14.9 The STT is arguably the most complex SRO in RAPID's current portfolio and it involves three partner companies. We have worked hard to create effective lines of communication, governance and decision making. A lean, core programme team made up of representatives from the three companies, supported by a competitively procured, independent programme manager, has been established to effectively manage this process.

14.10 We have driven efficiencies by using a core programme team, supported by technical experts procured through the existing framework agreements across the three companies. These frameworks have been used to competitively tender over 80% of the procured technical work. By tendering this work, we have benchmarked these costs against the market, delivered packages of work at or below budget estimates and have ensured value for money for our customers. The procurement process has maximised cost savings for specific technical disciplines and has avoided duplication of activities and/or resources across the three companies.

14.11 We have delivered economies of scale by partnering with other organisations to procure packages of work with common scope and objectives. Examples of this include procurement of planning guidance in partnership with the United Utilities Sources SRO, Vyrnwy Aqueduct SRO, Severn Trent Sources SRO, and Minworth Effluent Reuse SRO; fisheries surveys and water quality sampling with four other Thames Water SROs (SESRO, reuse, and Southern Water and Affinity Water Transfers); and partnering with regional WRSE and WRW customer preference surveys. Where work has been undertaken in partnership, costs have been distributed equitably between the partners involved.

14.12 We have also actively engaged with the ACWG to partially fund consistency projects (e.g. cost consistency, environmental assessment, bulk supply agreement review).

14.13 We estimate that the approaches described above have delivered overall savings of between 10-15% of the overall spend.

14.14 Expenditure is only for relevant work in AMP7 and to STT. There is no carryover of AMP6 spend. There is no expenditure claimed against 'business as usual' company WRMP or other non-STT related activities.

14.15 As an SRO, we have reviewed existing data sources and undertaken gap analysis to ensure we have not duplicated existing research. We have employed programme management and governance oversight to ensure that scoping, procurement, and delivery of the services for STT are managed efficiently.

14.16 We have continuously monitored budgets and reported on a monthly basis to ensure costs are in line with forecasts, and any negative variances have been rectified by delivery of recovery plans.

Forecast spend to Gate 2

14.17 We have developed a Gate 2 budget by engaging with workstream leads and external stakeholders including the EA National Appraisal Unit, Natural England, and the Drinking Water Inspectorate. We have referenced the Gate 2 requirements published in the Final Determination, and mapped activities and deliverables to achieve those outcomes. A detailed programme for Gate 2 can be viewed in Chapter 15.

14.18 The Final Determination allowance for Gate 2 is £9.99m, based on a 15% allocation of the £66.6m total. Our forecast out-turn estimate for Gate 2 is £7.5m. If we deliver this forecast spend, we will outperform our Gate 2 allowance by 25%, enabling £2.49m to be returned to customers.

14.19 It should be noted that this is a forecast and is based upon a number of assumptions, dependencies, and risks (as referenced in Chapter 9).

Assurance of Gate 1 expenditure

14.20 We can confirm that our Gate 1 expenditure activities and approach have been assured by our independent third line assurer.

Table 14-1: Breakdown of costs against activities undertaken to Gate 1.

STT Workstream Categories (Totals)	Proportion of spend (%)	Value of spend (£,000s)	Description
Tripartite Company Activity	**10%**	**£431**	UU, STW and TW STT partner company activities including: day-to-day liaison, reviews decision making and oversight; Programme and Steering boards; managing in-company assurance, reporting and governance; ACWG, RCG, RAPID 'task and finish' and cross-SRO interfaces and support.
Programme Management & Delivery	**9%**	**£400**	Independent senior programme manager, plus commercial, scheduling and PM workstream support. Note, the programme manager was appointed in January 2020 but costs have only been included from the start of AMP7 in April 2020.
Engineering Lead & Technical Assessments	**15%**	**£683**	
• Technical lead and Interconnector design development	9%	£427	STT engineering lead, water resources appraisal and WRSE regional submission, costings, system operation, system pre-optimisation, source alternatives review, system model scoping, Interconnector Deerhurst to Culham and Cotswold Canals Options design review and Gate 1 design development. Includes commencement of STT System Water Resources Model development as agreed with RAPID.
• Vyrnwy Bypass and Shrewsbury	6%	£256	Vyrnwy Bypass and Shrewsbury options appraisal and design development and bypass costing
Environmental: - Environmental lead and appraisal	**11%**	**£510**	
•Environmental lead	2%	£109	STT Environmental lead with regulator and pan SRO technical engagement; Regional submissions, appendices, and report production.
• Environmental studies and assessment	9%	£401	River assessments of outfalls from Netheridge, Minworth and Vyrnwy Bypass; INNS; WQ assessments; review of river modelling requirements; initial environmental, social and economic valuations; SEA, HRA, WFD, NC, BNG assessments; assessing groupings and metrics for WRSE; inputs to engineering scheme design development and mitigations for Vyrnwy bypass and Interconnector pipeline and canal options.
Environmental: Losses & unsupported flow	**14%**	**£642**	
• River Vyrnwy and Severn losses – field trials	10%	£405	Gauging station calibration, physical flow loss trials over Summer 2020 to quantify potential River Vyrnwy and Severn losses. Included ground water borehole arrays, spot gauging and data collection for releases of water from Lake Vyrnwy to simulate STT operation.
• River losses analysis	5%	£238	Planning, analysis and reporting of flow trails for River Vyrnwy and River Severn; analysis and reporting of River Avon estimated losses; River Avon and Severn catchment modelling (Kestrel) using WRSE 500yr stochastics to unsupported flow time series for WRSE DO calculations
Environmental: gap analysis and ecological monitoring	**13%**	**£583**	
• Gap analysis and modelling	2%	£95	APEM literature gap analysis for the Rivers Vyrnwy, Severn and Avon and commencement of river modelling. Note the principal study was commenced by the partners in AMP6. Expenditure in AMP6 is excluded.
• River Vyrnwy investigations	3%	£117	Various water quality monitoring, ecological and hydromorphological transects to inform both Summer 2020 trail releases and development of strategy for direct releases into the River Vyrnwy.
• Ecological monitoring	8%	£371	Invertebrate, fisheries, macrophyte, ecological and BNG/NCA walkover surveys and hydromorphological transects. Includes work agreed with both RAPID and EA/NRW for surveys required in Gate 1 that will be reported in Gate 2.
Environmental: - Water Quality testing and sampling	**14%**	**£634**	Water quality monthly water quality spot sampling (including Algae) and continuous (sonde) monitoring and suite of water quality analysis. Includes for PM, reporting and agreement of methodology and scope with DWI and EA. Extensive sampling and testing required at 16 sites between Lake Vyrnwy and Lechlade including Rivers Vyrnwy, Avon, Severn, and various potentially affected canals.
• River Vyrnwy, Severn, and Avon	9%	£396	Ten sampling points
• Cotswolds Canal Option	5%	£238	Six sampling points - Gloucester and Sharpness & Stroudwater canals and R.Thames at Lechlade
Planning & Consent	**1%**	**£59**	Development of initial Gate 1 planning consents strategy.
Stakeholder	**0%**	**£5**	Stakeholder engagement planning and activities. Customer preference survey of both potential recipient (WRSE) and donor (WRW) customers.
Procurement delivery strategy	**2%**	**£81**	Development of initial Gate 1 procurement strategy and appointment of advisor to commence critical activities required for Gate 2.
Assurance	**2%**	**£108**	Assurance activities including third line assurance.
Third party costs: EA / NE, regional WRMP, NRW	**8%**	**£356**	Various third-party charges to support the STT SRO activities
Total	**100%**	**£4,494**	
Note: (i) All figures have been rounded and deflated to 17/18 cost base. (ii) Company capital overheads have been calculated in accordance with company specific rules with overhead costs allocated to each activity in proportion to the value of spend. (iii) All percentages are rounded to the nearest 1%			

15. Proposed Gate 2 activities and outcomes

Penalty assessment criteria, incentives, and consideration of solution delay impact

15.1 The STT scheme is on course to deliver the RAPID and regional outputs to the required quality and timescales.

15.2 Chapters 3 and 9 set out the key dependencies, assumptions, and risks. While there are a number of key technical and commercial aspects to be addressed as the scheme development proceeds, we do not currently anticipate any solution delay impacts for the delivery of Gate 2. For Gate 2, we do not propose any changes to the outcomes, penalty assessment criteria and incentives proposed by RAPID and as set out in the Final Determination.

Proposed Gate 2 activities

15.3 The key objectives for Gate 2 are to efficiently deliver the following:

- Confirm the scheme feasibility including data collection, assessment and endorsement from key regulatory stakeholders.
- Undertake further options appraisal of the Interconnector to define a preferred solution, review overall route options, investigate solution enhancements, mitigations, and opportunities.
- Refine and update data for the regional modelling of the STT system with updated prices from source SROs, costs, metrics and benefits for the WRSE January 2022 update.
- Undertake key activities to mitigate risks, maintain or improve programme and to be ready for Gate 3 if the scheme is selected to proceed.

15.4 The principal workstreams which form the work breakdown structure for Gate 2 and will enable the key objectives to be achieved are summarised in Table 15-1.

Table 15-1: Gate 2 Work Breakdown Structure

ID	Key activities and desired outcome
1	**Workstream – Environmental lead and assessments**
1.1 1.2 1.3 1.4 1.5	Undertake benefits assessment and other targeted studies Review and update Biodiversity Net Gain, natural capital HRA, WFD, SEA and Drinking Water Safety Plan assessments Environmental coordination and stakeholder engagement Undertake water quality, hydromorphology and hydrology modelling Permitting requirements and strategy **Outcome:** A defined list which has been agreed with key stakeholders (EA/NRW/Natural England/ Drinking Water Inspectorate) detailing the required assessments and metrics for regional plans and Gate 2 and identify risks/opportunities.
2	**Workstream – Environmental monitoring**
2.1	Data collection including ecological, physical and water quality monitoring **Outcome:** Robust evidence base, supported by stakeholders, for assessment and scheme development.
3	**Engineering lead, studies and surveys**
3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8	Engineering coordination and optioneering of Interconnector options Interconnector design development, route alignment review and identify preferred solution Develop River Vyrnwy Mitigations design Review and update costings based on increased certainty Develop operational and control philosophy Update and refine design and construction programme with Early Contractor Involvement/constructability advice Develop a common data environment and project-specific GIS platform River Severn Regulation – liaise with EA and NRW to develop 'heads of terms' for regulation changes and the process to implement the 'put and take' arrangement. **Outcome:** Robust detailed feasibility design to support regional data updates and Gate 2
4	**Water resource analysis**
4.1 4.2	Develop STT system model Develop deployable output and utilisation assessment

ID	Key activities and desired outcome
4.3 4.4 4.5	Continuation of work completed during Gate 1 to define River Severn losses Rerun pre-optimization modelling and update data and metrics for regional plan. Work with source SRO's and others to explore utilisation opportunities **Outcome:** Timely update of STT system data for regional plans; optimisation of STT water resource benefit aligned with regional plans for Gate 2.
5	**Commercial delivery advice**
5.1 5.2	Develop scheme commercial and procurement strategy including DPC Create promoter organisation ahead of Gate 3 **Outcome:** Commercial funding, trading, ownership and procurement models developed, agreed with RAPID; preferred Gate 2 procurement strategy; promoter legal entity ready for Gate 3 delivery if required.
6	**Legal support**
6.1	Legal advice and review as required to support delivery **Outcome:** Improved quality and risk management including ensuring legal compliance.
7	**Planning**
7.1	Develop planning consents strategy **Outcome:** Preferred planning route established for Gate 2.
8	**Land**
8.1	Land lead and land assessment including land referencing **Outcome:** land considerations are fed into scheme development, costings and risk mitigation.
9	**Stakeholder engagement**
9.1	Stakeholder engagement, customer preference surveys and analysis **Outcome:** Appropriate level of stakeholder and customer preference engagement to both inform scheme development and promote stakeholder understanding and support.
10	**Programme management and delivery**
10.1	Programme management and support activities **Outcome:** Effective programme management to ensure the efficient delivery of regional and RAPID deliverables to time, cost and quality, and stakeholder satisfaction.
11	**Tri-partite company direction**
11.1	Programme direction and governance including support to STT through extra-programme activities such as ACWG, Regional Coordination Group, RAPID and stakeholder engagement **Outcome:** Collaboration between partners; buy-in from company boards.
12	**Gate 2 report production and assurance**
12.1	Report production and assurance **Outcome:** Gate 2 report meets the required quality with evidence.

16. Conclusions and recommendations

Conclusions

16.1 The solution offered is robust, flexible, adaptable and resilient as a result of its diverse sources, the potential for phasing of the development of those sources and the agreement in principle for a 'put and take' arrangement with the EA and NRW.

16.2 This is an ambitious, strategic project to provide additional capacity of 300 to 500Ml/d of raw water to the South East of England during drought events. At the project's heart is the Interconnector which enables the transfer of raw water from the River Severn to the River Thames.

16.3 The scheme capacity of 300 to 500Ml/d equates to a Dry Year Annual Average Deployable Output benefit of 250 to 400Ml/d to the South East. The regional planning process will determine the volume, timing, and utilisation of water to be transferred. The diversity of sources means they can be developed in a phased manner to meet the ultimate demand profile as determined by the regional planning.

16.4 These additional sources of water are being provided by United Utilities and Severn Trent Water who are working in collaboration with Thames Water to develop this solution. The additional four sources are:

- **Lake Vyrnwy**: Utilisation of up to 180Ml/d of water licensed to United Utilities from Lake Vyrnwy by three separate means
  - A direct release of 75Ml/d of water into the head of the River Vyrnwy.
  - A release of 80Ml/d of water into the existing Vyrnwy Aqueduct with a new bypass pipeline that connects it to the lower River Vyrnwy, thus mitigating any environmental impacts upstream.
  - The provision of 25Ml/d of treated water supply to Shrewsbury from the Vyrnwy Aqueduct via Oswestry WTW. This will release flows into the River Severn that were previously abstracted to supply Shrewsbury.
- **Mythe**: Temporary transfer of 15Ml/d of Severn Trent Water licensed abstraction at Mythe, thus releasing flows to the River Severn;
- **Minworth**: The transfer of 115Ml/d of a treated wastewater discharge from Severn Trent Water's Minworth Wastewater Treatment Works (WwTW) to the River Severn via the River Avon; and
- **Netheridge**: The transfer of 35Ml/d of a treated wastewater discharge at Severn Trent Water's Netheridge WwTW to a new location upstream of the current discharge to the River Severn

16.5 While the final volume of permitted release from Lake Vyrnwy is yet to be established, our initial consultation has concluded that a minimum release of 75Ml/d can be utilised.

16.6 The Interconnector has the longest lead time of all of the elements of this SRO and can be constructed and commissioned by 2033.

16.7 We have worked collaboratively to develop procurement guidelines and a project delivery structure to enable effective communication, governance & decision making across three companies for this proposal. For the post Gate 2 planning and procurement delivery we will need to establish the scheme promoters and adopt more formal positions and relationships for the implementation of this solution.

16.8 All capital costs have been benchmarked and care has been taken to ensure efficient spend on agreed, appropriate activities to progress STT's development through Gate 1. The efficient spend is evidenced by the 33% saving in the budget allowance.

16.9 This is a complex solution requiring the coordination and management of multiple elements with the added challenges and complexity of being developed across three companies. We have worked efficiently and collaboratively to create effective lines of communication, governance and decision making. The Gate 1 spend has been efficient as evidenced by the lean core programme team, competitive procurement of technical work and partnering work packages with others who had common scopes and objectives.

16.10 Tier 1 customer and stakeholder engagement has concluded that there is support in principle for the scheme. Continued engagement is important as it will help to shape and challenge each stage of the scheme development.

16.11 No material issues have been identified during the Gate 1 process.

Recommendation

16.12 This proposal and its options (pipeline and canal) should advance to Gate 2 where the activities identified in this report and work on regional planning will provide greater definition to the scheme proposal.