# ANNEX B1

## Environmental Regulatory Assessments (IEA) Overarching Report

This document has been written in line with the requirements of the RAPID gate two guidance and to comply with the regulatory process pursuant to Severn Trent Water's statutory duties. The information presented relates to material or data which is still in the course of completion. Should the solution presented in this document be taken forward, Severn Trent Water will be subject to the statutory duties pursuant to the necessary consenting process, including environmental assessment and consultation as required. This document should be read with those duties in mind.

STSources SRO
Severn Trent Water

# SEVERN TRENT SOURCES

## Initial Environmental Appraisal Report

Report for: Severn Trent Water Limited

Atkins ref. 5213609 Issue: 003 09/09/2022

Contains *sensitive* information

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This document has 68 pages including the cover.

## Document history

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| 1.0 | Draft for Client Review | SB | EdV | MF | PMU | 08/07/2022 |
| 2.0 | Revision for Client Review | SB | MF | PMU | PMU | 29/07/2022 |
| 3.0 | Update following STWL 2nd line comments and NAU comments | SB | MF | PMU | PMU | 09/09/2022 |
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# 1. INTRODUCTION

## 1.1 BACKGROUND

The Severn Trent Sources (STS) scheme has been identified as an SRO in the PR19 Final Determination, with funding provided to Severn Trent Water (STW) as an individual company. The STS SRO is considered integral to the Severn Thames Transfer (STT) SRO.

The aim of the STT is to provide additional capacity of 300 to 500 Ml/d of raw water to the South East of England to provide additional water resources in the River Thames catchment. At the project's heart is the Interconnector which enables the transfer of raw water from the River Severn (near Deerhurst) to the River Thames (near Culham). Abstraction of raw water from the lower River Severn is limited by various Hands of Flows (HoFs) targets. As such, additional sources of water, apart from those naturally occurring in the River Severn, have been identified to augment the baseline flows when the River Severn is at the HoFs.

These multiple diverse sources of additional water provide resilience in the provision of raw water flows to the River Thames. The STT scheme capacity of 300 to 500 Ml/d equates to a Dry Year Annual Average Deployable Output benefit of 250 to 400 Ml/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. Each of these additional sources of water are subject to their own SRO assessment and include:

- Lake Vyrnwy: Utilisation of water licensed to United Utilities from Lake Vyrnwy;
- Minworth: The transfer of a volume of treated wastewater discharge from Severn Trent Water's Minworth Wastewater Treatment Works (WwTW) to the River Severn via the River Avon; and
- The STS SRO which consists of two elements:
    - Mythe Water Treatment Works (WTW): transfer of a portion of the Severn Trent Water (STW) licensed abstraction at Mythe WTW, thus releasing flows to the River Severn; and
    - Netheridge WwTW: The transfer of a volume of treated wastewater effluent at STW Netheridge WwTW to a new location upstream of the current discharge to the River Severn.

This Initial Environmental Appraisal (IEA) considers the STS element of the STT which include the Mythe WTW abstraction licence transfer and the Netheridge WwTW effluent transfer. The provision of the additional water is covered under the United Utilities Sources and Minworth WwTW SROs. Additionally, the STT SRO also considers the cumulative impacts associated with the United Utilities Sources and Minworth WwTW and STS SROs. Further background information on the wider schemes can be found in the STW Gate 1 submissions[1].

## 1.2 STUDY AREA

A schematic of the STS SRO Scheme is presented in Figure 1-1 and Figure 1-2 (which details the pipeline route). The two combined schemes will provide up to 50 Ml/d and comprises of two principal aspects:

- A 15 Ml/d licence transfer from Mythe WTW abstraction to the STT pipeline abstraction location at Deerhurst. Named 'Mythe abstraction reduction' on Figure 1-1.
- A transfer of up to 35 Ml/d of final effluent from Netheridge WwTW to the River Severn at Haw Bridge. Named 'Netheridge STW effluent diversion' on Figure 1-1.

The following sections provide a detailed overview of the STS SRO.

[1] RAPID - Gate 1 Submission Sources v7.docx (severntrent.com)

Figure 1-1: Schematic of the STT and the supporting SRO's, including the location for Mythe WTW and Netheridge WwTW (from Gate 1 submission)

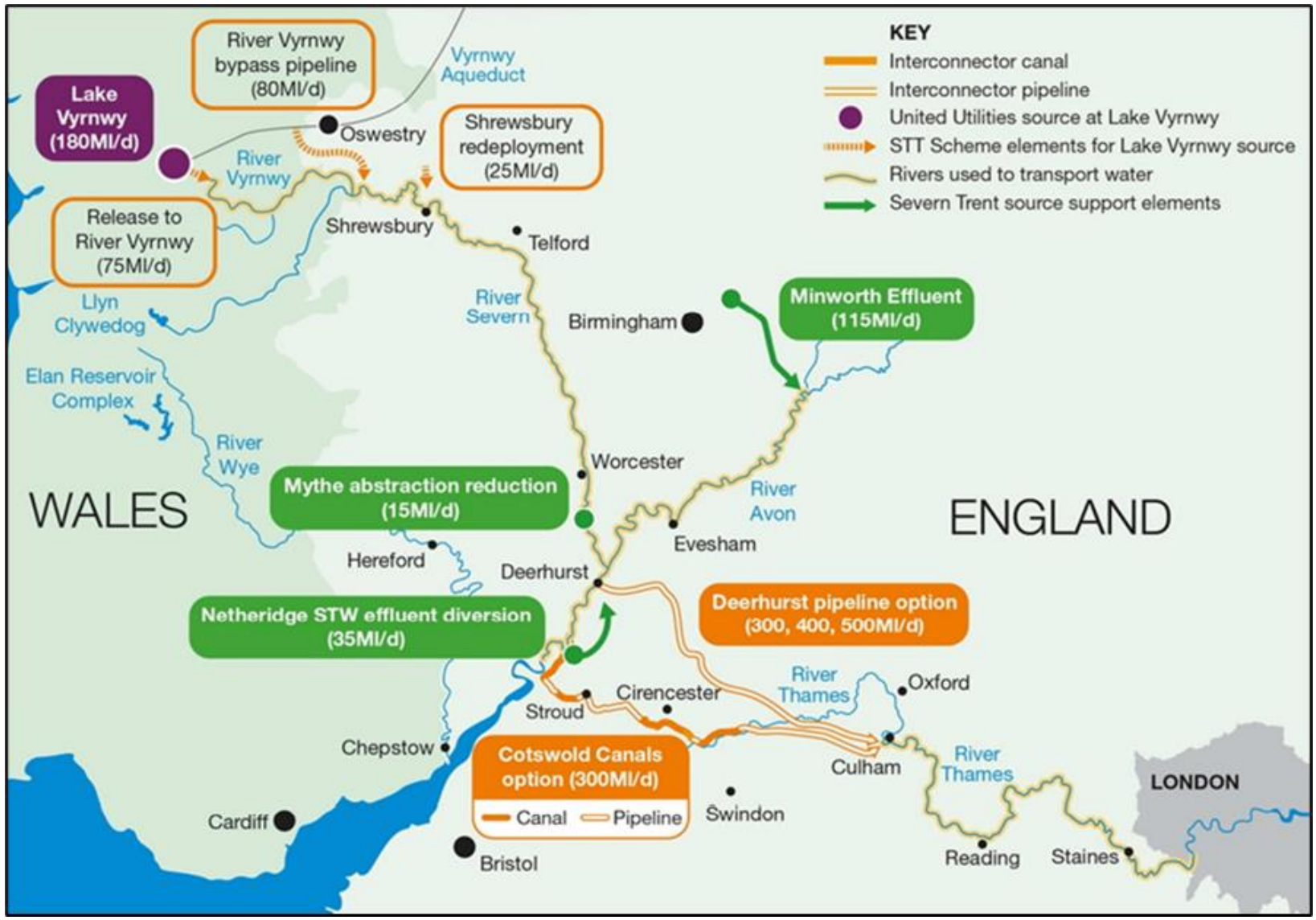
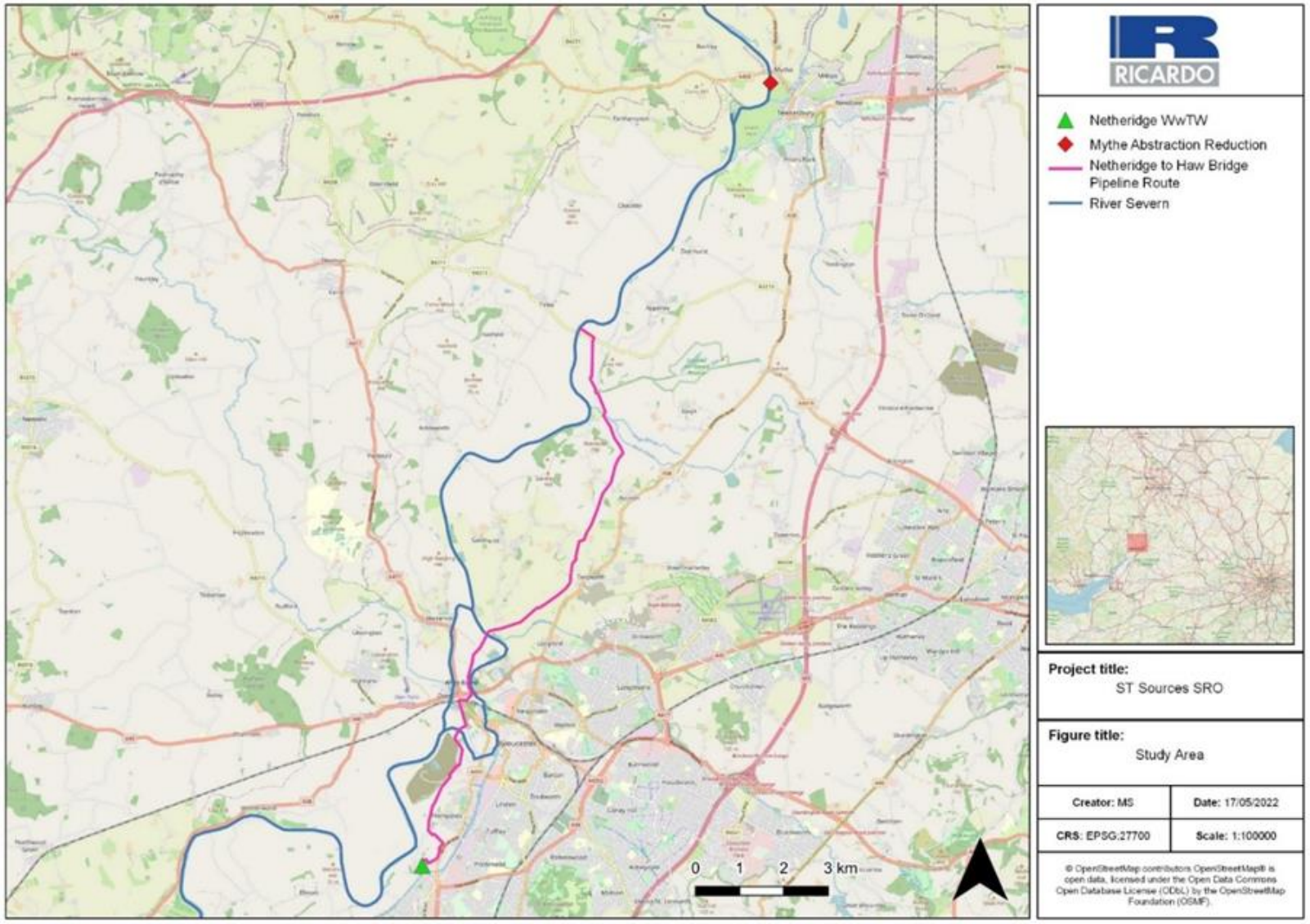


Figure 1-2: Map showing the study area and indicative pipeline route



### 1.2.1 Mythe WTW abstraction licence transfer (15 Ml/d)

This part of the Scheme provides support to the STT from the Severn catchment by redeploying 15 Ml/d of the existing STW abstraction licence at its Mythe WTW intake in the lower River Severn. This infrequently used licensed volume from Mythe would now remain in the River Severn for abstraction downstream at Deerhurst. STW has advised that no construction works would be required to redeploy the spare licence volume for abstraction. It is understood from STW that no specific additional resource to replace this current abstraction licence volume has been determined to date. The Mythe WTW abstraction licence Scheme will not operate alone and will operate in-combination with the Netheridge WwTW discharge diversion to Haw Bridge.

### 1.2.2 Netheridge WwTW discharge diversion, Haw Bridge Pipeline (35 Ml/d)

Currently treated effluent from the Netheridge WwTW is discharged into the upper Severn Estuary. STS SRO proposes to divert a 35 Ml/d portion of this treated discharge from Netheridge WwTW (approx. grid reference: SO 80891 15805) to a new outfall at Haw Bridge (just downstream from Deerhurst - approx. grid reference: SO 84595 27955), on the freshwater River Severn to support STT abstraction at Deerhurst.

The pipeline discharge to Haw Bridge will not be continuous. It will range from zero (when flows are high enough in the River Severn to support the STT transfer, there is no sweeting flow), up to 20 or 35 Ml/d when fully operational (during periods of lower flows in the River Severn). The pipeline will include nine drain-down points through which water in the pipeline will be discharged during maintenance activities (map provided in Technical Appendix B3.3). These drain-down points will be set back at least 10 m from water courses. The effluent will be subject to enhanced treatment prior to discharge.

The discharge diversion from Netheridge WwTW would be pumped by a new pumping station, located at the WwTW via a 700 mm diameter pipeline approximately 15.5 km long. Where possible tunnelling would be undertaken at named water courses, such as the River Severn, to minimise environmental impact. The outfall location to the River Severn will be located just upstream of the level gauge at Haw Bridge (3.9 km downstream of Deerhurst). The proposed outfall structures are submerged to reduce visual impact, riparian habitat loss and improved health and safety. The design will ensure compliance with the eel regulations[2].

The environmental assessments undertaken on the Netheridge WwTW scheme are based on the technical details provided in Technical Annex A1, the Gate 2 Concept Design Report**Error! Bookmark not defined.**. A summary of the key details is provided in the following subsections from the Technical Annex A1. Detailed information can be found in the Conceptual Design Report.

#### *1.2.2.1 Pipeline details*

It is assumed that the pipeline throughout its length will be constructed using open cut trenching techniques, except at specific strategic crossing points where trenchless tunnelling techniques will be employed. It is anticipated that the working area will comprise a 20 to 25 m working strip along the length of the proposed pipeline route. Topsoil will be removed for this working strip and carefully stockpiled for reinstatement. Pipe lengths will be strung out along the working area in advance of the excavation. The excavation would generally be offset to one side of the working strip allowing space for the temporary stock piling of excavated material, as well as the establishment of a haul road for plant and materials and a safe pedestrian access route in the vicinity of the working zone. Typically, the working strip would be fenced with post and wire fencing and the topsoil stripped and stockpiled for the duration of the works within that section. It is assumed that the pipeline installation will be completed in vertically sided (supported with trench boxes or drag boxes) or battered excavations depending on depth, ground and groundwater conditions.

#### *1.2.2.2 Pipeline route*

The pipeline would travel from Netheridge WwTW to Haw Bridge. The pipeline route was selected based on the following principles:

- Achieve the shortest and most direct viable route between the Netheridge WwTW and the proposed discharge point;
- Minimise construction within the existing road networks to minimise disruption to the local area, maximise construction productivity and reduce construction financial and carbon costs;

[2] The Eels (England and Wales) Regulations 2009

- Avoid areas of population (towns and villages, farms and private gardens), where possible;
- Avoid areas of woodland, ponds and other environmentally sensitive areas where possible;
- Minimise the maximum elevation of the pipeline to reduce static pumping head requirements;
- Minimise the total amount of rise and fall on the pipeline, and;
- Consider the crossing points for major infrastructure and ensure that there is sufficient space available for the construction of the crossing

A map of the various pipeline routes considered is presented in Figure 1-3. The Gate 2 assessments are based on the Option 2 route (as shown on Figure 1-3) to Haw Bridge. The Gate 1 assessments were based on Option 1 which was a pipeline to Deerhurst. Following Gate 1 this option was discounted following discussions with the Environment Agency (EA) and further assessments are being undertaken to provide additional evidence regarding the environmental impacts associated with Option 1 and other alternative routes. Option 3 and 4 (into Gloucester & Sharpness Canal) have been discounted at this stage and have not been assessed in this IEA. Further information on the scheme evolution can be found in Section 4.

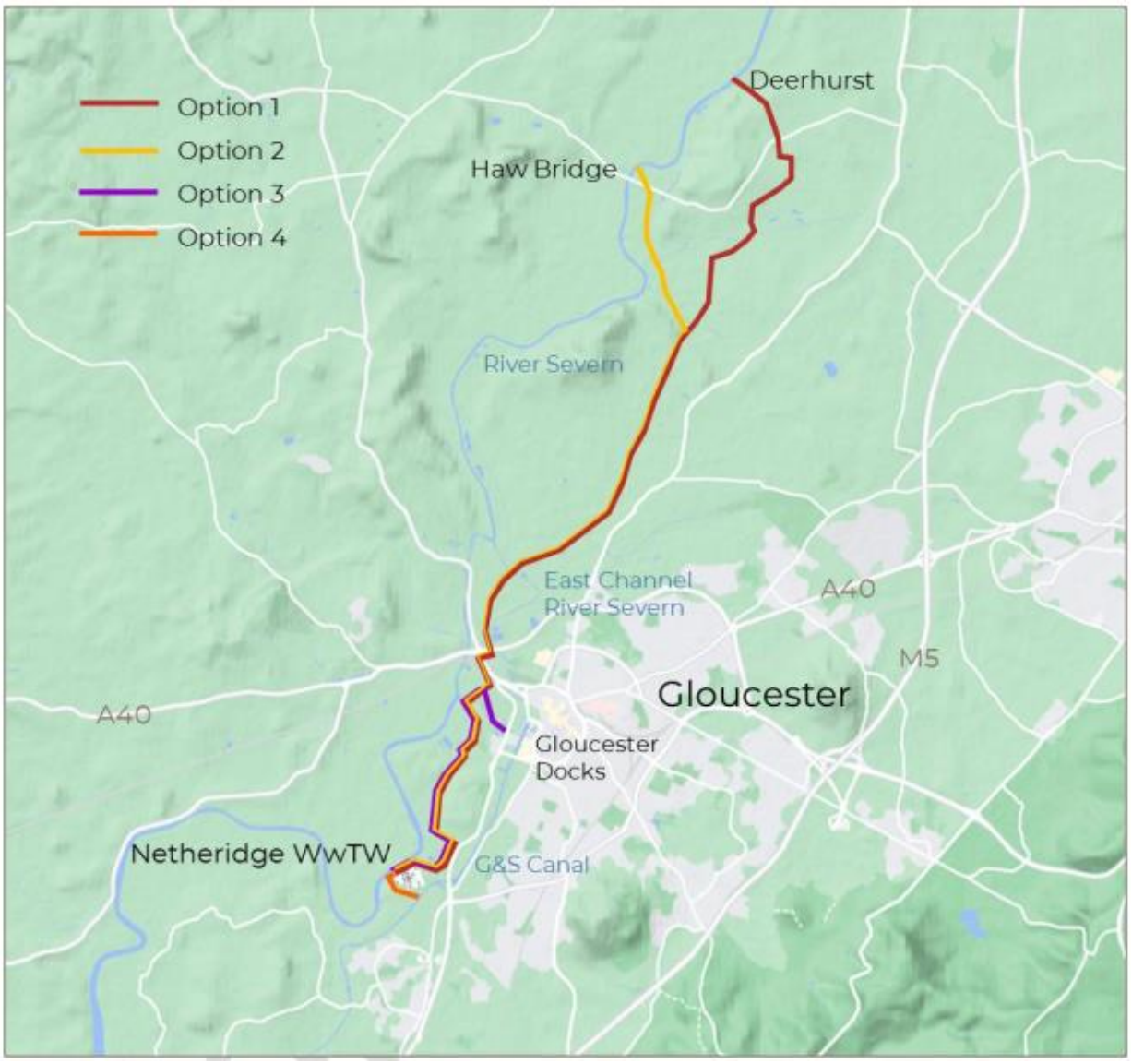



Figure 1-3: Netheridge WwTW to Haw Bridge pipeline route (Gate 2 route) from Technical Annex A1.

### *1.2.2.3 Netheridge WwTW treatment upgrade*

The portion of the treated effluent from the Netheridge WwTW that will be diverted to the River Severn at Haw Bridge will be subject to extensive tertiary treatment (Figure 1-4), comprising of:

- Moving Bed Biofilm Reactor (MBBR) for the further removal of ammonia;
- Magnatite clarification for the further removal of phosphorus;
- Ozonation for the removal of trace organics;
- Biological Aerated Flooded Filter (BAFF) technology for the further treatment suspended solids, and;
- Granular Activated Carbon (GAC) technology for the removal of trace organics

Further information of the treatment upgrades is provided in Technical Annex A1. As a result, the quality of the effluent that will be discharged at Haw Bridge during operation of the STS SRO will be significantly better than the effluent currently being discharged into the River Severn near Gloucester. In addition, STW have committed to further treatment should there be a WFD compliance risk for other determinants in the future.

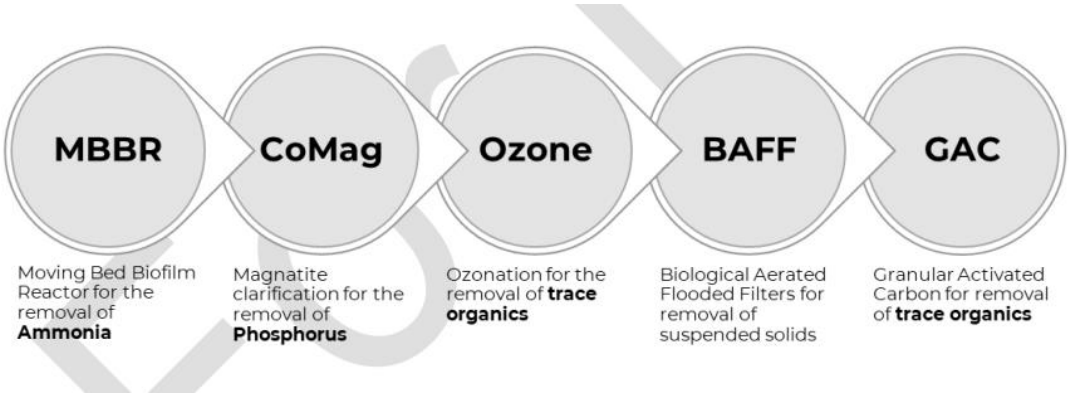



Figure 1-4: Tertiary treatment plan for Netheridge WwTW proposed for the scheme (from Technical Annex A1)

### *1.2.2.4 River Severn outfall structure*

Between Gate 1 and Gate 2 the proposed outfall structure changed from Deerhurst to Haw Bridge which is around 3.9 km downstream. A new outfall structure will be required. It is proposed that the outfall structure shall be a submerged outfall as opposed to a bank side outfall. It is preferable and considered good practice to use submerged outfall structures where high volume and or high velocity discharges such as WwTW, industrial or hydroelectric waters are to be discharged to the natural environment. A submerged type outfall has a number of advantages over a bank side outfall including.

- Reduced visual impact on the riverbank, a bank side outfall for a 700 mm pipeline discharging flows in excess of 500 l/s will be substantial. In comparison a submerged outfall would be relatively concealed from public view.
- Reduced bank side or riparian habitat lost, either through the direct removal of vegetation by the construction, or indirectly by exacerbating bank side erosion and bank collapse.
- Improved health and safety, for example risk of sudden water discharge following pump switch on, leading to a risk of persons, animal or objects being swept away, injured or killed. This risk is significantly reduced with a submerged outfall. However, strong underwater currents can be generated and appropriate warmings will be required.

#### *1.2.2.5 River and other major water course crossings*

Major infrastructure crossings below a main river are exempt from the requirements of a Flood Risk Activities permit (FRAP) providing that they constructed at depth greater than 1.5 m below the riverbed along its whole length. The 700 mm pipeline proposed is too large to be installed using directional drill. It is therefore proposed that an oversized (1000-1200 mm) tunnel steel or concrete sleeve is needed for any underground crossings, which will need to be installed using micro-tunnelling. As such the depth of the tunnel below the riverbed will be significantly greater than the minimum required 1.5 m.

#### *1.2.2.6 Small Water Course Crossing*

It is assumed that for small water courses it will be possible for the pipeline to cross using open cut trenching techniques. It is assumed that these crossings will be in accordance with STW design standard with the crown of the pipeline a minimum 1 m below the bed of the water course. It is also assumed in constructing these crossings it will be possible to cut off flows temporarily using a pair of overdriven interlocking sheet pile walls. If flow conditions require over pumping will be used to locally transfer water while the crossing is being constructed.

WSP recommend that further assessment in conjunction with the EA or local council drainage board should be undertaken at Gate 3 to determine the water course classification of any of these small water courses. The water course classification and hence regulatory body will likely have an impact on the nature of crossing design that is permissible at each location.

#### *1.2.2.7 Groundwater control*

It is assumed that for the majority of excavations that groundwater ingress into excavations will be readily controlled using traditional sump pumping techniques. However, it is noted that a high groundwater table has been observed in the vicinity of Alney Island and more advanced groundwater control maybe required in this area. Ground investigation comprising mechanically excavated trial pits should be completed in this area during the next phases to determine the ground and groundwater conditions on the proposed route to further inform the pipeline permanent and temporary works designs and allow cost estimates to be updated accordingly.

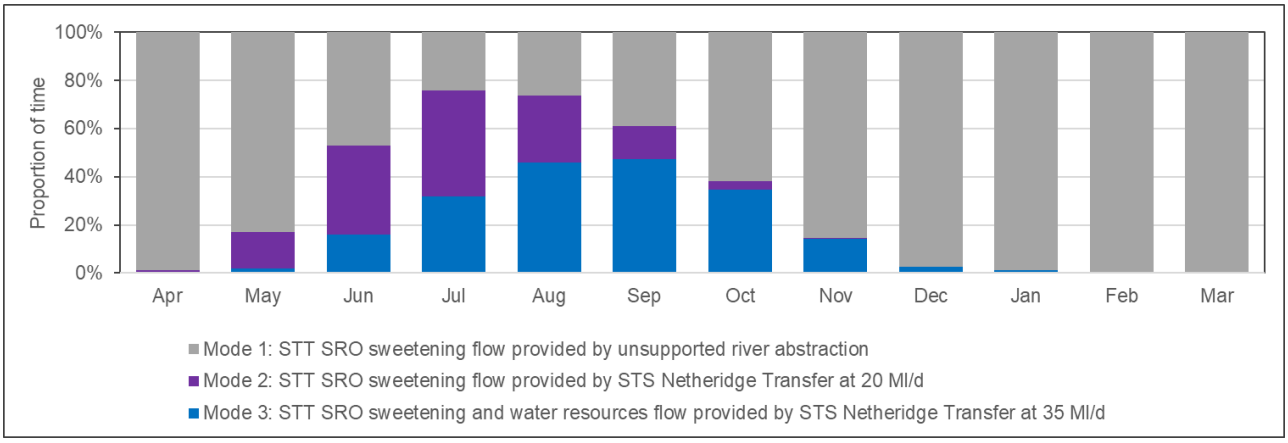
### 1.2.3 Indicative operation of the scheme

There are the following modes of operation (Figure 1-5). Please note the duration of the Scheme's operation is indicative at this stage and could be refined based on further modelling or changes to river flow triggers.

- **Mode 1- STT SRO sweetening flow provided by unsupported river abstraction:** STS SRO is not in operation and STT is also off. There is enough water in the River Severn at Deerhurst to provide the 20 Ml/d STT sweetening flow between the River Severn to the Thames, with no undesirable effects on the River Severn.
- **Mode 2- STT SRO sweetening flow provided by STS Netheridge WwTW effluent transfer at 20 Ml/d:** STS is 'on' but STT off. This means 20 Ml/d is piped from Netheridge WwTW to Haw Bridge because STT is not operational and thus only requires the sweetening flow, which the river can't provide. This mode of operation would be expected to occur 12 % of the time (modelled over a 47-year period).
- **Mode 3- STT SRO water resources provided by the STS Netheridge WwTW effluent transfer at 35 Ml/d:** STS is 'on' and STT is 'on'. This means 35 Ml/d is piped from Netheridge to Haw Bridge to allow a 35 Ml/d STT abstraction. STT takes the additional 15 Ml/day from Mythe WTW abstraction licence transfer, so STT takes a 50 Ml/d contribution from STS overall. This mode of operation would be expected to occur 16 % of the time (modelled over a 47-year period).

Mode 2 and 3 would be operable primarily in the summer months, peaking in July and August.

Figure 1-5: Proportion of the time the STT and STS would be operational based on model outputs




## 1.3 RAPID GATED PROCESS

### 1.3.1 Gate 1

The STS SRO was subject to a detailed assessment in Gate 1 with the objective of delivering regulatory assessments of potential environmental effects of the SRO in the context of the All Company Working Group (ACWG) guidance. 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. At Gate 1, using the information available, the environmental appraisals identified the key environmental consideration to be the proposed Netheridge WwTW discharge location. These conclusions were reached in the context of identified gaps in understanding, and the stated need for further data and evidence collection and discharge locations to support the Gate 2 investigations. The key change between Gate 1 and Gate 2 is the Netheridge WwTW discharge location which has changed to from Deerhurst to Haw Bridge (around 3.9 km downstream). Further information on the design evolution of the scheme can be found in Section 4.

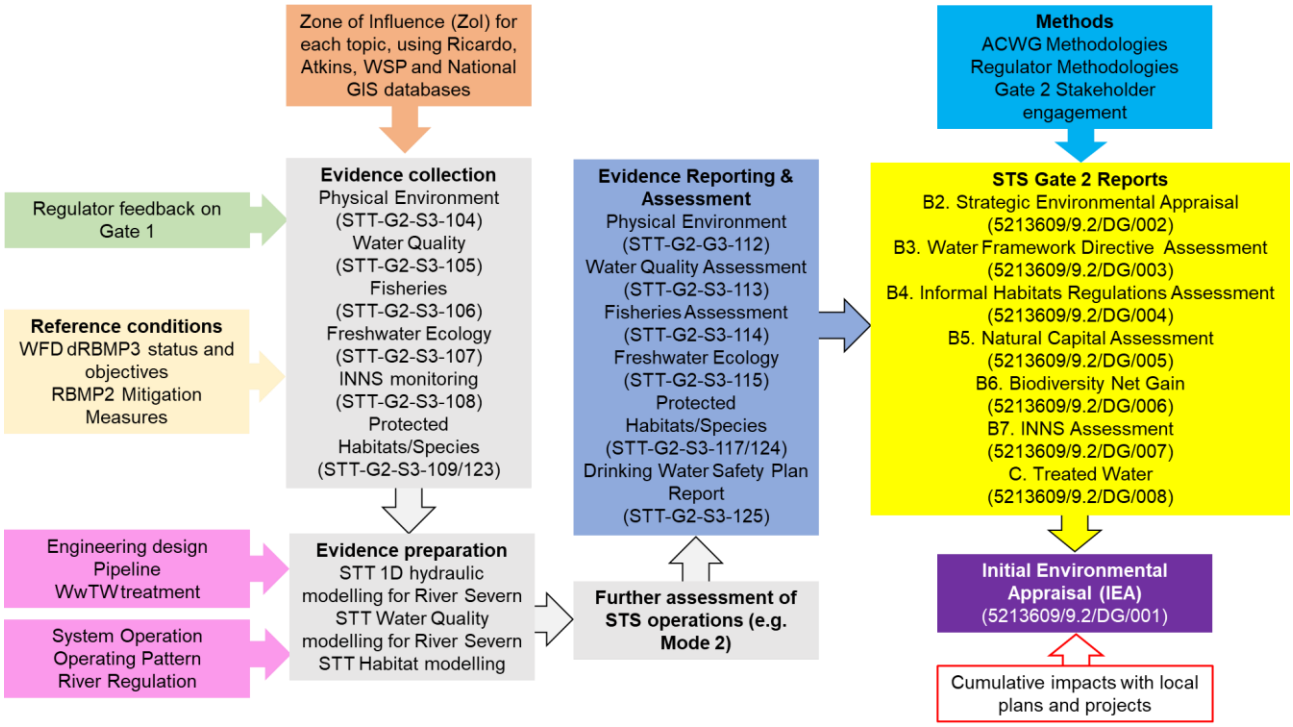
### 1.3.2 Gate 2

The ACWG guidelines set out that Gate 2 builds on Gate 1 activities to improve the detail and breadth of studies for a key decision point for strategic solutions. This will include concept solution designs, with reduced uncertainty in costs and benefits and re-testing in revised regional and company models (to support updated decision making and filtering on outputs including those that are mutually exclusive). At the end of Gate 2, the solution should be developed to a standard suitable for submitting into final regional plans and/or final WRMPs. In this context, this stage (Gate 2) of the programme aims to further enhance the funding portfolio, based on refined and consistent costs and benefits, with suboptimal solutions eliminated and viable solutions carried forward to the pre-planning stage.

To support the programme, the potential environmental effects associated with the STS SRO identified in Gate 1 will be considered in view of updated scheme design, changes in potential operational patterns, feedback on Gate 1 assessments from various regulators and stakeholders and further data gathering, modelling and assessment work completed since the publication of the Gate 1 assessment report[1].

In order to engage with regulators over the approach, evidence collection, monitoring programmes, and data analysis for Gate 2, targeted meetings have been held with the EA and Natural England (NE). As part of these, the regulators are asked to provide insights and inputs on specific aspects where needed in order to ensure the work undertaken is as robust as possible. Feedback on the Gate 1 work has been used to finalise the approach and inform the wider environmental assessment for Gate 2.

Figure 1-6 shows the investigations being undertaken for Gate 2 and their interactions, in order to show the full scope of work across both environmental engineering disciplines.




## 1.4 SCOPE OF THIS REPORT

The IEA (this report) is an overarching document, collating various workstreams and providing an overview of key results and findings. The IEA draws upon the separate regulatory reports being produced (WFD assessment, HRA, Invasive Non-Native Species (INNS) assessment, Biodiversity Net Gain (BNG), and Natural Capital assessments as presented in Section 2. As per Figure 1-6, these regulatory reports have been informed by separate evidence reports and assessments. The IEA also provides a summary of other relevant workstreams, signposting to where further information can be found if published at Gate 2 such that the report acts as a standalone document that can be read to understand the environmental risks and opportunities of the solution proposed at Gate 2.

As the Gate 2 submission does not form a statutory plan or project, there is no statutory SEA required to be undertaken for Gate 2; however, the Gate 2 guidance does state that "*some SROs may require an SEA, in particular where they are forming a plan or programme of works. Legal advice should be sought by the water company to determine the need for a statutory SEA*." This report is prepared on the basis that there is no requirement for a formal SEA for the STS SRO at Gate 2.

Having regard to the maturity of the design of the SRO, which is still at feasibility and concept design stage in Gate 2, the environment assessment undertaken in Gate 2 comprises an initial high-level appraisal, although this appraisal is cognisant of the likely EIA requirements at Gate 3.–Some aspects of the SEA and EIA are common to both requirements, including consideration of similar environmental topics as set out in Schedule 2 of the SEA Regulations[3] and Schedule 4 of the EIA Regulations[4]. The structure of the IEA report has regard to these common topic areas.

This IEA report has been authored by Atkins and Ricardo Energy & Environment and presents the findings from the range of assessments set out for Gate 2. The assessments undertaken are based on the baseline assessment (Section 5). The findings of the analysis are presented on a reach-by-reach basis, addressing

[3] Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment ("SEA Directive")

[4] Directive 97/11/EC amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment ("EIA Directive")

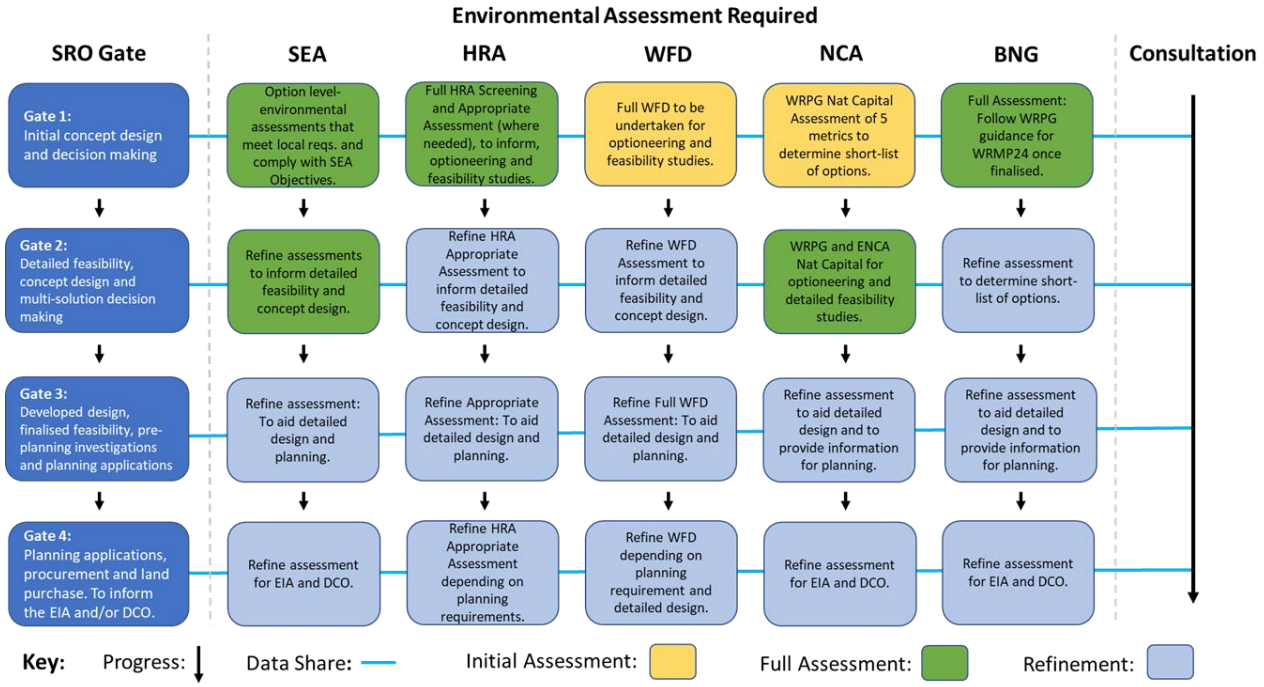
each metric of change. The information is presented in this way so there is clarity over where effects from the scheme are observed. Assessments have been updated from the Gate 1 assessments undertaken.

This report also identifies where more confidence could be placed in the results (i.e., where some uncertainty remains), through further evidence collection and analysis. Please note the Regulatory Assessments also identify remaining data/evidence gaps, provides a summary of the proposed programme of works and approach to address any data/evidence gaps as part of RAPID's gated assessment for the SRO. The following have been undertaken:

- Informal Habitats Regulations Assessment (HRA).
- Water Framework Directive (WFD) Assessment,
- Strategic Environmental Assessment (SEA),
- Invasive Non-Native Species (INNS) Risk Assessment.
- Natural Capital Assessment (NCA),
- Biodiversity Net Gain (BNG) calculations, undertaken using Biodiversity Metric 3.0,
- Treated Water Assessment, and
- Carbon.

Figure 1-7 details the key environmental assessment required for Gate 2 which are a combination of full assessments or a refinement of a Gate 1 assessment. Please note INNS does not cover a core assessment but has been included in the overall assessment.

Figure 1-7 - Environmental assessment integration with SRO Gates



### 1.4.1 Other supporting documents

This report provided an overview and there are a range of supporting appendices which provide the detailed methods and results. These supporting reports will be referenced throughout the reports as required. The key supporting documents are detailed in Table 1-1.

Table 1-1: Key supporting documents

| Annex Reference | Document Ref No | Document Title |
|---|---|---|
| A1 | *70088464-WSP-NETHSRO-RP-GT-2001* | A1: Conceptual Design Report |
| B2 | 5213609 / 9.2 / DG / 002 | B2. STS Strategic Environmental Assessment |
| B3 | 5213609 / 9.3 / DG / 003 | B3. STS Water Framework Directive Assessment |
| B4 | 5213609 / 9.4 / DG / 004 | B4. STS Habitats Regulations Assessment |
| B5 | 5213609 / 9.5 / DG / 005 | B5. STS Natural Capital Assessment |
| B6 | 5213609 / 9.6 / DG / 006 | B6. STS Biodiversity Net Gain Calculations |
| B7 | 5213609 / 9.7 / DG / 007 | B7. STS Invasive & Non-Native Species Risk Assessment |
| C1 | 5213609 / 9.8 / DG / 008 | C. STS Treated Water Assessment |

## 1.5 STRUCTURE OF THE REPORT

This IEA is structured in the following way:

- **Section 2:** A summary of the regulatory assessments undertaken and the key findings. This is only the key outputs and detailed findings are presented in the technical appendix.
- **Section 3:** An overview of the environmental appraisal approach to establish the baseline in which the regulatory assessments are based on.
- **Section 4:** The design evolution of the scheme which details the key technical details of the scheme.
- **Section 5:** The impact risk assessment of the option implementation which informs the regulatory assessment.
- **Section 6:** Assessment of the cumulative effects of the Scheme implementation
- **Section 7:** Details the overall stakeholder engagement for the scheme
- **Section 8:** Wider benefits the scheme is expected to bring
- **Section 9:** Additional RAPID Gate 2 requirements
- **Section 10:** Scoping Checklist

# 2. REGULATORY ASSESSMENTS

## 2.1 INTRODUCTION

A range of regulatory assessments have been undertaken for Gate 2. This following section provides an overview of the key outcomes. Further information, including the method and approach followed is found within the individual technical annex (Table 1-1).

## 2.2 STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)

The Gate 2 submission does not form a statutory plan or programme and therefore there is no statutory requirement for SEA. However, as with Gate 1 it is recognised that the SEA approach can assist in the identification of potential environmental effects (positive and negative) as well as mitigation and enhancement measure and aid option refinement and selection. These outputs will help identify potential environmental risks and opportunities mitigation measures as well as data gaps and uncertainties.

An objectives-led approach to SEA has become standard practice in the assessment of both Water Resource Management Plans (WRMPs) and Drought Plan (DPs). An objective-led approach to the Gate 2 SEA has therefore been adopted. The SEA objectives set out in Table 6.1 of the ACWG Strategic Environmental Assessment: Core Objective Identification report (October 2020) have been adopted. These SEA objectives were identified by the ACWG following a review of Water Company approaches to SEA and an updated assessment of legislation, policies and guidance.

The key issues identified in the review of baseline conditions and of relevant plans, programmes and policies have been used to create a number of key guide questions related to each SEA topic. These key guide questions have been used as prompts in the assessments to help ensure consistent and robust assessment for each of the SEA topic areas. As with the development of the SEA objectives the development of the guide questions has also drawn upon other sources of information including:

- the SEA guide questions set out in the WRSE Regional Plan SEA Scoping Report September 2020; and
- the SEA guide questions included in the SEAs of recent WRMPs.

SEA assessment tables were completed for both the Netheridge WwTW effluent transfer, Haw Bridge pipeline and the Mythe WTW abstraction licence transfer components and summaries of the key environmental effects of each component are provided below.

### 2.2.1 Mythe WTW abstraction licence transfer (15 Mld)

This component does not have any major or moderate positive of negative effects associated with it. The component has some uncertain effects associated with operational carbon emissions and resource use. Effects are otherwise neutral with a few minor positives identified during operation resulting from leaving water in the river for abstraction further downstream and the component contributing to a more resilient water supply.

### 2.2.2 Netheridge WwTW effluent transfer (35 Mld) – Haw Bridge Pipeline

This component has some major and moderate negative and moderate positive effects after consideration of currently embedded mitigation measures.

Major negative effects include:

- Effects associated with soil as the route crosses the Hempsted landfill site and is within proximity of others (historic landfill sites) therefore there exists the potential for contaminated land and associated risks to health and environment during construction.

Moderate negative effects include:

- Effects on habitats of very high distinctiveness (lowland meadows)
- Potential effects on the health and well-being of the local community during construction of the proposed development.
- Significant volumes of chemicals will be required for advanced treatment processes.

Moderate positive effects are identified in respect of the component contributing to a more resilient water supply. Furthermore, with respect to climatic factors this component provides additional water resource and

will during operation assist the reliable transfer of water, therefore reducing the vulnerability to drought risks associated with climate change and improving resilience to the likely effects of climate change. (e.g., construction would represent capital investment which is expected to generate a number of employment opportunities and supply chain benefits).

The major and moderate negative effects identified with the currently costed embedded mitigation measures could potentially be further mitigated to reduce effects to a minor negative or neutral effect through the implementation of further mitigation measures. These measures, which are proposed to be investigated further during Gate 3, include:

- Re-routing of the pipeline away from lowland meadow habitat and Alney Local Nature Reserve (LNR).
- Re-routing the pipeline away from the permitted waste site (including the permitted area)and undertaking investigations/remediation for land contamination. This could mitigate the potential negative effects relating to soil.
- Sensitive siting of construction compounds, routing of construction traffic and limiting hours of working. This could reduce effects on the environment and amenity to a minor negative effect.

Further investigations and works are proposed during Gate 3 that will help to identify further mitigation measures to potentially reduce the identified effects further. It should be noted that the further mitigation measures identified have not been costed for or integrated into detailed design at this stage. In consequence, these measures are subject to more detailed assessment and, at this stage, the effectiveness of these measures has still to be fully determined. In addition to identifying and assessing the effectiveness of further mitigation measures, the Gate 3 activities will also confirm the effectiveness of the embedded mitigation measures identified within the assessments.

## 2.3 WATER FRAMEWORK DIRECTIVE (WFD)

The WFD Regulations Compliance Assessment for the STS SRO Scheme at Gate 2 builds upon work undertaken at Gate 1, utilises the ACWG methodology and spreadsheet and is supported by bespoke hydrological and water quality modelling undertaken by Ricardo.

The Level 1 assessment (Screening and Scoping) identifies 16 water bodies within the Severn Vale Management Catchment, which have the potential to be affected by the Scheme (including rivers, a canal, a transitional estuarine water body and coastal water bodies; the Scheme is not considered to interact with groundwater bodies). Eight of these water bodies intersect only with a 1 km buffer around the proposed pipeline are thus screened out from further assessment as there is no direct Scheme interaction. In four further water bodies, Scheme interaction is limited to pipeline construction and maintenance activities which are deemed WFD compliant at the Level 1 assessment. The final four water bodies which interact directly with the Scheme (licence transfer, pipeline/water course crossings, pipeline discharge) are passed forward to a Level 2 (Impact) Assessment.

All Scheme interactions are considered WFD compliant at the Level 2 assessment due to the following mitigations built into the Scheme design:

- The licence transfer will not lead to any change in abstraction patterns at the Mythe WTW intake. Therefore there will be no hydrological, hydromorphological, ecological or water quality impacts on the River Severn between Mythe and Deerhurst (3.9 km).
- Enhanced abstraction at Deerhurst will only be active at maximum capacity 16% of the time and (when operating in conjunction with the Netheridge WwTW discharge diversion) will lead to a maximum reduction in flow of 1.3 % on the River Severn between Deerhurst and Haw Bridge, which is deemed unnoticeable and is unlikely to present any impediment to WFD compliance.
- The Netheridge WwTW effluent transfer to Haw Bridge could also be operational on 12 % of the time to support the sweetening flow for the STT pipeline. During these periods only 20Ml/d will be transferred when STT is not operational.
- The limited frequency of the Netheridge WwTW effluent transfer to Haw Bridge (at maximum capacity (35 Ml/d) only 16 % of the time) will have a non-discernible impact on the overall flow and channel processes at this location of the River Severn.

- Detailed assessment of the instream habitat quality and quantity identified no discernible impacts on habitat availability. Overall, the average change in velocity and depth has been modelled as <2% in all months when the Netheridge WwTW effluent transfer to Haw Bridge is operational (at maximum capacity (35 Ml/d) only 16 % of the time).
- Generally, this equates to a modelled reduction in depth of ~1cm and velocity of 0.002m/s. These changes are considered unnoticeable in the context of the modelled baseline conditions which shows average depths of 3.8m and velocity of 0.1m/s.
- Enhanced tertiary treatment of the effluent at Netheridge WwTW prior to upstream transfer ensures that the waters discharged into the River Severn at Haw Bridge (or drained during maintenance activities) are of higher quality than the current output from the Netheridge WwTW and will not result in a WFD risk.

Overall the Scheme is deemed compliant with WFD requirements in both ACWG Level 1 and Level 2 assessments based on moderate confidence in the available WFD data and the Scheme design. We draw the following conclusions with respect to the WFD Assessment Objectives:

- The Scheme does not lead to deterioration in status of any water body.
- The Scheme does not create any impediments to water bodies achieving their target status.
- The Scheme does not compromise any mitigation measures to protect and enhance water bodies.

We also identify some potential benefits to downstream water quality in the Upper Severn estuary linked to the tertiary treatment plan for the diverted Netheridge WwTW effluent discharged at Haw Bridge.

This assessment must be reviewed and updated at Gate 3 as the Scheme design evolves, paying particular attention to the following:

- Potential impacts to groundwater if the updated Scheme design has the potential to impact on (superficial) WFD groundwater bodies or sensitive groundwater features.
- How pipeline maintenance activities might affect the flow and water quality of individual water bodies, especially if the pipeline is likely to be drained into these water bodies, some of which are small and unnamed.

## 2.4 INFORMAL HABITATS REGULATION ASSESSMENT (HRA)

The ACWG guidance[5] states that the Habitat Regulations Assessment (HRA) for each SRO should be undertaken in accordance with available guidance for England and Wales and should be based on a precautionary approach as required under the HRA process. The requirement for a HRA is established through the Conservation of Habitats and Species Regulations 2017 (as amended), commonly referred to as the Habitats Regulations. The Habitat Regulations state that, any plan or project which is likely to have a significant effect on a European site (either alone or in-combination with other plans or projects) and is not directly connected with, or necessary for the management of the site, must be subject to a HRA to determine the implications for the site in view of its conservation objectives. As such, each SRO should meet the requirements of the Habitats Regulations before implementation.

The STS SRO HRA aims to establish whether components included in the STS SRO are likely to have a significant effect on European sites[6], either alone or in-combination. This is judged in terms of the implications of the plan for a site's conservation objectives, which relate to its 'qualifying features' (i.e., those Annex I habitats, Annex II species, and Annex I bird populations for which it has been designated). Significantly, HRA

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

[6] The amended 2017 Habitats Regulations created a national site network on land and at sea, including both the inshore and offshore marine areas in the UK. The national site network includes Special Areas of Conservation (SACs) and Special Protected Areas (SPAs). Designated Wetlands of International Importance (known as Ramsar sites) do not form part of the national site network. Many Ramsar sites overlap with SACs and SPAs and may be designated for the same or different species and habitats. All Ramsar sites are protected in the same way as SACs and SPAs. For ease of reference through this report, these designations are collectively referred to as "European sites".

is based on a rigorous application of the precautionary principle. Where uncertainty or doubt remains, an impact should be assumed, triggering the requirement for appropriate assessment of that scheme.

As per the latest RAPID guidance a full HRA for an SRO solution is not required until a planning and/or permit application (or its equivalent, for example a Development Consent Order). The *principles* of the HRA process are applied during the gated process to identify risks to feasibility and deliverability of the schemes (alone and in-combination) as part of an informal HRA. As such, there is no competent authority undertaking the integrity test.

Each component of the STS SRO was considered as a whole to determine whether there are any *risks* of Likely Significant Effects (LSEs) arising from construction or implementation activities and/or operation on one or more European sites, adopting the *principles* of HRA. The following sites were identifies as associated with the STS SRO:

- Cotswold Beechwoods Special Area of Conservation (SAC).
- Dixon Wood SAC.
- Severn Estuary SAC.
- Severn Estuary Special Protected Area (SPA).
- Severn Estuary Ramsar.
- Walmore Common SPA.
- Walmore Common Ramsar.

Screening identified a risk of LSE for the Severn Estuary SAC, SPA and Ramsar site as well as the Walmore Common SPA and Ramsar site and the need for an appropriate assessment based on the following pathways:

- Netheridge WwTW effluent transfer pipeline/outfall construction related impacts, including the impacts on supporting habitat for migratory fish and the designated bird communities.
- Netheridge WwTW effluent transfer operation and impacts on water quality, downstream of Haw Bridge. This includes impacts on supporting habitats for migratory fish, impacts on migratory cues and impacts on habitats within the Severn Estuary European Marine Site that support the designated birds and fish.
- Joint Mythe WTW licence transfer and Netheridge WwTW effluent transfer operation and impacts on hydrology associated with the abstraction of 50Ml/d at Deerhurst and consequent augmentation of 35Ml/d at Haw Bridge, with net 15Ml/d reduction downstream of the discharge of treated effluent affecting the River Severn downstream and into the Severn Estuary. This includes impacts on supporting habitats for fish, migratory cues, and the designated bird communities.

The informal appropriate assessment concluded that, based on the current information and the proposed mitigation measures, there would be no adverse effects on site integrity of the Severn Estuary SAC, SPA and Ramsar site or the Walmore SPA and Ramsar site. The mitigation measures proposed include a wide range of measures in relation to potential construction phase effects on supporting habitat for designated bird and fish communities.

Enhanced tertiary treatment of the effluent at Netheridge WwTW prior to upstream transfer ensures that the waters discharged into the River Severn at Haw Bridge (or drained during maintenance activities) are of higher quality than the current output from the Netheridge WwTW and will not result in a water quality risk to the designated fish communities with a potential overall benefit to the Severn Estuary.

The potential impacts on supporting habitat were also considered in detail, in particular, the habitat within the 3.9km reach of the River Severn which will be subject to a net reduction in flow as a result of the STT abstraction. The assessment was informed by detailed modelling which included consideration of a moderate-low flow year and the very low flow year. Overall, the average change in velocity and depth will be <2% in all months. Generally, this equates to a reduction in depth of ~1cm and velocity of 0.002m/s. These changes are considered as non-discernible in the context of the modelled baseline conditions which shows average depths of 3.8m and velocity of 0.1m/s.

Selected endocrine disruptors which may act as olfactory inhibitors in the context of SROs (including the STS) have only recently been identified. These chemicals require specific analysis which has only recently

commenced and has a smaller evidence base at present that should be kept under review in Gate 3. Further assessment of the risk to olfactory cues needs to be considered in Gate 3 when data becomes available and further modelling is completed. The results of any further monitoring and modelling will need to be considered in the review of the appropriate assessment.

The conclusion on the risk of LSE and predictions regarding adverse effects on site integrity will also need to be reviewed and updated (where required) as more information becomes available during completion of the Gate 3 assessments and more detailed scheme design. This also includes the in-combination assessment with other plans and projects. This includes consideration of any further monitoring and modelling outputs made available between completion of the current HRA and the end date of the Gate 2 assessments and any changes in the applicability and/or availability of mitigation measures.

## 2.5 NATURAL CAPITAL ASSESSMENT (NCA)

A Natural Capital Assessment (NCA) has been undertaken for the STS SRO, building on an NCA conducted for the Scheme at Gate 1, and is based on the All Companies Working Group (ACWG) guidance for Gate 2 and the Environment Agency's final Water Resources Planning Guidance (WRPG) supplementary guidance 'Environment and Society in decision making'. The ACWG guidelines indicate that at Gate 2 water companies must provide a Natural Capital Assessment (NCA) aligned with WRPG and Defra's Enabling a Natural Capital Approach (ENCA) methodologies. The aim of the NCA is to support the identification of a best value solution.

Based on an assessment of habitat changes for the current baseline and two post-Scheme scenarios – one without the delivery of BNG and one including the delivery of BNG – the Gate 2 NCA has drawn the following conclusions in relation to the impacts of the Scheme on the natural capital assets within the Scheme boundary and the ecosystem services they provide:

- Without the implementation of off-site habitat creation to deliver BNG, there is a decrease in the overall ecosystem services value as a result of the Scheme of around £2k per year due to expansion of the WwTW area. This is primarily driven by the likely decrease in the amount of carbon sequestration; however, all services quantified, which included carbon sequestration, air quality regulation, natural hazard regulation, recreation and tourism and food production, show a disbenefit under this scenario.
- With the delivery of BNG through implementation of off-site habitat creation, there is also a decrease in the net ecosystem services value of around £9k per year. However, this is mainly due to the replacement of the off-site cropland with other habitats, resulting in a loss to food provisioning services. All other services quantified (excluding recreation and tourism which was not quantified for the 'with BNG' scenario), show a benefit under this scenario. Excluding the food provisioning and recreation and tourism services, the overall benefit to ecosystem services is estimated to be £40k per year.

It should be noted that this assessment represents a high-level appraisal of the potential ecosystem services impacts of the Scheme. The values generated should be considered as indicative only, representing an order of magnitude level of accuracy.

For Gate 3, the ACWG Guidance indicates that the NCA should include further refinement of the assessment to aid detailed design and to provide information for planning. The following recommendations are therefore made for consideration as part of the Gate 3 NCA:

- The NCA should be refined through provision of greater detail on the habitats affected by the Scheme and length and scale of impacts to provide great clarity on the impact pathways and ecosystem services values. This will be supported by further refinements to the BNG assessment. The BNG assessment also recommends the use of some site surveys to validate habitat types and their quality.
- It was not possible to quantify the impacts of the 'with BNG' scenario on recreation due to the requirement for a specific site for habitat creation to be identified for both terrestrial and river habitats. For Gate 3, it is recommended that further development of the 'with BNG' scenario is undertaken to enable more robust quantification of the impacts of this scenario on recreation, in addition to other services.
- Due to data limitations the NCA relied on national values by habitat type to assess the potential impacts on natural hazard regulation (flooding). For Gate 3 it would be beneficial to undertake a more detailed assessment of this specific service.

- It is recommended that results from the climate regulation (carbon sequestration) assessment be combined with overall operational and embodied carbon impacts from the Scheme to identify the need and means to support delivery of Net Zero targets through the Scheme, e.g. through the use of further habitat creation and nature-based removals of carbon.
- Similarly, it is recommended that for Gate 3 consideration be given to the delivery of environmental net gain (ENG) through the Scheme. ENG is based on the concept of ensuring that development leaves the environment in a measurably better state compared to the pre-development baseline[7]. There is currently no legal definition of ENG, but the Defra 25 Year Environment Plan indicates that this represents an expansion of BNG to "*include wider natural capital benefits, such as flood protection, recreation and improved water quality and air quality*"[8]. Furthermore, although not yet a legal requirement, the Government committed to embedding ENG in infrastructure within the 25 Year Environment Plan, and the approach is supported by the National Infrastructure Commission[9].

[7] National Infrastructure Commission (2021). Natural capital and environmental net gain – a discussion paper. Available from: https://nic.org.uk/app/uploads/Updated-Natural-Capital-Paper-Web-Version-Feb-2021.pdf .

[8] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf

[9] https://nic.org.uk/app/uploads/Updated-Natural-Capital-Paper-Web-Version-Feb-2021.pdf

## 2.6 BIODIVERSITY NET GAIN (BNG)

Water resource options achieving a BNG would support the net gain actions in the Government's 25-year Environment plan and meet the likely future requirements as per the Environment Act.

For this assessment the Biodiversity Metric 3.0 has been applied to the Scheme, based on the route option provided for Gate 2 assessment including its connection to Netheridge WwTW, and an expansion of Netheridge WwTW to accommodate additional tertiary treatment. Biodiversity Metric 3.0 was applied instead of Biodiversity Metric 2.0 (as per Gate 1) to ensure consistency with the assessments being undertaken for the STT SRO. Excluding any off-site habitat interventions the Scheme is predicted to result in:

- a net loss of 193.34 habitat area units, with a predicted total net change of -54.92%.
- a net loss of 2.83 hedgerow units, with a predicted total net change of -16.32%.
- a net loss of 1.90 river units, with a predicted total net change of -44.30%.

These quoted results do not include the loss of the lowland meadow (a very high distinctiveness) habitat that will occur as a result of the Scheme. This is because "losses of irreplaceable or very high distinctiveness habitat cannot adequately be accounted for through the metric"[10]. If this loss cannot be avoided, "bespoke compensation should be agreed with the relevant decision maker for any losses or impacts to these habitats"[10]. This habitat is shown on an inventory and is close to Alney Island LNR. This 'lowland meadow' habitat should be a priority for field survey to confirm its status, and for design review to see if it can be protected.

The strategy for achieving BNG, including its definition in relation to the proposed biodiversity improvement parameters, will need to be discussed and agreed with local stakeholders and must be based on ecological functionality with regard to local conservation priorities and local biodiversity targets.

The assessment demonstrates how carefully thought-out biodiversity improvements designed to deliver ecological functionality and local conservation priorities also have to consider the BNG process carefully to deliver net gain of biodiversity units, as measured using Biodiversity Metric 3.0 (including compliance with the habitat trading rules).

The initial design work and undertaking of this BNG assessment have followed the mitigation hierarchy and the principles and rules of Biodiversity Metric 3.0. It is likely that the predictions, particularly in relation to habitat area units, are currently over precautionary and that (1) savings can be made through further environmentally sensitive design options; and (2) further substantial reductions may be possible to confirm in relation to some losses being temporary and countable as retention rather than losses followed by habitat creation. However, this precautionary approach shows the importance of sensitive design, both to project ecological features in themselves, and to result in subsequent cost savings.

Based on the current, precautionary assessment, illustrative estimates of potential offsite compensation needs have been calculated and are detailed in the BNG Appendix. As already noted, they are likely to be overestimates. Assuming habitat units would meet BNG trading rules and would be delivered through habitat creation on areas supporting cereal crops, for habitat areas, a net gain requirements are estimated as follows

- For creation of wetland, woodland, grassland and scrub habitat, 229.01 units would need to be delivered on 90.29 ha to reach no net loss and then provide ≥10% net gain.
- For hedgerows, 4.62 units would need to be delivered by planting 0.6 km of species-rich native hedgerow to reach no net loss and then provide ≥10% net gain.
- For water courses, 2.1 km of river would need to be enhanced to reach no net loss and then provide ≥10% net gain. However, through good design to reduce losses and build habitat enhancement into the proposals these requirements can be reduced. For example, if the water courses undergoing open cutting were enhanced by 1 condition category whilst they were reinstated, only 0.2 km of offsite enhancement would be required.

[10] [redacted] (2021). *Biodiversity metric 3.0: Auditing and accounting for biodiversity – User Guide.* Natural England.

During detailed design an appropriate BNG management and maintenance plan will be produced. This will detail the measures required to ensure the habitat creation proposals reach their target condition and give confidence that every effort will be made to enable the Scheme to achieve BNG.

## 2.7 INVASIVE NON-NATIVE SPECIES (INNS)

The INNS risk assessment has been undertaken through the application of the Environment Agency's standardised risk assessment tool for use by all SROs at Gate 2 (the SRO Aquatic INNS Risk Assessment Tool (SAI-RAT)).

The Mythe abstraction licence transfer was not considered to pose a risk to INNS and therefore was not considered further. This is because this Mythe abstraction licence transfer does not involve new infrastructure or a raw water transfer and simply result in additional resource being available for abstraction (i.e., no new pathways are created). The INNS assessment therefore focused on the risk of INNS being introduced and spread via the effluent re-use transfer from Netheridge WwTW to the River Severn.

The inputs provided for the Scheme risk assessment provide a risk score of 38.0 %, compared to a maximum score of 100 %. The lack of recreation or external INNS pathways at the source or along the route of the transfer highlights that the inherent risk of unmitigated movements of large water volumes was the key factor in driving the risk score for this effluent reuse transfer, which was exacerbated by the presence of INNS around the vicinity of the source and along the transfer route. The presence of priority habitats along the transfer route and at the receptor is a further contributor factor to the overall risk score . The activity of transferring water from the WwTW to the River Severn is intrinsic to the STS SRO and thus further design mitigation is likely to be the key to reducing INNS transfer risk, where applicable.

The generalised biosecurity module included within the SAI-RAT identified potential biosecurity measure types from a defined list of 30 options. This automated process accounted for the INNS transfer pathways identified to be present and highlighted which options may be broadly applicable for targeting each specific pathway. These measures, alongside measures supplementary to those identified by the SAI-RAT, have been further evaluated for the management of the transfer.

Within the appraisal of INNS mitigation measures, it has been considered that Netheridge WwTW already treats all final effluent to a high standard, which will be upgraded further with the addition of a MBBR, CoMag® system, ozone water treatment plant, BAFF and GAC filter. These additional treatments will effectively kill all INNS propagules, meaning there is limited relevance of additional INNS mitigation measures. As such, the Scheme is not considered to pose any 'significant' INNS transfer risk.

The shortlist of suitable biosecurity measures for further consideration as part of subsequent design stages has been based on an initial assessment of the efficacy and feasibility of implementing the measures. This shortlist contains only general site biosecurity measures which include a biosecurity management plan and stringent Check Clean Dry protocols as well as an INNS monitoring programme to detect any new INNS in the vicinity of the source and receptor of the transfer.

## 2.8 TREATED WATER ASSESSMENT

A Water Quality Risk Assessment (WQRA) for the STS SRO has been developed by adopting the outputs of the STT SRO WQRA, as the source / conveyance / treatment / distribution options are the same. The STT WQRA employed the ACWG methodology, with limiting hazards updated from their Gate 1 scoring during the Gate 2 water quality risk assessment workshop held by Jacobs, attended by relevant stakeholders from Severn Trent Water, Thames Water, Affinity Water and Bristol Water. In the workshops, the list of limiting hazards as well as their likelihood scores were reassessed in light of information received from the Gate 2 water quality monitoring programme.

Although the STS Gate 2 submission is linked to the use of the STT Interconnector, the STT WQRA reviewed a number of different pipeline and canal conveyance options - with or without the support of Minworth STW. The pipeline conveyance options have a slightly reduced list of limiting hazards compared to the options with canal conveyance. Although both sourced from the River Severn, the additional limiting hazards of Algae and Bromide have been associated with the Canal conveyance option. The limiting hazards for the Purton intake option differ due to the difference in source as well as a difference in the receiving zone compared to the other STS/STT SRO options. Control measures for all the limiting hazards have been identified to reduce the

likelihood (and hence risk scores), with the majority of control measures being identified in the 'Treatment' stage, with some control measures focussing on consumer engagement.

It is recommended that the WQRA is revisited in Gate 3 for the preferred STS/STT SRO option, in line with the ACWG methodology, to continually review and update the limiting hazards as well as their risk scores using the most up to date water quality monitoring information. For a full review of the WQRA of the Gate 2 STS SRO, refer to the Gate 2 STT SRO WQRA report [STT-G2-S3-354-Drinking Water Safety Plan Report].

## 2.9 CARBON

A carbon accounting investigation was completed for the STS SRO, specifically for the Netheridge WwTW discharge diversion, Haw Bridge Pipeline (35 Ml/d)[11]. As no construction or operational changes are required at Mythe, no carbon assessment has been undertaken.

Embedded carbon has been calculated using the STW Carbon Calculator (Jacobs), including the relevant treatment and the pipeline. Carbon emissions associated with the two main elements were calculated by the tool using a top-down approach in terms of tonnes of $CO_2$ emissions ($tCO_2e$) per quantity unit rates for different asset types and sizes (e.g. $XXtCO_2e$ per 100kW submersible pump). Assets and quantities have been derived in the form of a bill of quantities (BoQ) which has also been used for costing[12] purposes. The use of $tCO_2e$ per quantity unit rates for each asset type is not affect by interannual/regional cost variations and would allow for a comparative assessment between options at a later stage. However, not all assets derived as part of the BoQ are a perfect match to the 'Asset Index' included within the tool. Where a match has not been possible, assumptions have been made to represent the carbon emissions associated with the component.

Whole life carbon has been calculated using the STW Carbon Calculator (by Jacobs) over a 20-year appraisal period. Capital carbon emissions are incurred in year 0 of the project while operational carbon emissions are uncured throughout the appraisal period from years 0 to 19.

Capital Carbon Emissions ($tCO_2e$) as calculated by the STW Carbon Calculator (Jacobs) for the Netheridge WwTW discharge diversion, Haw Bridge Pipeline (35 Ml/d) is estimated as follows:

- Annual capital carbon of 120, 000 $tCO_2e$ with most ~95% attributed to the pipeline construction.
- Annual operational carbon of 2,200 $tCO_2e$ with most ~95% attributed to power use for treatment and pumping.

Whole life carbon has been calculated using the STW Carbon Calculator (Jacobs) over a 20-year appraisal period and is summarised as follows:

- Pipeline Capital Carbon of 114,600 tCO2e
- Treatment Capital Carbon of 5,199 tCO2e
- Power Operational Carbon of 34,171 tCO2e
- Non-Power Operational Carbon of 6,876 tCO2e
- Total Whole Life Carbon of 164,156 tCO2e

[11] WSP (2022). Severn Trent Sources Strategic Resource Options. Netheridge Carbon Report. Report for Severn Trent Water Ltd. 70088464-WSP-NETHSRO-RP-GT-2005

[12] Pipeline capital cost estimate were developed using the Severn Trent Water 'Cost Tool Lite' (Atkins/Arup, version May 2019).

# 3. ENVIRONMENTAL APPRAISAL

## 3.1 METHODOLOGY / APPROCH TO IEA

In February 2021, RAPID produced final guidance as to the expectations of the regulators for solution submission at Gate 2[13]. This guidance indicates a change in approach from the original Gate 2 guidance and the ACWG methodology, which both envisaged a SEA approach; to an IEA report. The proposed scope of the STS SRO IEA has been developed to align with the approach agreed for the STT SRO[14] (referred to as IEA Methodology), which has had regard to this guidance. The STS SRO IEA also has also had regard to the comments made by the regulators on the STS SRO Gate 1 submission, plus RAPID's recommendations and actions contained in its Gate 1 final decision on the STS SRO[15].

The IEA is a summary of the STS SRO workstreams and environmental assessments undertaken. The structure and scope of the IEA has regard to the environmental topic areas as identified in both the SEA and EIA regime and Gate 2 RAPID guidance. In line with the IEA Methodology the IEA undertaken in Gate 2 comprises an initial high-level appraisal but is consistent of the likely EIA requirements at Gate 3.

A summary of the baseline environment is provided in Section 5.1 with reference to relevant work completed during Gate 2 and the additional evidence base available across both the STS SRO and STT SRO. The key sensitive receptors across each SEA/EIA topic are defined in Section 5.2 following the baseline review.

For Gate 2, the Netheridge WwTW discharge diversion and Mythe WTW abstraction licence transfer are considered within this report to determine the key environmental positive and negative effects. Within Section 5.2 the effects identified from the Gate 1 SEA output tables have been reviewed, alongside an update of activities and pathways for impact, to help determine areas where design refinements and optimisation at Gate 2 are to be considered further, and to help develop further mitigation and enhancement measures to be embedded within the detailed design. Where additional work is required to further develop these mitigation measures, the necessary investigations and studies have also been identified. Following the review of potential effects and existing uncertainty around the proposed additional mitigation measures, an overall risk rating has been applied to each effect. The risk assessment uses a "traffic light" red / amber / green (RAG) system to display the findings of the assessment. The risk scoring used is provided in Table 3-1.

Table 3-1: Risk RAG Scores

| Risk Score | Description |
|---|---|
| **Red** | Effect is a major/moderate environmental constraint and is likely to be challenging to overcome; significant additional mitigation required; there is significant current uncertainty surrounding understanding of effect and/or scope/effectiveness of additional mitigation measures, will require extensive further investigations to improve understanding. |
| **Amber** | Effect is a major/moderate environmental constraint, but with known or commonly applied mitigation measures effect will be overcome; mitigation will potentially be extensive; likely to require further studies and investigations to improve understanding of effect and refine mitigation measures. |
| **Green** | Effect is a negligible or minor constraint or is easily mitigatable with best practice measures and currently defined mitigation or minor additional mitigation requirements. |

To facilitate the environmental appraisal of the STS SRO being developed to a level suitable for submitting into final regional plans or final WRMPs, the SEA output tables produced in Gate 1 have been updated for the Gate 2 design using the same methodology, objectives and presentational format. The SEA is provided in *Gate 2 STS SRO SEA Environmental Report (Technical Annex B2)*. A summary of the SEA is also provided in Section 2.2 above.

[13] NRW, NE, NEAS, December 2021, DRAFT Strategic regional water resource solutions: detailed feasibility and concept design. Gate Two Guidance

[14] Ricardo Energy and Environment, March 2022, Severn Thames Transfer SRO Gate 2 Methodology Report: Initial Environmental Appraisal

[15] Regulators' Alliance for Progressing Infrastructure Development, 21 December 2021, Strategic regional water resource solutions: Standard gate one final decision for River Severn to River Thames Transfer

Enhancements and opportunities are considered within the *Gate 2 STS SRO NCA and BNG reports* (Technical Annex B5 and B6) and a summary of these opportunities is provided in Sections 2.5 and 2.5.

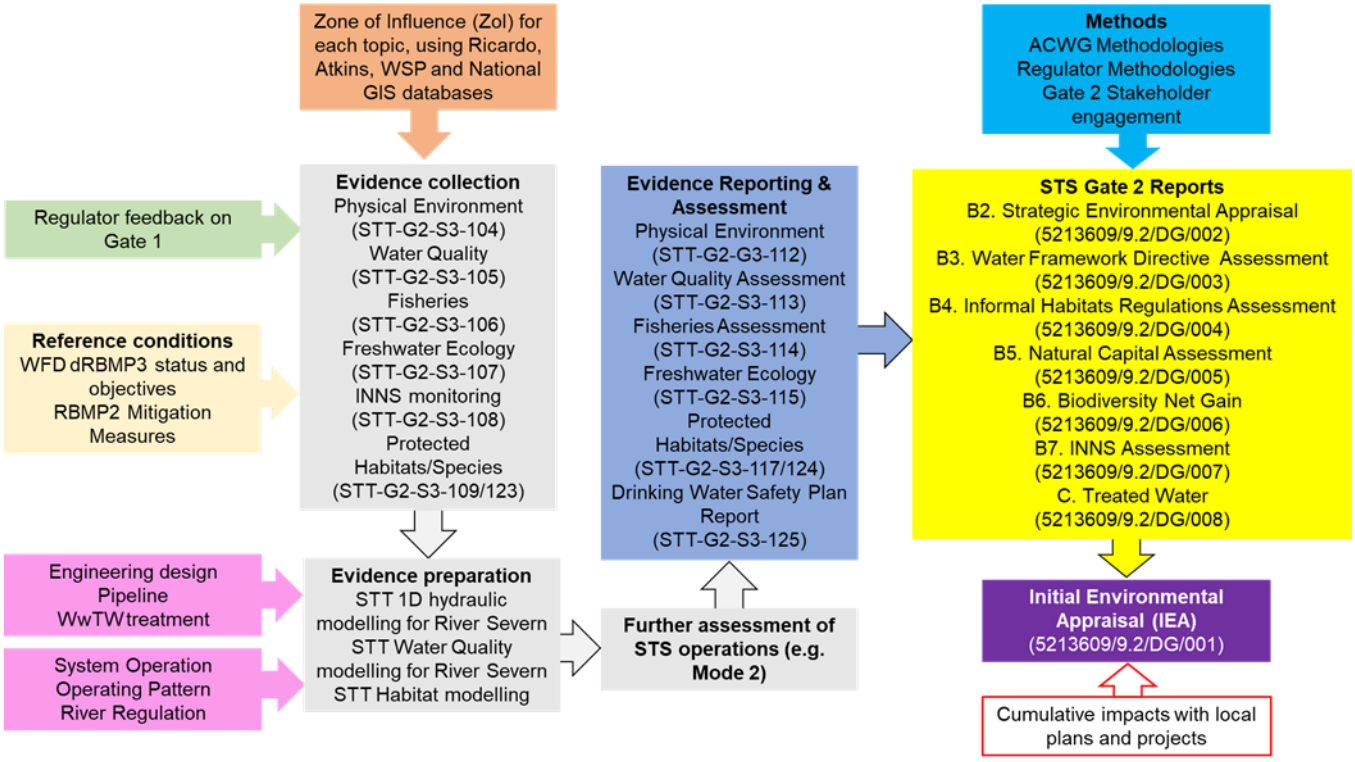
Section 5.4 provides a summary of the proposed plan of work for Gate 3 required to address remaining data gaps and uncertainties. The proposed scope has been developed to address the likely requirements for planning consent.

### 3.1.1 Information informing the IEA

The Gate 1 STS SRO SEA assessment[16] recognised that there were still a number of uncertainties and risks that need to be managed, and that further iterations of the assessment are required as more detailed information and assessment work becomes available during Gate 2. The Gate 1 SEA assessment recommended that the Gate 2 work should include the consideration of the recommended *further* mitigation measures as well as confirming the effectiveness of the embedded mitigation measures identified within the Gate 1 matrices.

In this context, the Gate 2 STS SRO environmental appraisals have been updated as more detailed design and mitigation information is now available. These appraisals cover the physical environment, water quality, fish, invasive species, protected species, protected habitats, macroinvertebrates and other ecology. In addition, updated STS SRO HRA, WFD, NCA, and BNG assessment have been undertaken and have fed into this IEA. Figure 3-1 illustrates how the further survey work, studies and assessments help inform the development of the concept designs, mitigation measures and the IEA. It should be noted that many of these additional studies have been undertaken as part of the STT SRO Gate 2 work packages

Figure 3-1: Summary of the surveys, assessment and modelling that has informed this IEA

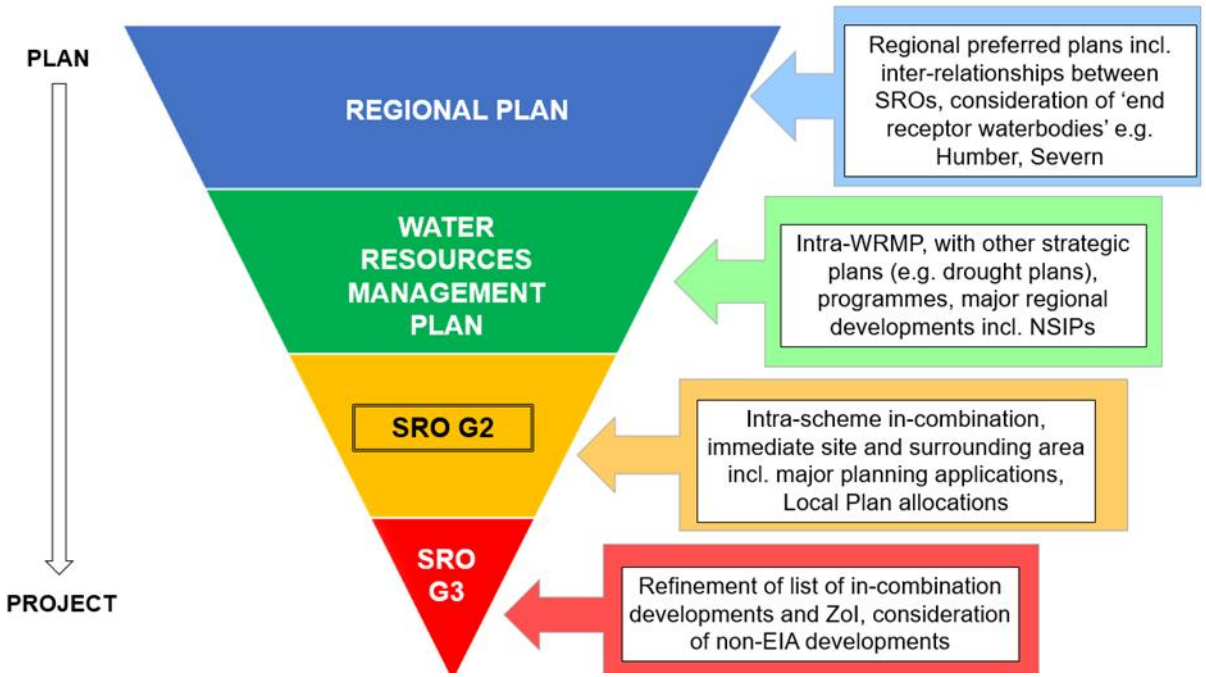



The assessment uses qualitative and/or quantitative information where this is available (such as identified by the HRA or WFD assessment process, conceptual design information, and/or public domain datasets including GIS datasets). The appraisal is at a strategic level and makes use of spatial analysis, professional judgement and applicable assessment guidelines relating to that topic/objective.

### 3.1.2 Cumulative effects and in-combination assessment

Whilst the Gate 2 environmental appraisal is not a regulatory assessment the requirement to assess cumulative effects is set out in the Rapid Gate 2 guidance[17]. The cumulative effects and in-combination assessment draws on the proposed approach outlined in the Gate 2 Environmental Appraisal - Cumulative effects methodology (December 2021) (referred to as the Cumulative effects methodology)[18], originally presented to the National Appraisal Unit (NAU) for comment in February 202219. Figure 3-2 presents a high-level overview of the approach to be taken.

Figure 3-2: The proposed responsibility for completion of cumulative effects assessment: Regional Plans, WRMPs and SROs




In terms of SROs, the cumulative effects methodology states that these will report the outcomes of the regional plan and WRMP24 in-combination and cumulative effects assessments (relevant to their SRO), where timing permits, and will not undertake any further assessment of the in-combination and cumulative effects of the SRO with the other SROs, plans or programmes identified in these assessments. It will be assumed that the Regional Plan and WRMP24 assessments have concluded no significant in-combination and cumulative effects at a plan level, enabling the SRO to progress. The SRO specific cumulative effects assessment will then look in further detail at the site and surrounding area in terms of local and site-specific information including large development allocations within Local Plans and larger planning applications.

At Gate 2, the SROs are at a conceptual design stage and therefore the level of design information is much less detailed than that available at the EIA stage. Furthermore, the appraisal that is presented in the IEA does not report on likely significant effects but rather potential environmental effects in terms of risks and opportunities and likely required mitigation. Therefore, a full cumulative effects assessment, as would be reported in an EIA, is not appropriate for Gate 2 but rather the focus is on identification of risks due to potential cumulative effects of SROs with other plans and projects that will need to be addressed at future gates and for which additional mitigation may be required.

As per the hierarchy shown in Figure 3-2, the SRO cumulative effects assessment at Gate 2 focuses on the larger and longer-term developments that could combine with the SRO to cause an additional or different

[17] Rapid (Feb 2022) Strategic regional water resource solutions guidance

[18] Mott Macdonald (April 2022), Gate 2 Environmental Appraisal, Cumulative effects methodology

[19] The latest version of the note was circulated on 5 April 2022, with a subsequent meeting with the NAU Leads to formally agree its adoption for the SRO process.

effects on receptors for the SRO only and will be undertaken for the whole of an SRO scheme regardless of consenting route.

The first step is to identify the other plans and developments to be considered by establishing a zone of influence (ZoI) for each topic, using GIS, to determine the maximum area within which other developments and plans will need to be identified. Table 3-2 provides indicative zones of Influence which will vary depending on the nature of the SRO.

Table 3-2: Environmental topics and Zone of Influence

| Environmental topic | Zone of influence explanation |
|---|---|
| Air quality | **Construction:** 350m ZoI from anticipated construction activities for effects relating to construction dust and emissions.<br>**Operation:** 1km ZoI for construction and operational traffic effects. |
| Biodiversity, flora and fauna | 2 km ZoI for both construction and operational effects on national statutory designated sites which will be extended where impacts extend beyond this e.g. where there is a SSSI impact risk zone.<br>1 km ZoI for both construction and operational effects on habitat and non-statutory designated sites which will be extended where impacts extend beyond this.<br>Habitats Regulations Assessment to define ZoI for internationally designated sites. |
| Historic environment | 500 m ZoI for both construction and operational effects on the significance of designated heritage assets.<br>200 m ZoI for both construction and operational effects on the significance of non-statutory heritage assets. |
| Landscape | **Construction and operation:** 1 km ZoI for both construction and operational effects on landscape. |
| Material assets | **Construction and operation:** 200 m ZoI for both construction and operational effects. |
| Noise | **Construction and operation:** 600 m ZoI from anticipated construction activities as a worst case. |
| Population and human health | **Construction and operation:** 500 m ZoI for assessing impacts on community assets with considering to effects outside of the 500 m area where these are likely to occur. |
| Soils | **Construction and operation:** A 200 m ZoI for both construction and operational effects. |
| Transport and access | **Construction and operation:** A 1 km ZoI for both construction and operational effects which will be extended where impacts extend beyond this. |
| Water | **Construction and operation:** 1 km ZoI for flood risk which will be extended where impacts extend beyond this.<br>Water Framework Directive Assessment to define ZoI for water resource (flow and quality) for construction and operational effect. |

#### *3.1.2.1 Cumulative effects assessment with other plans and developments*

As per the Cumulative effects methodology, it is assumed that the Regional Plan will have been subject to an in-combination effects assessment with SROs, and that the WRMPs will be subject to a cumulative effects assessment with adopted and emerging Development Plans, therefore, these have been excluded from the SRO-specific cumulative effects assessment at Gate 2 with the exception of large existing and emerging site allocations. Other confirmed investments by water companies at sites that form part of the SRO options are also considered.

Therefore, the list of other developments and plans considered for this IEA are:

- Large existing and emerging Local Plan allocations e.g. 500 or more dwellings.
- Projects on the Planning Inspectorate's Programme of Projects.
- Hybrid Bills e.g., HS2 Phase One.
- Transport and Works Act Orders for large-scale transport infrastructure.
- Minerals and waste applications, including for landfill and energy from waste.
- Large Town and Country Planning applications where an EIA is required.

Initially the list of other plans and developments has been identified, and a schedule has been developed providing information for each development including location information, planning status, and programme for construction / operation to determine if there is an overlap in temporal scope and which receptors have potential to experience effects from both the SRO and the other development. This allows the potential for

cumulative effects of two or more developments by virtue of overlaps in temporal or geographical scope or due to the scale and nature of the 'other development' / receiving environment, and whether these could require additional mitigation. The intention is to identify interactions of construction and/ or operational effects between developments. This information has not been collected to inform route and/or site selection decisions. Therefore, developments that are likely to be completed prior to construction commencing on the SRO will be excluded from a cumulative effects assessment, as they will instead become part of local, environmental baselines against which broader environmental assessment will be undertaken.

Potential SRO-specific cumulative effects are reported within this IEA together with any proposed mitigation measures (including how the mitigation could be secured and delivered).

It is noted that as the RAPID process progresses and the scheme is refined at Gates 3 and 4, the topic ZoIs will need to be reviewed and updated as necessary. As the ZoIs change, data collection on 'other developments' will therefore also be reviewed and updated ahead of a future EIA Scoping Opinion request. The list of developments for the EIA-stage cumulative effects assessment will also need to be reviewed and updated, for example, consideration given to applications for NSIPs under the Planning Act (2008) and for major developments under the TCPA (1990).

#### *3.1.2.2 Inter-relationships between effects*

There is no standard approach to the assessment of interrelationships between effects. Effects are very rarely additive, but rather a collection of impacts on a receptor that need to be drawn together. Consideration also needs to be given to the potential for 'synergistic' effects whereby different types of impact affecting a receptor may interact together and increase their effect.

A receptor-based approach to the assessment of interrelationships between effects is set out below.

- Step 1: Identify receptor types (e.g. community, ecological habitat or species, a heritage asset, landscape feature or natural feature, waterbody or watercourse) and geographical locations.
- Step 2: Identify receptors and their geographical location.
- Step 3: Screen out receptors where there is no potential for interrelationships between effects or temporal overlap of impacts, or where impacts are anticipated to be negligible.
- Step 4: Assess interrelationships between effects at remaining receptors and report on a receptor basis (within geographical areas) appropriate to the effects identified.

It is considered that climate change can be scoped out of the assessment of interrelationships between effects as topic-specific climate change effects will be considered through topic assessments (and be carried through to the cumulative assessment if appropriate), with no separate input to the cumulative assessment required for the climate change topic. Carbon effects are not location specific within the anticipated ZOI for the SROs and do not interact with other environmental effects therefore will be scoped out of the assessment of interrelationships between effects.

# 4. DESIGN EVOLUTION

A separate concept design report has been completed on behalf of STWL by WSP. This report has been supported by a Netheridge pipeline appraisal report and a Netheridge process basis of design report. Details are available in the following reports (not included in this report):

- WSP (2022). Severn Trent Sources Strategic Resource Option. Netheridge Concept Design Report. Report completed on behalf of STWL. Report 70088464-WSP-NETHSRO-RP-GT-2001.
- WSP (2022). Severn Trent Sources Strategic Resource Option. Netheridge Pipeline Route Appraisal Report. Report completed on behalf of STWL. Report 70088464-WSP-NETHSRO-RP-CY-4000.
- WSP (2022). Severn Trent Sources Strategic Resource Option. Netheridge Process Basis of Design Report. Report completed on behalf of STWL. 70088464-WSP-NETHSRO-RP-CY-3000.

# 5. IMPACT RISK ASSESSMENT

A summary of the baseline environment within the study area is provided in Section 5.1 with reference to relevant work completed during Gate 2 and the additional evidence base available across both the STS SRO and STT SRO. The key sensitive receptors across each SEA/EIA topic are defined in Section 5.2 following the baseline review. Section 5.2 provides the RAG assessment of risks associated with the STS Sources SRO across each SEA/EIA topic and Section 5.4 sets out the key additional work required in Gate 3 to address uncertainties and information gaps.

## 5.1 ENVIRONMENTAL BASELINE

### 5.1.1 Biodiversity

The STS SRO study area contains a number of sites that are designated at a European, national or local level as important for biodiversity, flora and fauna. These are outlined below in Table 5-1 and shown on Figure 5-1.

Several areas of habitat protected under Section 41 of the Natural Environment and Rural Communities Act 2006 (NERC Act) are also found within the study area, such as coastal and floodplain grazing marsh, traditional orchard, lowland meadows, lowland calcareous grassland and deciduous woodland (see Figure 5-2).

Further details of the relevant European sites (SAC, SPA and Ramsar) can be found in the STS Gate 2 HRA Report (Technical Annex B4) as summarised in Section 2.42.2. Other protected sites and habitats (including Sites of Special Scientific Interest (SSSIs)) are considered within the scope of the STT SRO, which has included a number of surveys during Gate 2 (e.g. habitat mapping and hydrological connectivity walkovers) to better understand water dependant habitats within the study area. Further details can be found in the '*STT SRO Gate 2 Protected Habitats Evidence Report*' and '*STT SRO Gate 2 Protected Habitats Assessment Report (Ref. STT-G2-S3-109)'.* The STT SRO assessment reports have provided a key source of information and have informed the risk assessment presented in this IEA.

Table 5-1: Designated sites in the STS SRO assessment area

| Site | Designation | Associated Schemes / Distance to Designated Site |
|---|---|---|
| Bredon Hill | SAC | Mythe WTW abstraction licence transfer (15 Ml/d) / 7.1 km |
| Cotswold Beechwoods | SAC | Netheridge WwTW discharge diversion, Haw Bridge pipeline (35 Ml/d) / 6.7 km |
| Dixton Wood | SAC | Mythe WTW abstraction licence transfer (15 Ml/d) / 8.9 km |
| Severn Estuary | SAC / SPA / Ramsar | Netheridge WwTW discharge diversion, Haw Bridge pipeline (35 Ml/d) / 10.3 km (45 km via hydrological connectivity)<br>Mythe abstraction licence transfer (15 Ml/d) / 29.2km (50 km via hydrological connectivity) |
| Walmore Common | SPA / Ramsar | Netheridge WwTW discharge diversion, Haw Bridge pipeline (35 Ml/d) / 6.2 km |
| Coombe Hill Canal | SSSI | Netheridge WwTW discharge diversion, Haw Bridge pipeline (35 Ml/d) / 0.03 km |
| Wainlode Cliff | SSSI | Netheridge WwTW discharge diversion, Haw Bridge pipeline (35 Ml/d) / 0.43 km |
| Severn Ham, Tewkesbury | SSSI | Mythe abstraction licence transfer (15 Ml/d) / 0.40 km |
| Old River Severn, Upper Lode | SSSI | Mythe WTW abstraction licence transfer (15 Ml/d) / 0.78 km |
| Innsworth Meadow | SSSI | Netheridge WwTW discharge diversion, Haw Bridge pipeline (35 Ml/d) / 0.85 km |
| Alney Island | Local Nature Reserve (LNR) | Netheridge WwTW discharge diversion, site intersected by Haw Bridge pipeline (35 Ml/d) |
| Green Farm Orchard | LNR | Netheridge WwTW discharge diversion, Haw Bridge pipeline (35 Ml/d) / 0.53 km |

In addition to the above, there are several areas of ancient woodland in the study area; these are shown on Figure 5-1.

Several species protected under the NERC Act are also found within the study area. These include both water dependant species in proximity to the River Severn which may be impacted by potential habitat changes as a

result of the STS SRO, and terrestrial species which require consideration in relation to possible pipeline construction impacts.

The STT SRO provides a description of the water dependant protected species within the study area in the '*STT SRO Gate 2 Protected Species Assessment Report' (Ref. STT-G2-S3-123).* The STT SRO also provides a description of the aquatic ecology communities within the River Seven within the study area (downstream of the proposed Haw Bridge discharge location to the tidal limit); see the '*STT SRO Gate 2 Fisheries Assessment Report'* and '*STT SRO Gate 2 Macroinvertebrates/Other Freshwater Ecology Assessment Report'*.

The '*STS SRO Gate 2 INNS Assessment Report'* (Technical Annex B7) identifies that there are 14 invasive non-native species recorded within the study area of which eight had potential to be transferred by a water transfer. Prevalent INNS species included Asian clam, New Zealand mud snail, Himalayan balsam, zebra mussel and Canadian waterweed.ST.

Figure 5-1: Biodiversity Designations

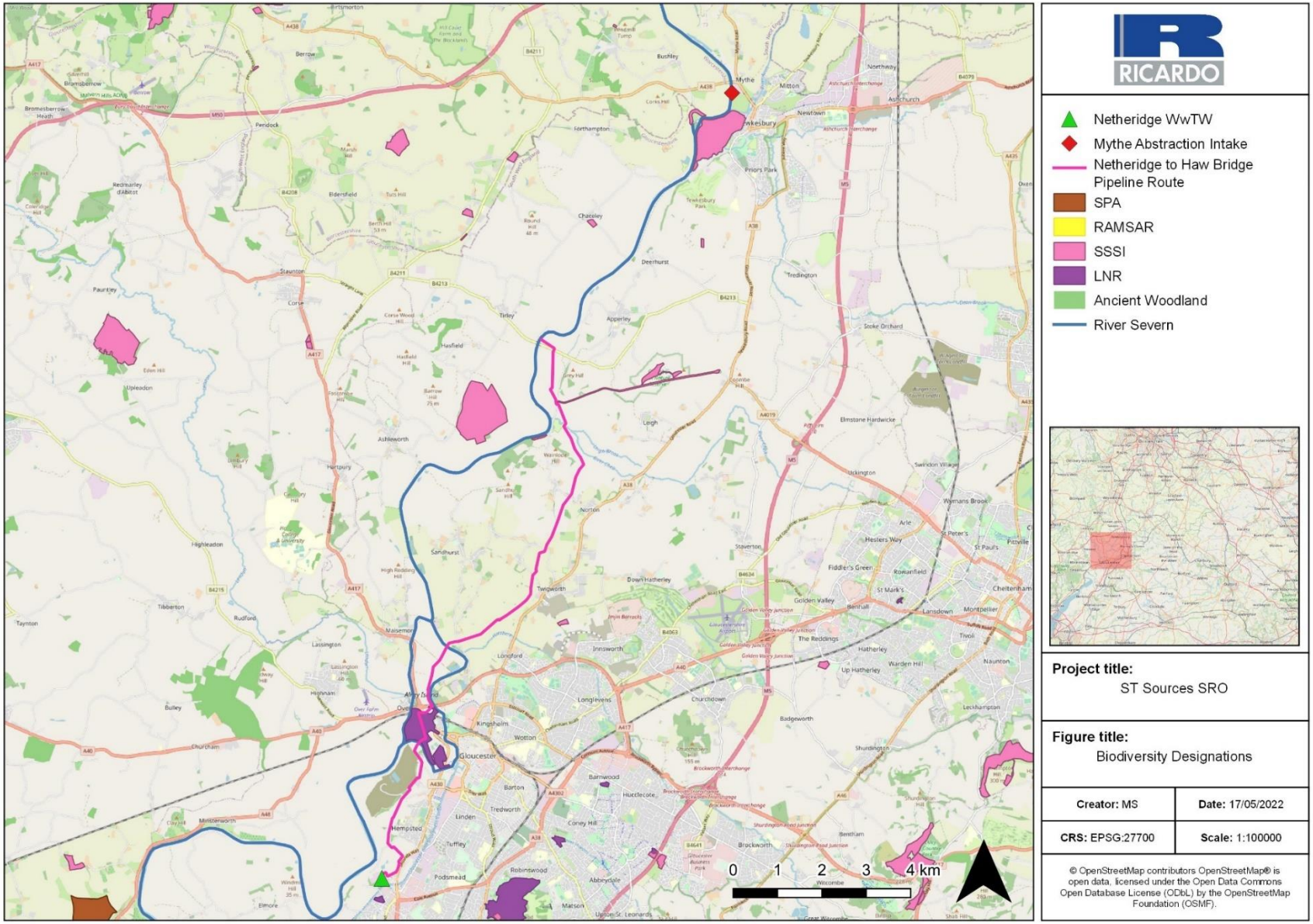
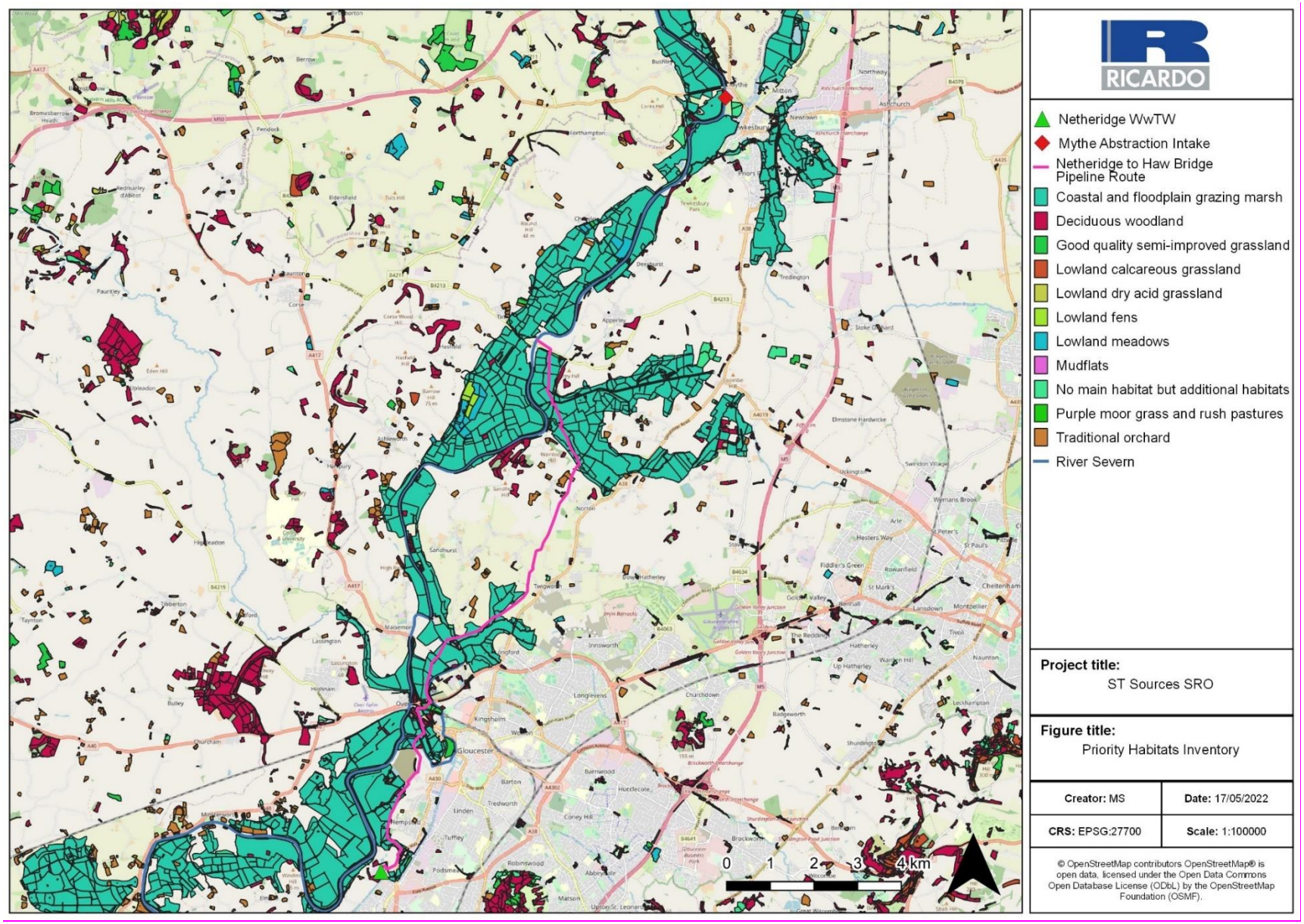


Figure 5-2: Priority Habitats Inventory



### 5.1.2 Soil and Land

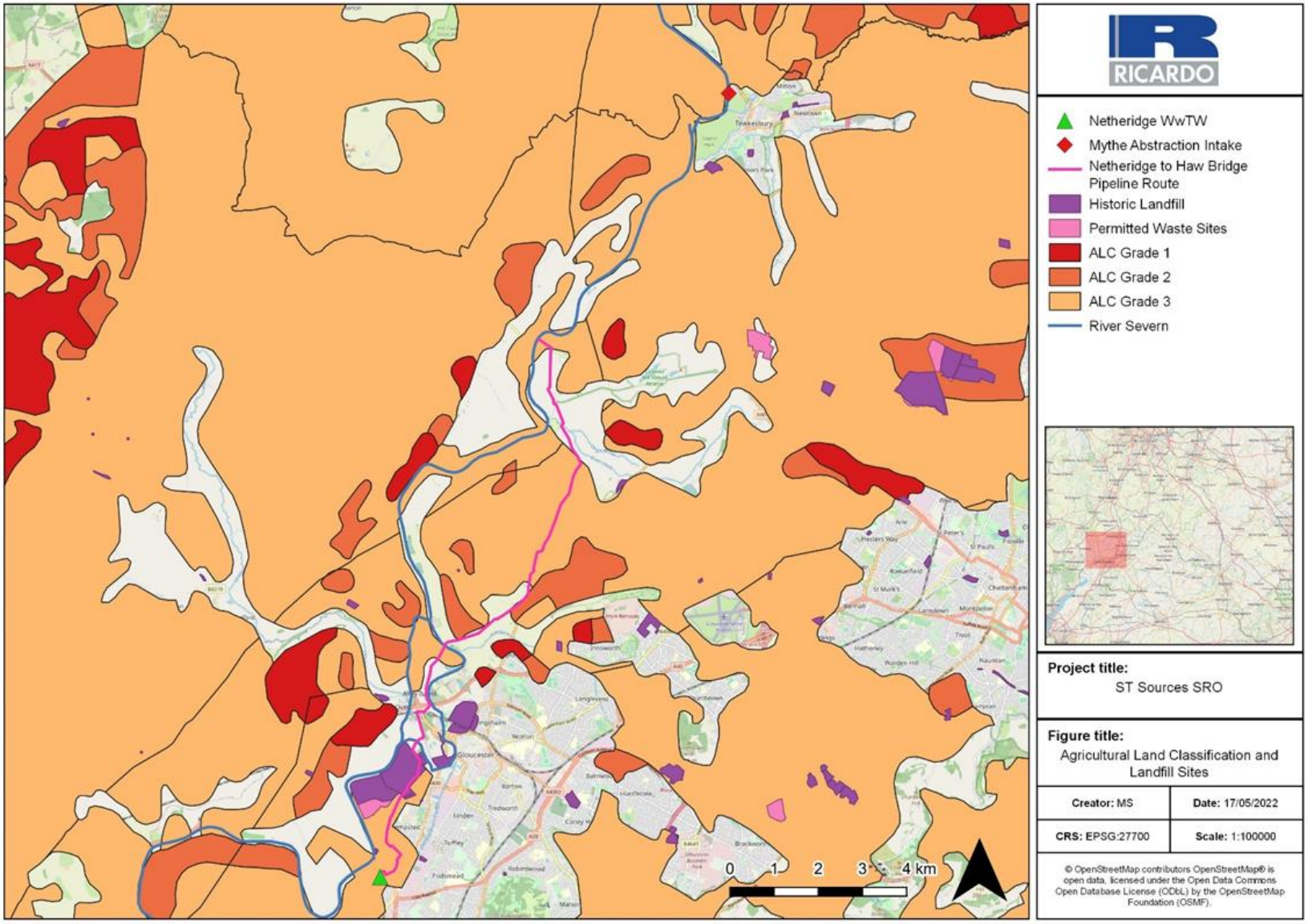
The underlying geology of the study area is comprised of Triassic and Jurassic soft rocks; largely mudstone with areas of interbedded limestone. There is a small area of aquifer to the north which is designated as low productivity.

The Soil Map of England identifies dominant soil subgroups. In terms of agricultural land quality, planning policy seeks to protect the best and most versatile agricultural land (categorised as Grades 1, 2 and 3a of the Agricultural Land Classification). Good soil structure is beneficial to water retention and crop yield. The majority of land in the study area is of Grade 3 and Grade 4, accompanied by smaller pockets of higher-grade soils (Grade 1 and 2) as demonstrated in Figure 5-3. Soil quality and structure is affected by changes in land use, groundwater levels and farming practices. Soil quality can influence run-off rates and therefore flooding and water quality.

Contaminated land is defined as land where substances could cause significant harm to people or protected species; or significant pollution of surface waters or groundwaters. Some types of contaminated land can be designated as special sites for a variety of reasons, including land that seriously affects drinking water, surface waters (e.g. lakes and rivers) and important groundwater sites. Data on contaminated land are compiled for the Government by the British Geological Survey.

The pipeline route crosses Hempsted landfill site. Historic landfill sites also pose an ongoing threat to the environment and have the potential to pollute surface and groundwaters. The majority of these sites can be dated between 1800 and 1990, when approaches to control contamination were not as stringent. There are five historic landfill sites within 500m of the Netheridge pipeline route, including Sudmeadow Road/Gloucester Refuse Tip which is crossed by the pipeline route and is also a currently permitted waste site (Figure 5-3).

Figure 5-3: Agricultural Land Classification and Landfill Sites



### 5.1.3 Water

The baseline reflects the inter-related nature of water quality, water resources (quantity) and flood risk within the overall water environment. The water environment in the study area is described in the '*STT SRO Gate 2 Annex B2.1* STT-G2-S3-104-Modelling / Physical Environment Evidence Report', *'STT SRO Gate 2 Annex B3.1* STT-G2-S3-112- Modelling / *Physical Environment Assessment Report'* and the '*STT SRO Gate 2 Annex B2.2* STT-G2-S3-105-Water Quality Evidence Report' and the '*STT SRO Gate 2 Annex B3.3* STT-G2-S3-113-*Water Quality Assessment Report'*. A baseline summary is provided below.

The assessment area is within the Severn Vale Management Catchment and spans three operational catchments:

- Severn River and Tributaries.
- Chelt, Hatherley and Normans Brook.
- Gloucester Tributaries.

For surface waters, there are two separate status classifications for water bodies: ecological and chemical. Ecological classification considers the condition of biological quality elements (e.g. fish and invertebrates), the hydromorphology of supporting habitat and the physio-chemical quality elements. Chemical classification considers priority hazardous substances and other pollutants. Table 5-2 demonstrates the draft Cycle 3 River Basin Management Plan (RBMP3) classification data for waterbodies within the study area.

Table 5-2: WFD classification data[20] for waterbodies in the STS SRO assessment area (2019, draft RBMP3 2)

| Operational Catchment | Water Body | Water Body ID | Type | Overall Ecological Status/Potential |
|---|---|---|---|---|
| Severn River and Trib | Severn - conf R Teme to conf R Avon | GB109054039760 | River, HMWB | Moderate |
| | Severn - conf R Avon to conf Upper Parting | GB109054044404 | River, HMWB | Moderate |
| | Combe Hill Canal | GB70910059 | Canal, AWB | Good |
| Chelt Hatherley and Normans Brook | Leigh Bk - source to conf R Chelt Water Body | GB109054039770 | River (not A/HMWB) | Moderate |
| | Chelt - M5 to conf R Severn | GB109054032810 | River (not A/HMWB) | Poor |
| | Hatherley Bk - source to conf R Severn | GB109054032801 | River, HMWB | Moderate |
| Gloucester Trib | Horsebere Bk - source to conf R Severn | GB109054032760 | River, HMWB | Moderate |
| | Wotton Bk - source to conf Horsebere Bk | GB109054032761 | River, HMWB | Moderate |
| | Twyver - source to conf R Severn | GB109054032702 | River, HMWB | Moderate |
| | Sud Bk - source to conf R Severn | GB109054032701 | River, HMWB | Moderate |
| | Daniels Bk - source to Glos-Sharpness Canal | GB109054032680 | River, HMWB | Moderate |
| Leadon | Leadon - conf Preston Bk to conf R Severn (W Channel) | GB109054032511 | River (not A/HMWB) | Moderate |

[20] Draft river basin management plan data

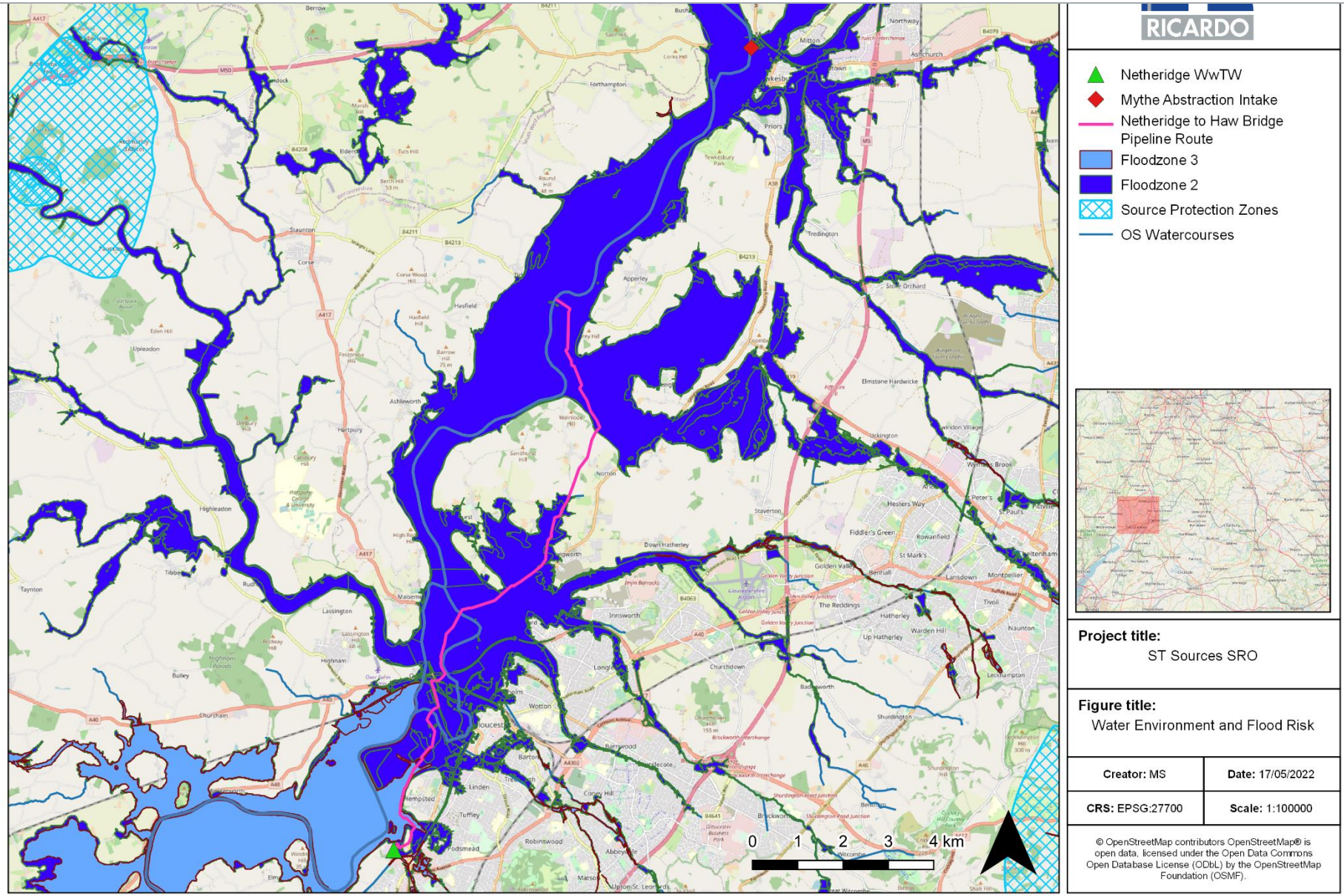
| Operational Catchment | Water Body | Water Body ID | Type | Overall Ecological Status/Potential |
|---|---|---|---|---|
| Severn River and Trib Estuary | Severn (E Channel) - Horsebere Bk to Severn Est | GB109054032750 | River, HMWB | Moderate |
| | Severn Upper | GB530905415403 | Transitional, HMWB | Moderate |
| Coastal bodies | Not part of a river water body | 154 | Coastal | N/A |
| | Not part of a river water body | 155 | Coastal | N/A |

Further details of the can be found in the *STS Gate 2 WFD Report (Technical Appendix B3)* as summarised in Section 2 above.

The assessment area is underpinned by the Severn Vale – Secondary Combined groundwater body (GB40902G204900). Under the WFD there are two separate classifications for groundwater body: chemical status and quantitative status. The groundwater body achieved 'good' status is both of these components. The STS SRO does not contain any activities relevant to the consideration of WFD groundwater bodies during the construction or operational phase.

Flooding can result from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources. The extreme floods of 2007 prompted the Pitt Review (2008) and the subsequent Flood and Water Management Act 2010 which in part regulates the implementation of sustainable drainage systems to increase infiltration and reduce flooding from surface water runoff. Across the country, the Government budgeted £2.3 bn on 1,500 flood defence schemes between 2015 -2021. The majority of the Netheridge WwTW and Mythe WTW schemes are located within flood zones 2 and 3 (Figure 5-4).

Figure 5-4: Water Environment and Flood Risk



### 5.1.4 Air

The activities associated with the construction and operation of this scheme have the potential to lead to adverse effects on local air quality through emissions associated with construction activities (including vehicle movements) or through the operation of the scheme.

The local air quality baseline can be described through the presence of designated Air Quality Management Areas (AQMA). A local authority declares an AQMA when UK national air quality targets are unlikely to be met. Figure 5-5 indicates the AQMAs in the assessment area. There is one AQMA (Priory Road) within 1 km of the Netheridge WwTW discharge diversion scheme and a further two within 3 km (Barton Street and Painswick Road).

There is one AQMA (Tewkesbury Town Centre) within 600 m of the Mythe WTW abstraction licence transfer scheme.

### 5.1.5 Climate

Water resource schemes have the potential to create beneficial effects on climatic factors through the provision of additional water resource which reduces vulnerability to water supply risks attributed to climate change. Adverse effects are also possible as the operation of the schemes rely on energy usage for treatment and pumping processes. Water companies have commitments to achieve net zero in line with government targets.

Climate monitoring and risk assessments have improved significantly over the last two decades but there are still limits to the understanding of future climate change impacts. Whatever happens to future 'greenhouse gas' emissions, there is already a certain amount of global warming "locked in" due to historic emissions due to the inertia and lags in the global climate system. Mitigation through reduction in greenhouse gas emissions will contribute to risk reduction over the long term (100 years). Adaptation is however needing to start now in order to reduce the costs and damages of potential impacts and to take advantage of opportunities that result from a changing climate.

The 2018 UK Climate Projections (UKCP18) to 2100 estimate that across the UK there will be:

- More intense rainfall events.
- Hotter, drier summers.
- More flooding of low-lying coastal areas.
- Milder and wetter winters.
- Less snowfall and frost.
- Lower groundwater levels.

The modelling and assessment work for the STT SRO has included climate change scenarios and the resilience of the scheme to climate change.

### 5.1.6 Landscape and Visual Amenity

National Character Areas (NCAs) divide England into distinct natural areas, each defined by a unique combination of landscape, biodiversity, geodiversity, history, and cultural and economic activity. The STS SRO study area is covered by the Severn and Avon Vales[21] NCA which is described as a low lying, open agricultural vale landscape made up of distinct and contrasting vales. The landscape is strongly influenced by the Severn and Avon rivers. The characteristics of this area are described below:

*The lower valleys of the rivers Severn and Avon dominate this low lying open agricultural vale landscape made up of distinct and contrasting vales, including Evesham, Berkeley, Gloucester, Leadon and Avon, with Cotswold outliers like Bredon Hill punctuating the otherwise flat vale landscape. The M5 Motorway runs through the centre and the eastern edge of the area.*

The scheme is within 1 km of the Cheltenham and Gloucester greenbelt. The Cotswolds AONB is over 4.2 km from the proposed pipeline (see Figure 5-6).

[21] Natural England (2012) NCA Profile; 106 Severn and Avon Vales (NE336)
http://publications.naturalengland.org.uk/publication/1831421?category=587130

### 5.1.7 Historic Environment

The scheme has the potential to affect historic landscape character and historic structures associated with the water environment. Archaeological remains are sensitive to changes in water quality, water levels (such as waterlogged deposits), pollution and land use practices.

The National Planning Policy Framework (NPPF[22]) defines the historic environment as: '*All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora.*'

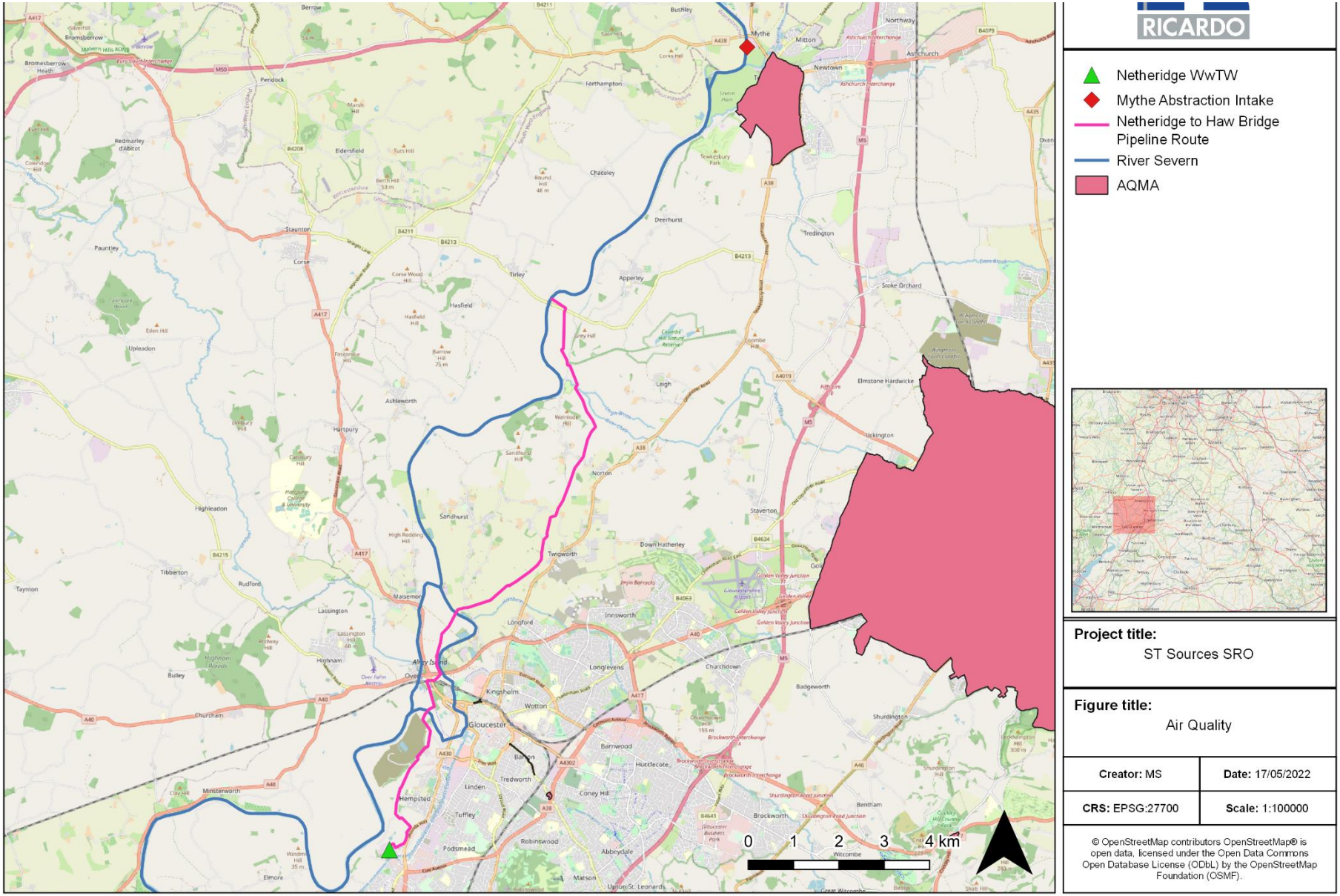
In the vicinity of the Netheridge WwTW scheme there are 38 listed buildings (including four Grade 1 and five Grade II) and five scheduled monuments within 500m of the scheme, including two scheduled monuments which fall within 110 m of the pipeline route (Lady's Well and Over Bridge). Figure 5-7 illustrates the distribution of heritage assets in the assessment area.

Surrounding the Mythe WTW abstraction intake, there are three scheduled monuments; Site of St. Mary's Abbey (1km), Holm Castle (~1.4 km) and a Deserted Medieval Village (~1.4 km) as well as six listed buildings within 500 m of the Scheme. Additionally, there is a historic battlefield (the Battle of Tewkesbury 1471) 1.2 km south of the Mythe WTW abstraction intake. This component also falls within the Tewkesbury conservation area.

In addition to sites identified above, due to the scale of the study area, there remains possibility that construction works could impact upon previously unknown, undesignated heritage assets and archaeological remains.

[22] MHCLG (2021) National Planning Policy Framework

## Figure 5-5: Air Quality



## Figure 5-6: Landscape Designations

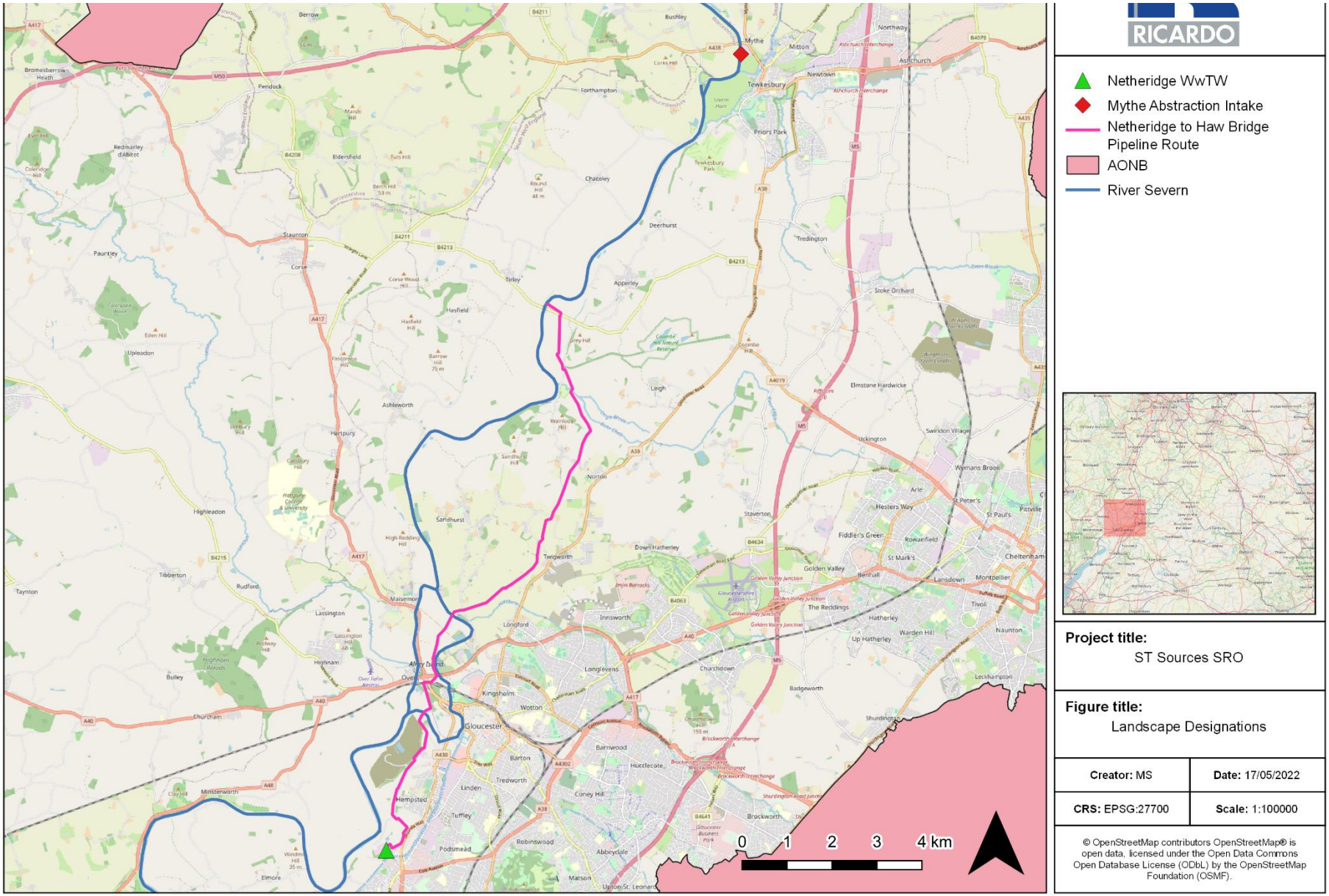
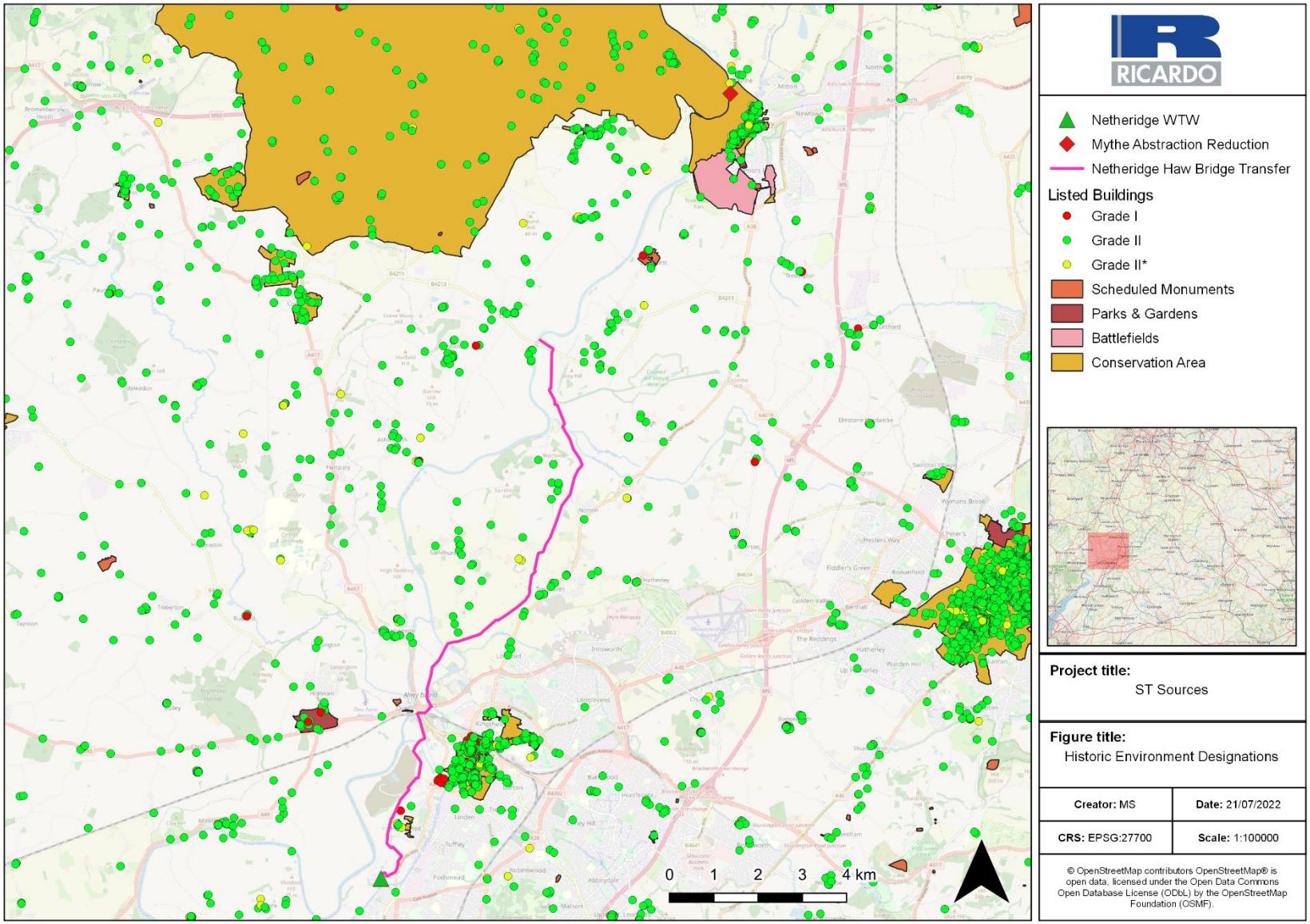


Figure 5-7: Historic Environment Designations



### 5.1.8 Population and Human Health

#### *5.1.8.1 Population*

The assessment area is underpinned by two local authority districts; Gloucester and Tewkesbury. Current population estimates and future projections are available at a subnational level and are exhibited in Table 5-3 for the year 2018 and 2028[23]. The forecasted population change for the Gloucester area is comparable with the rest of England, meanwhile Tewkesbury is anticipated to experience greater rates of population change and has the highest projected population growth of any area in England.

Table 5-3: Population estimates and future projections within the STS SRO study area

| Area | 2018 | 2028 | Population change (%) |
|---|---|---|---|
| Gloucester | 129,285 | 134,686 | 4.2 |
| Tewkesbury | 92,599 | 107,819 | 16.4 |
| England | 55,977,178 | 58,751,651 | 4.9 |

#### *5.1.8.2 Human Health*

Construction and operation of the Scheme has the potential to influence quality of life, including human health, well-being, amenity and community. Beneficial impacts could occur through the provision of additional supply of water to safeguard public health whereas adverse impacts may occur at the construction stage (e.g. noise and disruption). The proposed Netheridge WwTW pipeline route is within close proximity to a number of built-up areas including Gloucester and Twigworth. The Mythe WTW abstraction intake is within 1 km of Tewkesbury.

Life expectancy at birth is one of the main indicators used to determine the status of health and economic development amongst a demographic. For the period 2017 to 2019, life expectancy at birth in the Gloucester area was 78.6 for males and 82.9 for females. Tewkesbury experienced slightly higher life expectancies for both men and women at 81.2 and 85.2, respectively. Gloucester had slightly lower life expectancies than the average for the whole of England (79.4 for males and 83.1 for females) whereas Tewkesbury had greater life expectancies.

#### *5.1.8.3 Recreation and Tourism*

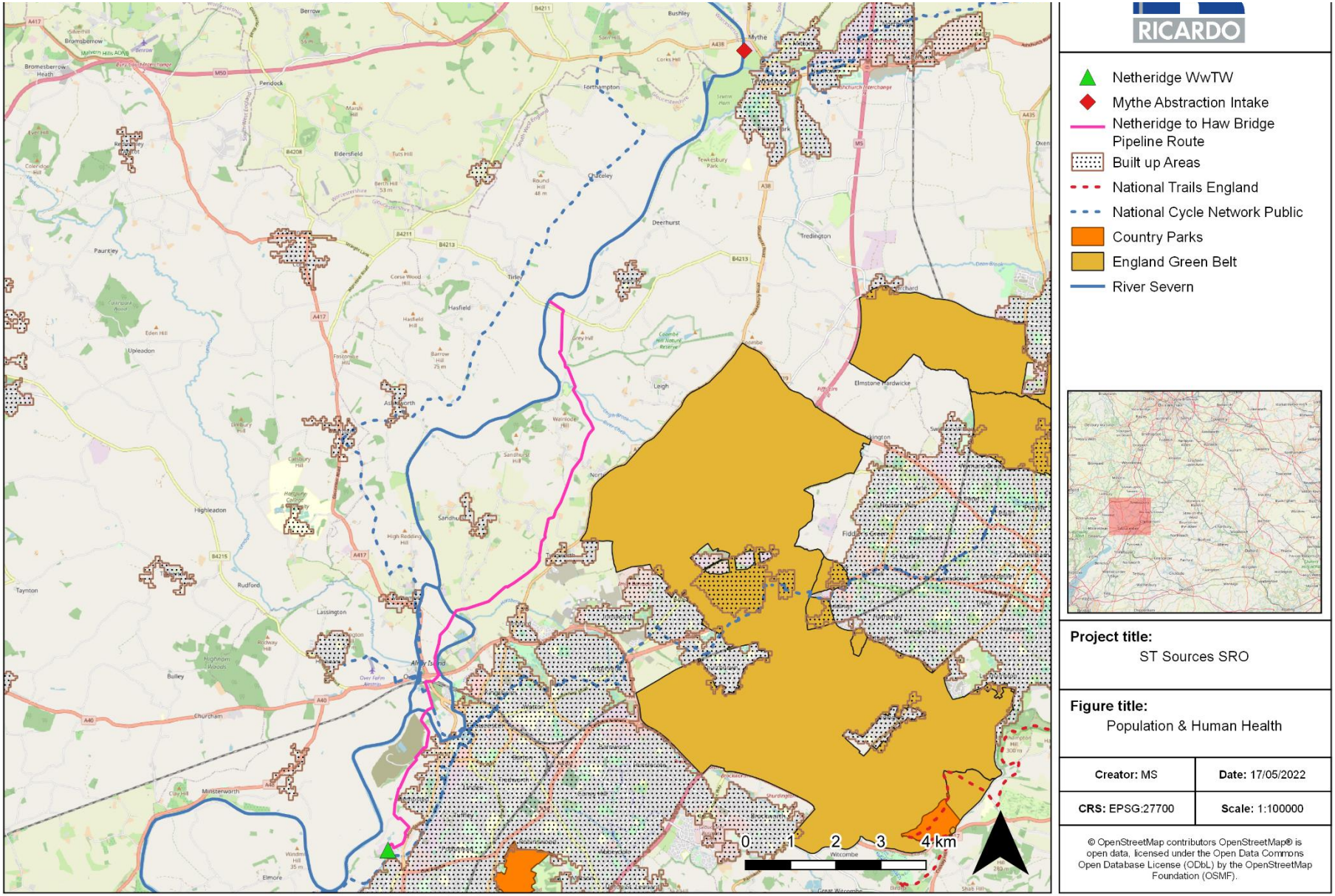
Public open space, Rights of Way, walking and cycle routes are important with respect to recreation and tourism. The National Planning Policy Framework (NPPF)[24] states planning policies should protect and enhance public rights of way and access.

The scheme has the potential to impact areas with recreational value either during construction or in operation. There are opportunities for recreation within the assessment area which are shown in Figure 5-8, including the Severn Way long distance footpath which runs adjacent to Netheridge WwTW, several National Cycle Routes, including a 400m section which is intersected by the proposed Netheridge WwTW pipeline route, playing fields within 150m and a Country Park located approximately 2km to the south east. With respect to the Mythe WTW abstraction intake, there is a National cycle route less than 500m away.

[23] ONS (2020) Subnational population projections for England, 2018-based.

[24] Ministry for Housing, Communities and Local Government (2021) National Policy Planning Framework

Figure 5-8: Population and Human Health



### 5.1.9 Material Assets

The Netheridge WwTW to Haw Bridge pipeline crosses through Tewkesbury and Gloucester, both of which are within the Gloucestershire County Council area. According to the Gloucestershire County Council website, 50.7 % of Gloucestershire's household waste was recycled in 2020-21. In 2020-2021 Tewkesbury Borough Council had a recycling rate of 48.3 % and Gloucester City Council had a recycling rate of 43.8 %, both higher than the national average of 42.3 %[25]. The County has the Gloucester Energy from Waste (EfW) facility which generates enough electricity to power around 25,000 homes, in addition to diverting 90 % of its household residual waste from landfill.

Gloucester City lies within the Severn Trent Strategic Grid area, this has been allocated a 'high vulnerability' status in the Severn Trent Water Resources Management Plan (2019). In response to this the Gloucester City Plan states that 'development proposals must demonstrate that the estimated consumption of wholesome water per dwelling should not exceed 110 litres of water per person per day'[26].

## 5.2 KEY RECEPTORS

**Table 5-4** shows a summary of the receptors per environmental topic for each of the sources discussed in this report.

Table 5-4: Summary of receptors located in the area of the STS SRO

| Environmental topic | Netheridge WwTW scheme component: Key Receptor(s) | Mythe WTW scheme component: Key Receptor(s) |
|---|---|---|
| Biodiversity | • Severn Estuary SAC, SPA and Ramsar<br>• Cotswold Beechwolds SAC<br>• Walmore Common SPA and Ramsar<br>• Coombe Hill Canal SSSI<br>• Wainelode Cliff SSSI<br>• Innsworth Meadow SSSI<br>• Alney Island LNR<br>• Green Farm Orchard LNR<br>• Ancient woodland<br>• Priority habitats and species<br>• INNS | • Bredon Hill SAC<br>• Dixton Wood SAC<br>• Old River Severn, Upper Lode SSSI<br>• Severn Ham, Tewkesbury SSSI<br>• Ancient woodland<br>• Priority habitats and species<br>• INNS |
| Soil and Land | • Permitted waste site<br>  • Hempsted landfill site<br>• Historic landfill site(s):<br>  • Sudmeadow Road / Gloucester Refuse Tip (pipeline route crosses site)<br>  • Upper Rea Farm (255m) | N/A |

[25] Local authority collected waste: annual results tables (2021) https://www.gov.uk/government/statistical-data-sets/env18-local-authority-collected-waste-annual-results-tables

[26] Severn Trent Water (2021) Letter in Support of Examination Question 34 relating to Policy G7 Water Efficiency https://www.gloucester.gov.uk/media/5138/matter-3-written-statement-severn-trent-water.pdf#:~:text=Severn%20Trent%20are%20supportive%20of%20the%20policy%20to,is%20specified%20in%20Part%20G%20of%20Building%20Regulations.?msclkid=c7d22d5fcfaf11ec9bdc4353aa3b7b1f

| Environmental topic | Netheridge WwTW scheme component:<br>Key Receptor(s) | Mythe WTW scheme component:<br>Key Receptor(s) |
|---|---|---|
| | • Between 24 and 28 Hempsted (390m)<br>• Central Electricity Generating Board (275m)<br>• Bristol Road (430m)<br>• Wainelode Cliff SSSI<br>• Agricultural land | |
| Water | • Flood Risk Zones<br>• WFD Waterbodies<br>○ Severn - conf R Avon to conf Upper Parting (GB109054044404)<br>○ Severn (E Channel) - Horsebere Bk to Severn Est (GB109054032750)<br>○ Severn Upper (GB530905415403)<br>○ Hatherley Bk - source to conf R Severn (GB109054032801)<br>○ Chelt - M5 to conf R Severn (GB109054032810)<br>○ Combe Hill Canal (GB70910059)<br>○ Coastal water body (ID 155)<br>○ Leigh Bk - source to conf R Chelt Water Body (GB109054039770)<br>○ Horsebere Bk - source to conf R Severn (GB109054032760)<br>○ Wotton Bk - source to conf Horsebere Bk (GB109054032761)<br>○ Twyver - source to conf R Severn (GB109054032702)<br>○ Sud Bk - source to conf R Severn (GB109054032701)<br>○ Daniels Bk - source to Glos-Sharpness Canal (GB109054032680)<br>○ Leadon - conf Preston Bk to conf R Severn (W Channel) (GB109054032511)<br>○ Coastal water body (ID 154) | • WFD Waterbodies<br>○ Severn - conf R Teme to conf R Avon (GB109054039760. |
| Air | • Priory Road AQMA (<1km)<br>• Barton Street AQMA (<3km) | • Tewkesbury Town Centre AQMA (550m) |

| Environmental topic | Netheridge WwTW scheme component:<br>Key Receptor(s) | Mythe WTW scheme component:<br>Key Receptor(s) |
|---|---|---|
| | • Painswick Road AQMA (<3km) | |
| Landscape and Visual Amenity | • Severn and Avon Vales National Character Area<br>• Cotswolds AONB (4.2km) | N/A |
| Historic Environment | • 38 Listed Buildings (four Grade I and five Grade II)<br>• Scheduled Monuments:<br>  ○ Lady's Well (~100m)<br>  ○ Over Bridge (~115m)<br>  ○ Hempstead village cross (~260m)<br>  ○ Over earthwork (~450m)<br>  ○ Llanthony Secunda Priory (~420m)<br>• Conservation areas near Gloucester and Hempsted | • Tewkesbury Local Conservation Area<br>• Listed buildings<br>• Battle of Tewkesbury 1471 (~1.2km)<br>• Scheduled Monuments<br>  ○ Site of St. Mary's Abbey (1km)<br>  ○ Holm Castle (~1.4km)<br>  ○ Deserted Medieval Village (~1.4km). |
| Population and Human Health | • Severn Way (adjacent to WwTW)<br>• Playing fields (150m)<br>• Robinswood Hill Country Park (2.2km)<br>• National Cycle Route (pipeline route crosses route) | • National Cycle Route (<500m) |

## 5.3 ASSESSMENT

Using a RAG based approach (see Section 3 above for further information), the key risks have been identified under each environmental topic. The approach seeks to understand the mechanisms (activities and pathways) by which activities arising from the scheme might affect the identified receptors. Table 5-5 presents the RAG assessment of the STS SRO.

The table summarises mitigation that has been specifically included within the design that avoids or reduces the impact for the environmental topic as well as additional mitigation identified through the assessment process.

Any uncertainties with the assessment completed to date are also highlighted (such as lack of data, uncertainty over how solution operates, uncertainty over level of impact).

Table 5-5: Assessment of risks across environmental topics

| Topic | Receptor | Activity and impact (construction and operational phases) | Embedded Mitigation | Additional mitigation | Uncertainties/Further Information Required | Risk RAG Rating |
|---|---|---|---|---|---|---|
| Biodiversity | Severn Estuary SAC, SPA and Ramsar | Netheridge WwTW discharge diversion, Haw Bridge pipeline – pipeline construction could result in direct impacts on floodplain grazing marsh habitat and lowland meadows (supporting habitat for designated bird interests within SPA); construction work associated with the pipeline and outfall could have an impact on river and sea lamprey ammocoete habitats and migration routes for all of the migratory species associated with the Severn Estuary (see *STS Gate 2 HRA Technical Appendix B4*). | Best practice construction methods. | Phased construction of the cofferdam to allow for lamprey to move out of the silt beds and, if required, lamprey ammocoetes should be relocated through electrofishing.<br>Directional/ baffled lighting during works on the riverbank will minimise light disturbance on the River Severn.<br>Consider the use of alternative piling rigs required and/or soft starts during the construction to reduce noise and vibration.<br>Avoiding any night-time working within the channel and scheduling construction works to avoid continuous work with the main river channel.<br>Avoid open-cut crossings of minor water courses during upstream migration period for Atlantic salmon, European eel and lamprey.<br>Avoid and/or minimise construction works between October-May.<br>Construction compounds will be sited sensitively and a buffer from designated habitats and sensitive receptors is to be maintained.<br>All habitats should be reinstated after constructions. A rehabilitation plan should be developed by a suitably qualified ecologist and should include the reinstatement of site draining in habitats that are depended on the movement of groundwater.<br>Spoil from pipeline construction should be distributed across the construction easement before topsoil replacement.<br>The approach to reinstatement of habitats should be included in the Construction Environmental Management Plan<br>No construction works will take place during the wintering season from November – March. If construction works must be conducted during the wintering season to avoid nesting birds, an Ecological Clerk of Works is recommended to undertake a bird survey prior to works to ensure no birds are present within 200m of the works. If present, works must stop until the qualifying species have exited the construction area.<br>Vehicles should be equipped with noise dampening equipment to minimise disturbances.<br>Best practice biosecurity measures should be followed, as recommended by the GB Non-Native Species Secretariat[27] to guard against any potential for spreading invasive and non-native species during construction.<br>Earthworks drainage should be controlled including use of temporary settlement ponds and measures will be taken to protect any temporarily exposed bare soil from runoff during heavy rainfall events.<br>Works will be conducted in adherence to EA Pollution Prevention Guidelines (now archived) and will required a Construction Environmental Management Plan with risk assessment for pollution incidents and a response plan if occurred. | Confirmation of implementation of all mitigation measures. | |
| | | Netheridge WwTW discharge diversion, Haw Bridge pipeline – operation and impacts on water quality, d/s Haw Bridge. This includes impacts on supporting habitats for migratory fish, impacts on migratory cues and impacts on habitats within the Severn Estuary European Marine Site that support the designated birds and fish (see *STS Gate 2 HRA Technical Appendix B4*).<br>Joint Netheridge WwTW discharge diversion, Haw Bridge pipeline & Mythe abstraction licence transfer - with the abstraction of 50Ml/d at Deerhurst and consequent augmentation of 35Ml/d at Haw Bridge, with net 15Ml/d reduction downstream of the discharge of treated effluent affecting the River Severn downstream and into the Severn Estuary. This includes impacts on supporting habitats for fish, | Advanced treatment processes at Netheridge WwTW. Tertiary treatment of effluent will consist of the following:<br>• Moving Bed Biofilm Reactor (MBBR) for the further treatment of ammonia,<br>• Ferrous sulphate dosing into the Activated Sludge Process and CoMag treatment for further treatment of total phosphorus,<br>• Biological Aerated Flooded Filter (BAFF) technology for the further treatment of Biological Oxygen | N/A | Continue to review evidence base in relation to endocrine disruptors which may act as olfactory inhibitors. | |

[27] Non-native species secretariat (2021). *Biosecurity and Prevention*. Accessed from: http://www.nonnativespecies.org/index.cfm?sectionid=58

| | | | | | | |
|---|---|---|---|---|---|---|
| | | migratory cues and the designated bird communities (see *STS Gate 2 HRA Technical Appendix B4*). | Demand 9BOD) and Total Suspended Solids (TSS)<br>• Tertiary solids removal to reduce iron concentrations from the treatment process<br>• Ozone contactor to remove organic substances such as Chlorothalonil<br>• Granular Activated Carbon (GAC) for the removal of organics such as 2,4-dichlorophenol, nonylphenols, octylphenols, perfluorooctane sulfonic acid (PFOS) and its derivatives. | | | |
| | Cotswold Beechwolds SAC | Netheridge WwTW discharge diversion, Haw Bridge pipeline - potential construction air quality impacts however site sufficiently distanced that no impacts anticipated, and site not hydrologically linked to River Severn (see *STS Gate 2 HRA Technical Appendix B4*). | Not applicable, no impact pathway. | | | |
| | Walmore Common SPA, Ramsar, SSSI | Netheridge WwTW discharge diversion, Haw Bridge pipeline - pipeline/outfall construction related impacts, including the impacts on supporting habitat for migratory fish and the designated bird communities; hydrological changes associated with the operation of the scheme are not expected to impact designated species or supporting habitat with the Severn Estuary (see *STS Gate 2 HRA Technical Appendix B4*).). | Best practice construction methods. | Construction compounds will be sited sensitively and a buffer from designated habitats and sensitive receptors is to be maintained.<br>All habitats should be reinstated after constructions. A rehabilitation plan should be developed by a suitably qualified ecologist and should include the reinstatement of site draining in habitats that are depended on the movement of groundwater.<br>Spoil from pipeline construction should be distributed across the construction easement before topsoil replacement.<br>The approach to reinstatement of habitats should be included in the Construction Environmental Management Plan<br>No construction works will take place during the wintering season from November – March. If construction works must be conducted during the wintering season to avoid nesting birds, an Ecological Clerk of Works is recommended to undertake a bird survey prior to works to ensure no birds are present within 200m of the works. If present, works must stop until the qualifying species have exited the construction area.<br>Erect solid screens or barriers around site when directly adjacent to a sensitive receptor (in mitigation register.<br>Vehicles should be equipped with noise dampening equipment to minimise disturbances.<br>Best practice biosecurity measures should be followed, as recommended by the GB Non-Native Species Secretariat28 to guard against any potential for spreading invasive and non-native species during construction.<br>Earthworks drainage should be controlled including use of temporary settlement ponds and measures will be taken to protect any temporarily exposed bare soil from runoff during heavy rainfall events.<br>Works will be conducted in adherence to EA Pollution Prevention Guidelines (now archived) and will required a Construction Environmental Management Plan with risk assessment for pollution incidents and a response plan if occurred. | Confirmation of implementation of all mitigation measures. | |
| | Bredon Hill SAC | Mythe abstraction licence transfer – no construction activities required and site not hydrologically linked to River Severn (see *STS Gate 2 HRA Technical Appendix B4*). | Not applicable, no impact pathway. | | | |
| | Dixton Wood SAC | Mythe abstraction licence transfer – no construction activities required and site not hydrologically linked to River Severn (see *STS Gate 2 HRA Technical Appendix B4*). | Not applicable, no impact pathway. | | | |
| | Coombe Hill Canal SSSI | Netheridge WwTW discharge diversion, Haw Bridge pipeline - construction air quality impacts / noise disturbance. | Rerouting of pipeline from Gate 1 to avoid direct encroachment of SSSI. | Restrict construction area working widths informed by site condition and habitat surveys. | Need for understanding of distribution of interest | |

[28] Non-native species secretariat (2021). *Biosecurity and Prevention*. Accessed from: http://www.nonnativespecies.org/index.cfm?sectionid=58

| | | | | | | |
|---|---|---|---|---|---|---|
| | | No operational impacts anticipated as site hydrologically linked to River Severn. | Pipeline crossing the Coombe Hill canal (outside the SSSI boundary) will be via micro-tunnelling techniques.<br>Best practice construction methods. | Discussions with NE to agree additional mitigation measures. | features across site, habitat and condition survey.<br>Improve understanding of hydrological connectivity.<br>Need to complete SSSI assessment with detailed design information. | |
| | Innsworth Meadow SSSI | Netheridge WwTW discharge diversion, Haw Bridge pipeline - site is sufficiently distanced (>800m) that no construction air quality impacts / noise disturbance is anticipated. | Best practice construction methods. | No additional measures identified. | N/A | |
| | Old River Severn, Upper Lode SSSI | Mythe WTW abstraction licence transfer – – no construction activities required. | Not applicable, no impact pathway. | | | |
| | Severn Ham, Tewkesbury SSSI | Mythe WTW abstraction licence transfer – – no construction activities required. | Not applicable, no impact pathway. | | | |
| | Alney Island LNR | Netheridge WwTW discharge diversion, Haw Bridge pipeline – direct habitat loss/deterioration impacts during construction, approx. 800m length of pipeline route passes through LNR, construction air quality impacts / noise disturbance.<br>Small areas of permanent infrastructure within site footprint (three shafts and one drain down point). | Pipeline route selected to follow the existing access corridor along historic railway spurs within the site.<br>Micro-tunnelling methods to be used to cross railway line towards the northern end of the site<br>Best practice construction methods. | Restrict construction area working widths informed by site condition and habitat surveys.<br>Discussions with local authority to agree additional mitigation measures (construction and operation).<br>Habitat reinstatement following construction. | Site condition and habitat surveys. | |
| | Green Farm Orchard LNR | Netheridge WwTW discharge diversion, Haw Bridge pipeline - construction air quality impacts, not considered likely to be significant given distance to site (350m). | Best practice construction methods. | N/A | N/A | |
| | Ancient woodland | Netheridge WwTW discharge diversion, Haw Bridge pipeline - closest site is sufficiently distanced (>1km) that no construction air quality impacts / noise disturbance is anticipated | Not applicable, no impact pathway | | | |
| | Priority habitats – coastal floodplain grazing marsh | Netheridge WwTW discharge diversion, Haw Bridge pipeline – pipeline route crosses approximately 7km of coastal floodplain grazing marsh habitat; potential for disruption of localised surface and groundwater flows to support habitat; construction water quality impacts; habitat deterioration (e.g., soil compaction). | Best practice construction methods. | Pipeline optimisation informed by habitat mapping and condition surveys<br>Detailed design to ensure depth of pipe does not impede flow during operational phase.<br>Avoid construction during winter to avoid disrupting grazing marsh flood events.<br>Habitat reinstatement following construction.<br>Restore natural drainage following construction. | Need for habitat mapping along pipeline route.<br>Detailed hydrogeological studies to inform pipeline routing and depth. | |
| | Priority habitats – traditional orchards; lowland meadows, lowland calcareous grassland; deciduous woodland | Netheridge WwTW discharge diversion, Haw Bridge pipeline - direct impacts during construction (lowland meadows and traditional orchards for 100m length each) and construction air quality impacts. | Best practice construction methods. | Review pipeline routing to avoid encroachment of priority habitat, and construction working areas to avoid deterioration during detailed design (to be informed by habitat surveys).<br>Habitat reinstatement following construction (if required).<br>Discussions with NE to agree additional mitigation measures. | Need for habitat mapping along pipeline route. | |
| | Protected species – amphibians, birds, mammals, terrestrial invertebrates | Netheridge WwTW discharge diversion, Haw Bridge pipeline - direct impacts during construction, habitat loss and deterioration, construction air quality impacts / noise disturbance. | Rerouting of pipeline to avoid ponds.<br>Best practice construction methods. | Avoid construction during wintering bird period (October to March).<br>Review pipeline routing and construction working areas during detailed design (informed by protected species survey along route).<br>Habitat reinstatement following construction if required.<br>Discussions with NE to agree additional mitigation measures. | Need for protected species surveys along pipeline route. | |
| | Protected species – fish | Netheridge WwTW discharge diversion, Haw Bridge pipeline - construction water quality impacts / noise & vibration disturbance.<br>Joint Netheridge WwTW discharge diversion, Haw Bridge pipeline & Mythe abstraction licence transfer – impacts on fish species are not expected as a result of hydrological and hydraulic changes, and no changes in the physico-chemical characteristics of the water are anticipated. | Pipeline crossing over major rivers will use micro-tunnelling techniques.<br>Screening of outfall in line with relevant regulations e.g., Eel Regulations.<br>Coffer dam to be constructed in low flow conditions prior to outfall construction.<br>Best practice construction methods | Minimise removal of riparian vegetation (avoid damage to bank stability, minimise habitat loss). If necessary to remove, reinstate riparian vegetation.<br>Minimise duration of any necessary in-channel working to avoid compaction, disruption of flow processes, bank erosion.<br>Measures to minimise impacts on water quality e.g. buffer strips, straw bales to stop sediment from the site compounds running off-site untreated.<br>Construction mitigation relating to fine sediment runoff and spills and leaks management to be included as defined as part of any environmental permit applications and may require some route re-alignment. | Fisheries surveys and fish habitat surveys. | |

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|---|---|---|---|---|---|---|
| | | | | Timing of in river works and high noise/vibration works to within June to October to avoid lamprey migration, and salmon and shad upstream migration and spawning periods. | | |
| | INNS | Netheridge WwTW discharge diversion, Haw Bridge pipeline - increased risk of introduction of INNS though construction activities. | Best practice biosecurity measures. | N/A | N/A | |
| | | Netheridge WwTW discharge diversion – potential new pathway for INNS distribution via new discharge location. | Treated effluent further treated before the discharge which will remove invasive species and not create additional pathways. | N/A | N/A | |
| Soil and Land | Hempsted landfill site (permitted waste site) / Sudmeadow Road Gloucester Refuse Tip (historic landfill)<br>Other historic landfill sites (Upper Rea Farm, Between 24 and 28 Hempsted Lane, Central Electricity Generating Board, Bristol Road) | Netheridge WwTW discharge diversion – potential contamination risk during construction, pipeline route crosses Hempsted landfill site and is within 500m of other historic sites. | Best practice construction methods. | Review pipeline routing during detailed design to minimise encroachment.<br>Potential measures may include limiting the extent of pipeline construction at any one time will minimise the time period for soil disturbance, separation of contaminated and non-contaminated spoil, containment to prevent runoff, and containment barriers within pipeline working areas (exact requirements to be confirmed following Site Investigation). | Ground investigation. | |
| | Wainelode Cliff SSSI | Netheridge WwTW discharge diversion, Haw Bridge pipeline - site is designated for geological interest, no construction or operational impacts are anticipated. | Not applicable, no impact pathway. | | | |
| | Agricultural Land | Netheridge WwTW discharge diversion, Haw Bridge pipeline – temporary construction impacts as pipeline route passes through two small areas of grade 2 agricultural land and through larger areas of grade 3 land. | Best practice construction methods. | Limit extent of pipeline construction at any one time to minimise time period for soil disturbance.<br>Review pipeline routing during detailed design to minimise encroachment. | N/A | |
| Water | WFD Waterbodies<br>• Severn - conf R Teme to conf R Avon (GB109054039760)<br>• Severn - conf R Avon to conf Upper Parting (GB109054044404)<br>• Severn (E Channel) - Horsebere Bk to Severn Est (GB109054032750)<br>• Severn Upper (GB530905415403)<br>• Hatherley Bk - source to conf R Severn (GB109054032801)<br>• Chelt - M5 to conf R Severn (GB109054032810)<br>• Combe Hill Canal (GB70910059)<br>• Coastal water body (ID 155). | Netheridge WwTW discharge diversion, Haw Bridge pipeline – water quality and geomorphology impacts during construction of discharge outfall and river/stream crossings. | Best practice construction methods.<br>Tunnelling under main river crossings. | To include measures as set out for protected fish species above. | N/A | |
| | | Joint Netheridge WwTW discharge diversion, Haw Bridge pipeline & Mythe WTW abstraction licence transfer – operation of the scheme will not lead to a deterioration of any waterbody. | Advanced treatment processes at Netheridge WwTW. Tertiary treatment of effluent will consist of the following:<br>• Moving Bed Biofilm Reactor (MBBR) for the further treatment of ammonia,<br>• Ferrous sulphate dosing into the Activated Sludge Process and CoMag treatment for further treatment of total phosphorus,<br>• Biological Aerated Flooded Filter (BAFF) technology for the further treatment of Biological Oxygen Demand 9BOD) and Total Suspended Solids (TSS)<br>• Tertiary solids removal to reduce iron concentrations from the treatment process<br>• Ozone contactor to remove organic substances such as Chlorothalonil<br>Granular Activated Carbon (GAC) for the removal of organics such as 2,4-dichlorophenol, nonylphenols, octylphenols, perfluorooctane sulfonic acid (PFOS) and its derivatives. | N/A | Further consideration at detailed design stages to address scheme changes and additional information. | |

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|---|---|---|---|---|---|---|
| | WFD Waterbodies<br>• Leigh Bk - source to conf R Chelt Water Body (GB109054039770)<br>• Horsebere Bk - source to conf R Severn (GB109054032760)<br>• Wotton Bk - source to conf Horsebere Bk (GB109054032761)<br>• Twyver - source to conf R Severn (GB109054032702)<br>• Sud Bk - source to conf R Severn (GB109054032701)<br>• Daniels Bk - source to Glos-Sharpness Canal (GB109054032680)<br>• Leadon - conf Preston Bk to conf R Severn (W Channel) (GB109054032511)<br>• Coastal water body (ID154). | Netheridge WwTW discharge diversion, Haw Bridge pipeline – no direct impacts and intersect only with 1km buffer around pipeline | Not applicable, no impact pathway. | | | |
| | Groundwater | Netheridge WwTW discharge diversion, Haw Bridge pipeline – excavation associated with pipeline construction has the potential to affect groundwater quality and quantity in particular in the vicinity of Alney Island (high groundwater table) | Best practice construction methods. | Storage lagoons and other measures to be defined following ground investigations. | Ground investigation. | |
| | Flood Risk | Netheridge WwTW discharge diversion, Haw Bridge pipeline – potential for impact on flood risk during pipeline construction. | Best practice construction methods including flood compensation ponds.<br>Tunnelling under main river crossings. | Further mitigation measures will be set out in the applications for Flood Defence Consents where these are required for the river crossing construction works. | Flood Risk Assessment | |
| Air Quality | Residential properties, other locations, in particular within Priory Road AQMA, Barton Street AQMA, Painswick Road AQMA | Netheridge WwTW discharge diversion, Haw Bridge pipeline – air emissions and dust from construction traffic and equipment. | Best practice construction methods. | Consider measures to reduce construction traffic e.g. transportation of construction materials via rail and/or water. | Desk based air quality assessment | |
| | Tewkesbury Town Centre AQMA (550m) | Mythe WTW abstraction licence transfer – – no construction activities required. | Not applicable, no impact pathway. | | | |
| Landscape | Severn and Avon Vales National Character Area<br>Cotswolds AONB (4.2km) | Netheridge WwTW discharge diversion, Haw Bridge pipeline – construction activities/removal of vegetation effects on landscape character, the setting of landscape and heritage features, the character and amenity value of views.<br>Permanent above-ground installations would be limited and small in size, therefore landscape and visual effects during operation are unlikely to be significant. | Outfall structure proposed to be submerged which will avoid visual disturbance.<br>Best practice construction methods. | Discussions with NE to agree additional mitigation measures. | Desk based Landscape and Visual Impact Assessment | |
| Historic Environment | Scheduled Monuments:<br>• Lady's Well (~100m)<br>• Over Bridge (~115m)<br>• Hempstead village cross (~260m)<br>• Over earthwork (~450m) | Netheridge WwTW discharge diversion, Haw Bridge pipeline – disturbance to setting of heritage assets during pipeline construction, potential for disturbance of unknown assets. | Rerouting of pipeline to avoid known heritage assets;<br>Best practice construction methods. | Sensitive location of construction compounds to avoid heritage assets and retain a buffer around them to be defined further in consultation with Historic England.<br>Discussions with Historic England and the local authority to review the route alignment and working areas and agree additional mitigation measures.<br>Monitoring by qualified staff prior and during construction as agreed in investigation programme, including recording and intervention as appropriate. | Desk based study of cultural heritage assets within and adjacent to construction works (confirmation of locations, descriptions of assets).<br>Agreement of programme of archaeological and heritage investigation | |

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|---|---|---|---|---|---|---|
| | • Llanthony Secunda Priory (~420m)<br>Listed buildings<br>Conservation areas near Gloucester and Hempsted | | | | with Historic England and the local authority. | |
| | Scheduled Monuments<br>• Site of St. Mary's Abbey (1km)<br>• Holm Castle (~1.4km)<br>Battle of Tewkesbury 1471 (~1.2km)<br>Listed buildings<br>Tewkesbury Local Conservation Area | Mythe WTW abstraction licence transfer – – no construction activities required | Not applicable, no impact pathway | | | |
| Population and Human Health | Local communities | Netheridge WwTW discharge diversion, Haw Bridge pipeline - construction noise & vibration disturbance, air quality effects. | Best practice construction methods. | Construction compounds to be sited sensitively and away from residential areas and along the pipeline next to a main road, so that there is least disturbance to local traffic.<br>The hours of working associated with the construction of the treatment works, other sites and pipeline route limited to minimise amenity and environmental impacts. | Desk based air quality assessment<br>Desk based noise assessment | |
| | Severn Way footpath (adjacent Netheridge WwTW)<br>Playing fields (150m)<br>Robinswood Hill Country Park (2.2km)<br>National Cycle Route (0km) | Netheridge WwTW discharge diversion, Haw Bridge pipeline - construction noise & vibration disturbance. | Best practice construction methods. | Consider reviewing route to avoid recreational areas.<br>Avoid temporary closure of public rights of way and diversions.<br>All closures to be agreed with the relevant regulators and stakeholders.<br>Alternative routes identified if possible, using existing public rights of way or public highways, with appropriate signage.<br>Any public rights of way affected during construction to be reinstated following completion of works.<br>Screening to be used where required in construction locations which are in proximity to public rights of way. | Desk based assessment of recreational impacts | |

## 5.4 NEXT STEPS AT GATE 3 (AND BEYOND)

The following table (Table 5-6) provides an overview of the additional work required to inform the Gate 3 environmental assessment and development of the SRO, focusing on the key risks considered in Section 5 above. The additional information is required due to the greater level of assessment expected at Gate 3 and does not necessarily impact on the certainty for the Gate 2 assessments.

The Regional Plan modelling suggests that the STS SRO, along with the STT SRO, need to be operational by c. 2031 and therefore a planning application, most likely a Development Consent Order, will be required c. 2026. As such, a wider breadth of environmental topic areas than those identified below (e.g. noise, socio-economics) will need to be considered as part of any Environmental Impact Assessment (EIA) to support the planning process. The scope of this assessment, and supporting baseline surveys and modelling work, would be discussed and agreed with the regulators in due course.

Each of the Regulatory Assessments presents recommendations for Gate 3 and further assessments and are briefly detailed in Section 2.

Table 5-6: Gate 3 Lookahead

| Topic/Receptor | Data gaps/uncertainties | Proposed work at Gate 3 |
|---|---|---|
| **Biodiversity, flora and fauna** | | |
| Severn Estuary SAC and Ramsar site | • Limited evidence base in relation to endocrine disruptors. | Continue to review evidence base in relation to endocrine disruptors which may act as olfactory inhibitors. |
| Coombe Hill Canal SSSI | • Is there the potential for the pipeline to cause localised drying of wetland habitats/change in preferential flow pathways?<br>• Where are the interest features found within the site?<br>• How significant would air quality and noise disturbance issues be during construction. | Site condition assessment and mapping of interest features.<br>Establish whether there is any hydrological connectivity with the River Severn/source of water to the canal.<br>SSSI impact assessment supported by specialist air quality and noise assessments. |
| Alney Island LNR | • No data on the extent of interest features within the site or condition.<br>• Potential for significant loss of trees in northern area of site in open cut sections. | UK Habs survey.<br>Review pipeline routing and construction methods (trenchless) within LNR.<br>Assessment of habitat loss and mitigation/compensation measures required. |
| Priority habitat – coastal and floodplain grazing marsh | • Extent and quality of priority habitat within pipeline route corridor.<br>• Hydrological connectivity with River Severn. | UK Habs survey to identify areas of wetland/marsh<br>Review of hydrogeology (surface and groundwater flows) to identify areas which could be at higher risk of drying/water impedance if pipeline crosses |
| Priority habitats | • Uncertainty regarding loss of priority habitats; not currently quantified.<br>• Multiple crossings of river and streams priority habitat; cumulative effect.<br>• Data not publicly available for linear features e.g. hedgerows and arable field margins. | Where common pipeline corridors can be determined, and following further route optimisation, quantify types and areas of priority habitat that could be lost.<br>Obtain relevant biological record centre data once common pipeline corridors are identified, to aid pipeline route optimisation.<br>Desk based assessment with ground truthing of acceptable crossing points of the water courses (where there is existing infrastructure, no wetland habitat) to identify common crossing points to be used by all pipelines where possible.<br>Commence habitat mapping, UK Habs surveys and identification of Tree Protection Orders/trees of value. |
| Priority species | • Currently only considered in relation to designated sites. | Where site selection and common pipeline corridors can be determined, obtain relevant protected species information and commence targeted survey work. |
| Fish | • Use of habitat within the footprint of the outfall uncertain.<br>• Construction method for outfall uncertain; potential noise and vibration issues if piling required.<br>• Limited evidence base in relation to endocrine disruptors. | River MoRPH and fish surveys<br>Underwater noise assessment<br>Continue to review evidence base in relation to endocrine disruptors which may act as olfactory inhibitors. |
| Local designations | • Lack of understanding as to effect on local sites. | Obtain data for Sites of Importance for Nature Conservation. |
| **Soils and geology** | • Sufficient information available to complete strategic initial-option level assessment. | Establish composition of waste in existing/historic landfills and risk of encountering contaminated soils, landfill gas and leachate.<br>Carry out site investigations and Envirocheck review where pipeline cannot be re-routed to avoid areas. |
| | • Uncertainty over impacts to Wainloade Cliff SSSI. | Complete geological assessment of potential impacts. |

| Topic/Receptor | Data gaps/uncertainties | Proposed work at Gate 3 |
|---|---|---|
| **Land use** | • Significant potential to disrupt agricultural practices, existing drainage networks, and adversely affect Grade 2 and 3 land.<br>• The extent of temporary severance during construction for each individual landholding is unknown at present. | Review pipeline routing within individual field boundaries (arable) to establish whether existing paths/boundaries could be followed to minimise severance and temporary exclusion/sterilisation of areas.<br>Engage with land agents at earliest opportunity to establish landowner requirements (e.g. crop rotation/removal, drainage, and likely compensation package) |
| **Water resources and water quality** | • This assessment will require review and update at Gate 3 as the Scheme design evolves. In particular, several WFD water bodies that are crossed by the proposed pipeline which were screened out at the Level 1 assessment may need to be considered further at the Gate 3 assessment when further details on pipeline drain-down and maintenance become available, and especially if the pipeline is likely to be drained into these water bodies.<br>• Potential impacts to groundwater should be considered at the next stage of the assessment if the Scheme activities have the potential to impact on WFD groundwater bodies or sensitive groundwater features. | Review WFD assessment against any final Scheme design changes which could alter the WFD assessment. |
| **Flood Risk** | • Requirement for permanent infrastructure within Flood Zone 3 uncertain (e.g. pumping station, telemetry kiosks, valves for pipeline) | Obtain Environment Agency Product 4 data (detailed flow rates, flood levels and flood extents) for Flood Risk Assessment. |
| **Air quality** | • No quantification of impacts to residential receptors. | Desk based air quality assessment with identification of key receptors and likely impacts. |
| **Landscape and visual amenity** | • Localised impact of construction route through National Character Area not fully understood.<br>• Impact to visual amenity from loss of trees and hedgerows uncertain – temporary but long-term effect. | Desk based Landscape and Visual Impact Assessment |
| **Historic environment** | • Proximity of pipeline route to a number of scheduled monuments and uncertainty as to whether the setting of these heritage features could be impacted.<br>• Uncertainty over range of impacts to local resources. | Desk based assessment of sensitivity of scheduled monuments to pipeline construction and identify if pipeline routes need to be altered.<br>Local archaeological designations to be considered. |
| **Population and human health** | • Uncertainty over range of impacts to recreational resources.<br>• Uncertainty as to whether construction method for outfall construction could impact navigation. | Desk based assessment of recreational impacts.<br>Navigation assessment and/or incorporation of measures into outline Construction Environmental Management Plan |

# 6. ASSESSMENT OF CUMULATIVE EFFECTS

## 6.1 INTRODUCTION

The cumulative effects and in-combinations assessment draw on the proposed approach outlined in the SRO Cumulative effects methodology note[29] (see Section 3 above). As described, where appropriate, the SRO cumulative effects assessments will refer to the cumulative effects assessments undertaken for Regional Plans and Water Company WRMPs and acknowledge that the outcome of such assessments will need to be updated as SROs detailed designs develop and as part of the EIA-stage cumulative effects assessment. The conclusions of the Regional Plan and WRMPs are not available at the time of drafting this IEA.

It is assumed that the Regional Plan and WRMP24 assessments have concluded no significant in-combination and cumulative effects at a plan level, enabling the SRO to progress. This SRO specific cumulative effects assessment looks in further detail at the sites and surrounding area in terms of local and site-specific information including large development allocations within Local Plans and larger planning applications.

The Mythe WTW abstraction licence transfer scheme is located within the area of the Tewkesbury Borough Council. The Netheridge WwTW discharge diversion and Haw Bridge pipeline scheme crosses through both the Tewkesbury Borough Council and Gloucester City Council authorities. The following information sources have been used to identify the list of other developments and plans that could be included in the cumulative effects assessment with other plans and developments. A 2 km ZOI has been used to reflect the guidance and to initially capture a maximum search area for developments and plans. The list of other developments and plans within the ZoI of the STS SRO are shown in Table 6-1.

- **Gloucester City Council Website - Planning applications**

  Great Western Yard is within 2 km
- **Gloucester City 2019 Plan**

  No developments within 2 km identified as 'Large local plan allocations'
- **Tewkesbury Borough Council Website - Planning application advanced search (Major dwellings, mineral, Major retail)**

  Strategic allocations Innsworth and Twigworth are both within 1 km.
- **Planning Inspectorate's Programme of Projects**

  M5 Junction 10 Improvements (Tewkesbury) more than 2 km away and A417 Missing Link (Cotswold) more than 2 km away.
- **Joint Core Strategy (JCS)** which includes Cheltenham, Gloucester and Tewkesbury.

  All strategic allocations were checked and only Innsworth and Twigworth are within 2 km, with the next closest is Churchdown strategic allocation approximately 2.4 km away.
- **Transport and Works Act (TWA) applications and decisions**

  None within 2 km.
- **Hybrid Bills**

  Only HS2 was listed and outwith 2 km from the SRO schemes.
- **Gloucester County Council Website – Planning application advanced search**

  Tewkesbury Major Mineral Application, Tewkesbury Major Waste Application, Gloucester Major Mineral Application and Gloucester Major Waste Application. All applications are either located more than 2km away or dated 2015 or older.

[29] The latest version of the note was circulated on 5 April 2022, with a subsequent meeting with the NAU Leads to formally agree its adoption for the SRO process.

## 6.2 CUMULATIVE EFFECTS ASSESSMENT WITH OTHER PLANS AND DEVELOPMENTS

The list of developments and plans has been used to assess the cumulative effects of the SROs which are presented in Table 6-1.

The results of the cumulative effects assessment are presented in Table 6-2. At this stage there are no significant cumulative effects identified with other developments or plans. This assessment will need to be reviewed during Gate 3.

Table 6-1: Schedule of Developments

| Application reference | Planning Authority | Applicant and brief description | Closest distance from scheme boundary and orientation | Planning status | Overlap in temporal scope? | Scale and nature of development likely to have a significant effect? | Potential receptors affected | Other factors | Progress to cumulative assessment? |
|---|---|---|---|---|---|---|---|---|---|
| 15/00749/OUT | Tewkesbury Borough Council | Innsworth Strategic Allocation: A mixed use development comprising demolition of existing buildings, up to 1,300 dwellings and 8.31 hectares of land for employment generating uses comprising a neighbourhood centre of 4.23ha, office park of 1.31ha and business park of 2.77ha, primary school, open space, landscaping, parking and supporting infrastructure and utilities, and the creation of new vehicular accesses from the A40 Gloucester Northern Bypass, Innsworth Lane and Frogfurlong Lane. | 800 m to the east | Decided - Permitted | Construction commenced in 2019 | Y | Innsworth Meadow SSSI within development site.<br>Existing community in Innsworth within Gloucester Built up Area. | None | Y |
| 15/01149/OUT | Tewkesbury Borough Council | Twigworth Strategic Allocation: A mixed use development comprising demolition of existing buildings; up to 725 dwellings and a local centre of 0.33ha; primary school, open space, landscaping, parking and supporting infrastructure and utilities; and the creation of a new vehicular access from the A38 Tewkesbury Road. | 300 m to the east | Decided - Permitted | Y – Works are ongoing | Y | Existing community within the Twigworth Built up Area. | None | Y |
| 22/00323/EIA | Gloucester City Council | Great Western Yard: Proposed residential development scheme of up to 330 dwellings with associated landscaping, parking, and ancillary works on land at Great Western Yard, Great Western Road, Gloucester. | 1.7 km to the southeast | Not yet decided | Net yet known | N | Existing community within Gloucester Built up Area. | None | N |
| 15/00749/OUT | Tewkesbury Borough Council | Land North of Innsworth Lane: Provision of site infrastructure including primary road carriageway and attenuation ponds along with associated engineering works. | 800 m to the east | Decided - Approved | Y – Works are ongoing | Y | Innsworth Meadow SSSI within development site. | None | Y |

| Application reference | Planning Authority | Applicant and brief description | Closest distance from scheme boundary and orientation | Planning status | Overlap in temporal scope? | Scale and nature of development likely to have a significant effect? | Potential receptors affected | Other factors | Progress to cumulative assessment? |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Existing community in Innsworth within Gloucester Built up Area. | | |

Table 6-2: Cumulative Effects Assessment Matrix

| Application Reference | Planning Authority | Applicant and brief description of development | Potential for cumulative effects with the scheme | Potential mitigation |
|---|---|---|---|---|
| 15/00749/OUT | Tewkesbury Borough Council | Innsworth Strategic Allocation: A mixed use development comprising demolition of existing buildings, up to 1,300 dwellings and 8.31 hectares of land for employment generating uses comprising a neighbourhood centre of 4.23ha, office park of 1.31ha and business park of 2.77ha, primary school, open space, landscaping, parking and supporting infrastructure and utilities, and the creation of new vehicular accesses from the A40 Gloucester Northern Bypass, Innsworth Lane and Frogfurlong Lane. | The development is located 800m from the Netheridge WwTW pipeline. The construction programme of the development is unknown, but it is unlikely that there would be any overlap between the construction of the scheme and the development<br>As the scheme consists of an underground pipeline it will not be visible to any nearby residential receptors and noise impacts are not expected during operation. However, construction of the scheme may cause impacts (e.g. noise, vibration, dust, visual) if there are residents residing within the development prior to works commencing on the scheme.<br>Innsworth Meadow SSSI is within the development site, thus mitigation measures have been implemented to reduce the impact of the development on the protected site. Sustainable Urban Drainage Systems (SUDS) will ensure that groundwater levels and soil moisture within the SSSI are maintained. A buffer has been allocated surrounding the SSSI and nearby footpaths will be well maintained and controlled to protect the site from outside disturbances. The SSSI will also remain in private ownership and not be accessible to the public, therefore recreational impacts on the SSSI are not considered to be significant. Innsworth Meadow SSSI is 850m from the proposed Netheridge WwTW pipeline and no significant adverse residual effects have been identified as a result of the Innsworth Strategic Allocation development. It is unlikely that when combined with the | No additional mitigation has been identified above the measures which would be included within a Construction Environmental Management Plan. |

| Application Reference | Planning Authority | Applicant and brief description of development | Potential for cumulative effects with the scheme | Potential mitigation |
|---|---|---|---|---|
| | | | pipeline scheme the effects would result in significant cumulative effects. | |
| 15/01149/OUT | Tewkesbury Borough Council | Twigworth Strategic Allocation: A mixed use development comprising demolition of existing buildings; up to 725 dwellings and a local centre of 0.33ha; primary school, open space, landscaping, parking and supporting infrastructure and utilities; and the creation of a new vehicular access from the A38 Tewkesbury Road. | The development is located approximately 300m from the Netheridge WwTW pipeline. The construction programme of the development is unknown, but it is unlikely that there would be any overlap between the construction of the scheme and the development<br><br>As the scheme consists of an underground pipeline it will not be visible to any nearby residential receptors (Twigworth Built Up Area (BUA)) and noise impacts are not expected during operation. However, construction of the scheme may cause impacts (e.g. noise, vibration, dust, visual) if there are residents residing within the development prior to works commencing on the scheme.<br>The development has not predicted any significant adverse residual effects; thus it is considered unlikely that when combined with the pipeline scheme the effects would result in significant cumulative effects. | No additional mitigation has been identified above the measures which would be included within a Construction Environmental Management Plan. |
| 15/00749/OUT | Tewkesbury Borough Council | Land North of Innsworth Lane: Provision of site infrastructure including primary road carriageway and attenuation ponds along with associated engineering works. | The development is located 800m from the Netheridge WwTW pipeline. The construction programme of the development is unknown, but it is unlikely that there would be any overlap between the construction of the scheme and the development<br>As the scheme consists of an underground pipeline it will not be visible to any nearby residential receptors and noise impacts are not expected during operation. However, construction of the scheme may cause impacts (e.g. noise, vibration, dust, visual) if there are residents residing within the development prior to works commencing on the scheme.<br>Innsworth Meadow SSSI is within the development site, thus mitigation measures have been implemented to reduce the impact of the development on the protected site. Innsworth Meadow SSSI is 850m from the proposed Netheridge pipeline and no significant adverse residual effects have been identified as a result of the Land North of Innsworth Lane development. It is unlikely that when combined with the pipeline scheme the effects would result in significant cumulative effects. | No additional mitigation has been identified above the measures which would be included within a Construction Environmental Management Plan. |

## 6.3 INTER-RELATIONSHIPS BETWEEN EFFECTS

Potential effects of the STS SRO on key sensitive receptors are identified in Section 5.

Potentially, local communities (including schools) could be affected by multiple environmental effects during the construction of the project (see Table 6-3). Further assessment will be required during Gate 3 to establish cumulative effects on specific receptors.

Table 6-3 Intra-effects cumulative assessment matrix

| Receptor | Potential cumulative effects | Mitigation |
|---|---|---|
| Local communities | Noise – potential for noise during construction.<br>Vibration – potential for vibration during construction.<br>Air Quality – potential for dust and emissions during construction.<br>Visual – potential for visual effects during construction. | No additional mitigation is likely to be required beyond standard good practice construction measures. |

# 7. STAKEHOLDER ENGAGEMENT

Please refer to the Chapter 9 of the Severn Trent Sources Strategic Regional Water Resource Solution Option, Gate 2 Submission, which outlines stakeholder engagement undertaken during Gate 2.

# 8. WIDER BENEFITS

Please refer to Section 7.4 of the Technical Annex A1, the Gate 2 Concept Design Report, which outlines wider benefits of the scheme.

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