

Strategic Regional Water Resource Solutions: Annex B2.5: Invasive Non-Native Species (INNS) Evidence Report

Standard Gate Two Submission for River Severn to River Thames Transfer (STT)

Date: November 2022



Severn to Thames Transfer

INNS evidence report

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Disclaimer

This document has been written in line with the requirements of the RAPID Gate 2 Guidance and to comply with the regulatory process pursuant to Thames Water's, Severn Trent Water's and United Utilities' 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, Thames Water, Severn Trent Water and United Utilities will be subject to the statutory duties pursuant to the necessary consenting processes, including environmental assessment and consultation as required. This document should be read with those duties in mind.



SEVERN THAMES TRANSFER SOLUTION

Invasive Non-Native Species (INNS) Evidence Report

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CONTENTS

1. Introduction	1
1.1 Background and description of the STT scheme	1
1.1.1 The River Severn to River Thames Transfer Description	1
1.1.2 Gate 1	1
1.1.3 Gate 2	2
1.2 STUDY AREA	3
1.3 Aim of this report	5
2. Evidence Base for, and Approach to, the Gate 2 INNS Assessment	5
2.1 Scope and approach to the Gate 2 assessment and evidence base	5
2.2 Additional data collected during Gate 1 and Gate 2	8
3. Conclusions	9
3.1 Summary of baseline data, uncertainty and data gaps	9

Figures

Figure 1.1 Flow chart showing the investigations undertaken for Gate 2 and their interactions	3
Figure 1.2 Map showing the study area and associated catchments	4

Tables

Table 2-1 Evidence and approach to the Gate 2 INNS assessment	7
Table 3-1 Survey locations for the STT Solution monitoring programme for INNS	10

1. INTRODUCTION

1.1 BACKGROUND AND DESCRIPTION OF THE STT SCHEME

1.1.1 The River Severn to River Thames Transfer Description

The aim of the Severn Thames Transfer is to provide additional raw water resources of 300 to 500MI/d to the South East of England during drought, with 500MI/d preferred by the Water Resources in the South East (WRSE) group's emerging regional plan. The water would be provided from flows in the River Severn and transferred via an interconnector to the River Thames. For the completion of the Gate 2 assessment, a pipeline "Interconnector" has been selected as the preferred option to transfer water from the River Severn to the River Thames.

Due to the risk of concurrent low flow periods in both river catchments, additional sources of water, apart from those naturally occurring in the River Severn, have been identified to augment the baseline flows. These multiple diverse sources of additional water provide resilience in the provision of raw water transfer to the River Thames. A 'put and take' arrangement has been agreed in principle with the Environment Agency (EA) and Natural Resources Wales (NRW) which means that if additional source water is 'put' into the river, then the Interconnector can 'take' that volume, less catchment losses, regardless of the baseline flows in the River

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

- **Vyrnwy Reservoir:** Release of 25MI/d water licensed to UU from Lake Vyrnwy directly into the River Vyrnwy;
- **Vyrnwy Reservoir:** Utilisation of 155MI/d water licensed to UU from Lake Vyrnwy and transferred via a bypass pipeline ("Vyrnwy Bypass") to the River Severn;
- **Shrewsbury:** Diversion of 25MI/d treated water from UU's Oswestry Water Treatment Works (WTW) via an existing emergency transfer (the Llanforda connection), thus enabling a reduction in abstraction from the River Severn at Shelton WTW to remain in the River Severn for abstraction at Deerhurst;
- **Mythe:** 15MI/d of the Severn Trent Water licensed abstraction at Mythe remaining in the River Severn for abstraction at Deerhurst;
- **Minworth:** The transfer of 115MI/d of treated wastewater discharge from Severn Trent Water's Minworth Wastewater Treatment Works (WwTW) via a pipeline, to the River Severn via the River Avon at Stoneleigh; and
- **Netheridge:** The transfer of 35MI/d of treated wastewater discharge at Severn Trent Water's Netheridge WwTW to the River Severn at Haw Bridge, via a pipeline, upstream of the current discharge to the River Severn.

The STT Gate 1 submission was assessed by the Regulators' Alliance for Progressing Infrastructure Development (RAPID) who concluded that it should progress to standard Gate 2. The recommendations and actions received from RAPID and feedback from stakeholders from the Gate 1 process have been reflected in the scheme development and environmental assessments.

1.1.2 Gate 1

The STT Solution was subject to a detailed assessment in Gate 1 with the objective of delivering regulatory assessments of potential environmental effects of the Solution 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 did not identify any 'material issues', i.e. any unsurmountable obstacles that mean the scheme is unfeasible due to environmental reasons, at this stage. Both beneficial and adverse effects have been identified, which is to be expected given the scale of the scheme.

These conclusions were reached in the context of identified gaps in understanding, and the stated need for further data and evidence collection to support the Gate 2 investigations, further information on the operation of the scheme, and ongoing dialogue with regulators and other stakeholders.

1.1.2.1 Regulator feedback at Gate 1

Feedback from the regulators was sought before the submission of the Gate 1 submission and incorporated where possible. The environmental regulators also gave feedback as part of their formal Gate 1 review of the scheme. This feedback has informed the approach taken for Gate 2.

1.1.3 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 STT Solution 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 report¹.

RAPID issued a guidance document² in April 2022 to describe the Gate 2 process and set out the expectations for solutions at standard Gate 2.

The guidance stated the environmental assessment methodologies should be consistent with any relevant legislation and guidance and follow best practice. This includes, where relevant, Water Resource Management Plan (WRMP) guidance for 2024, All Company Working Group (ACWG) guidance³ and the Environment Agency Invasive Non-native Species risk assessment tool.

1.1.3.1 Overview of the environment assessment approach for Gate 2

Figure 1.1 shows the investigations undertaken for Gate 2 and their interactions, in order to show the full scope of work across both environmental engineering disciplines. Reporting for the environmental investigations is undertaken a phased way. The Evidence reports (pale blue box in the figure below, and this report) are produced first, that set out the data and evidence to be used in the assessment. The Assessment Reports which use the evidence to determine the potential effect of the STT scheme on the different topics, is produced later (dark blue box in the figure below). Together with other inputs, these reports feed into the production of the statutory reports and summary reports (yellow boxes).

1.1.3.2 Regulator engagement for Gate 2

In order to engage with regulators over the approach, evidence collection, monitoring programmes, and data analysis for Gate 2, the environmental assessment team have held monthly meetings with the EA, NRW and NE, in addition to topic-specific sessions and workshops with technical specialists. 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.

In the monthly meetings, the programme, progress and deliverables are reviewed; issues are raised for clarification and resolution, and the regulators are asked for their views and advice on different topics or issues.

In the sessions with technical specialists, each of the proposed approaches to the topics and statutory reports have been set out and explained. Drafts of documents have been issued, plus other technical notes, to the

¹ [United Utilities - Water Transfers – RAPID Gate 1 Submission](#)

² RAPID (2022) Strategic regional water resource solutions guidance for Gate 2

³ All Companies Working Group (2020) WRMP environmental assessment guidance and applicability with SROs

regulators to solicit feedback on the proposed approaches. Feedback on the drafts have been used to inform the wider environmental assessment for Gate 2, and finalise the approach, and reporting.

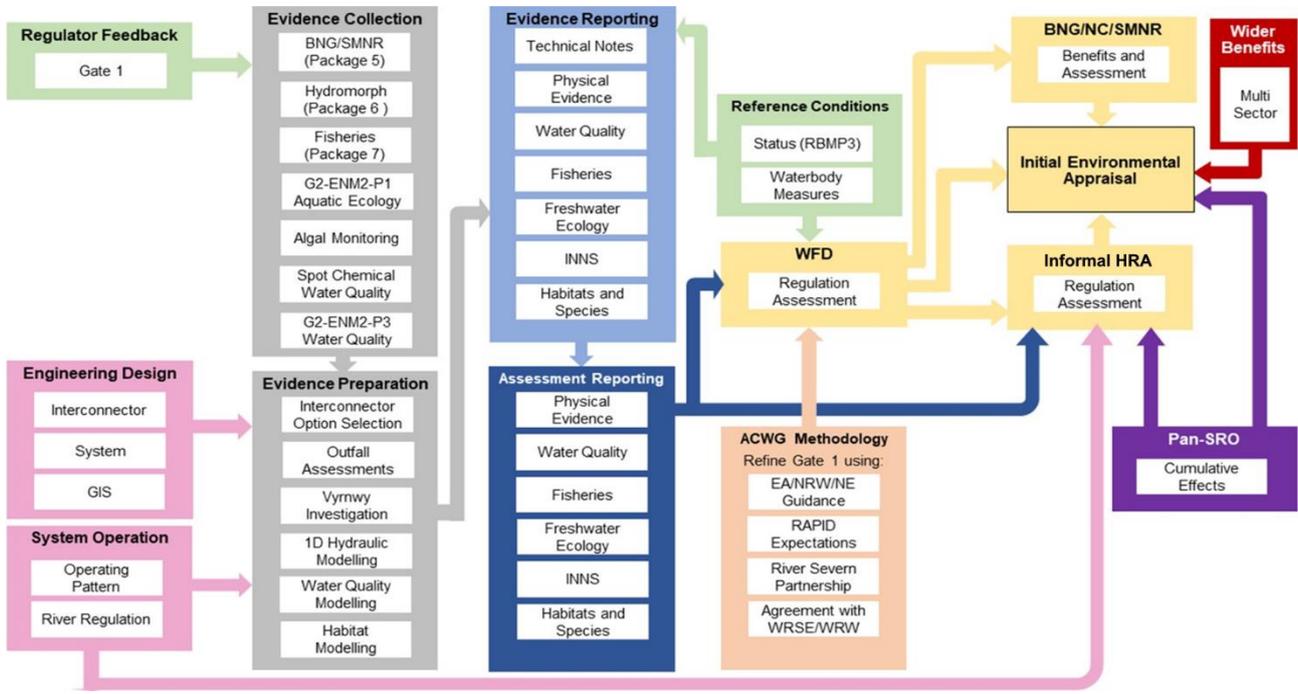


Figure 1.1 Flow chart showing the investigations undertaken for Gate 2 and their interactions

1.2 STUDY AREA

The Gate 2 assessment covers specific reaches and pipeline routes, as shown in **Figure 1.2**:

The River Vyrnwy catchment to the River Severn;

1. The River Severn catchment from the River Vyrnwy to the Severn Estuary, as well as those tributaries of the River Severn which could indirectly be affected by the operation of the STT solution;
2. The Warwickshire River Avon to the River Severn confluence; and
3. The River Thames catchment

It should be noted that the consideration of impacts in the River Tame and Trent, from the transfer of treated discharge from Minworth WwTW to the River Avon, is included in the ST Minworth Solution and therefore excluded from the STT scheme assessment.

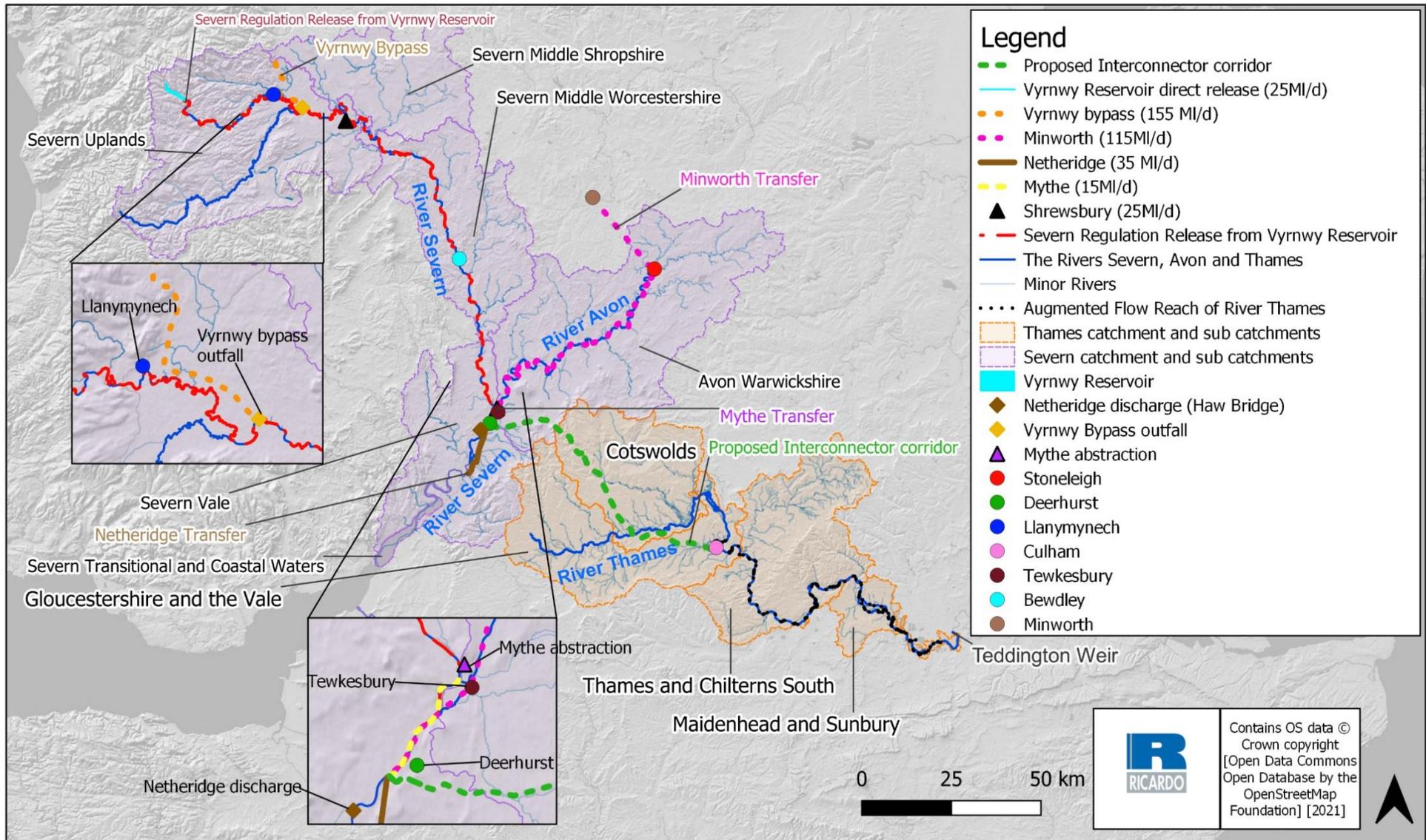


Figure 1.2 Map showing the proposed interconnector corridor

1.3 AIM OF THIS REPORT

The assessment of any potential risk to distributing Invasive Non-native Species (INNS) as a result of the operation of the STT should be considered in the context of the potential pathways which will be created during the construction and operation of the STT Solution. The risk, and the type and extent of mitigation, should also consider the current baseline information on INNS distribution.

This note provides the evidence and data catalogue used to inform the assessment of risk associated with INNS as a result of the construction and operation of the proposed STT Solution. Furthermore, this report identifies the 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 Solution.

2. EVIDENCE BASE FOR, AND APPROACH TO, THE GATE 2 INNS ASSESSMENT

Gate 1 of the STT Solution identified several datasets and studies that form the evidence base for the assessment of INNS risk. The Gate 1 process also identified where additional data are necessary to undertake the required INNS assessment for Gate 2.

Stakeholder consultation with the environmental regulators for England and Wales also identified additional datasets and studies that would be required to improve the INNS evidence base for the Gate 2 assessments.

This section:

1. Outlines the scope and approach to the INNS assessment tasks that will be undertaken;
2. Summarises the additional data and evidence collection tasks that were completed for Gates 1 and 2 in respect of INNS; and
3. Confirms the evidence base that will be used in the INNS assessment in Gate 2.

2.1 SCOPE AND APPROACH TO THE GATE 2 ASSESSMENT AND EVIDENCE BASE

The scope of the assessment required for Gate 2 and the approach to undertaking this assessment is described in **Table 2-1**. This table also includes a summary of the evidence base that will be used to inform the ecological/environmental elements/receptors and the extent to which these are altered as a result of the construction and/or operation of the STT Solution.

The evidence base for the assessment has been summarised in the supporting Excel workbook (*STT INNS Evidence Workbook*). These data were also used to inform the identification of any remaining data/evidence gaps that would result in any uncertainty in the assessment of the potential impacts of the STT Solution on INNS in the associated waterbodies.

The supporting Excel workbook (*STT INNS Evidence Workbook*) includes the following:

- Heat maps showing the density of INNS observed in opensource data constructed from the Kernel Density estimation algorithm. The heat maps are provided by watercourse and STT Solution construction element, including:
 - The River Vyrnwy from the Vyrnwy Reservoir to the confluence with the River Severn;
 - The River Severn from the confluence with the River Vyrnwy to the tidal limit;
 - The Warwickshire River Avon;
 - The River Thames from Culham to Teddington;
 - The potential pipeline route from Oswestry to Llanymynech;
 - The potential pipeline route from Oswestry to the River Severn; and
 - The potential pipeline route from Deerhurst to Culham.

- Tables showing the frequency of occurrence for each INNS species associated with the STT Solution study area (construction and operation). The Great Britain Non-Native Species Secretariat (GBNNS) Risk assessments (where applicable) are also included for each reach and construction route;
- A map of survey locations for the targeted surveys completed by the STT Group;
- A list of survey locations for the targeted surveys completed by the STT Group; and
- Raw data for the targeted INNS and eDNA surveys for spring 2020, summer 2020, spring 2021 and summer 2021.

Table 2-1 Evidence and approach to the Gate 2 INNS assessment

Task item	Scope of assessment	Approach to assessment	Evidence Base for Task
INNS	<ul style="list-style-type: none"> Update the Gate 1 assessment using additional baseline data collected during Gate 1 and Gate 2 and the new Environment Agency (EA) INNS risk assessment tool⁴. 	<ul style="list-style-type: none"> Update the Gate 1 INNS assessment to consider additional species/community data collected during Gate 1 and Gate 2. Use updated scheme design and operation information for Gate 2, including any treatment of raw water. Update the Gate 1 INNS assessment in consideration of new EA INNS risk assessment tool. Consider the interpretation of the fluvial (flow) model, including the flow series at key locations for different scenarios to consider the risk of changes in velocities, depth and wetted margin that may result in changes in community structure, loss of preferred habitat, scouring of biofilm, etc. Include relevant Solution monitoring programme survey data such as Acoustic Doppler Current Profiler (ADCP), habitat walkovers and River MoRPh survey outputs and additional habitat modelling at key locations. Update the Gate 1 INNS assessment in consideration of the interpretation of the water quality assessment and model outputs to consider risk of water quality driven changes in community structure. Suggest further mitigation and/or treatment measures (where required) for design/engineering interface. 	<ul style="list-style-type: none"> Physical Environment and Water Quality assessments will provide scenario outputs to consider in the assessments. Data from EA Ecology & Fish Data Explorer from 2010-2021. Open-source data (e.g. NBN Atlas and NBN Atlas Wales INNS Portal). Targeted monitoring (including eDNA results) completed since 2020 at freshwater sites within the project area (see Section 2.2). EA’s Invasive Non-Native Species Isolated Catchment Mapping⁵. EA’s INNS risk assessment tool for SRO, including handbook with mitigation measures. GBNNS risk assessments⁶. Evidence and literature collated as part of the initial gap analysis of the STT which includes information on fish passes on the River Severn⁷.

⁴ The EA has developed an INNS risk assessment tool that provides a consistent approach to assessing INNS risks across water supply options and will be used to assess INNS risks for SROs. The Microsoft Excel based tool has been developed to account for the diversity of assets and raw water transfers which may comprise any one SRO and uses a single assessment process via a modular approach, to provide a quantitative score of relative risk.

⁵ Environment Agency (2018). Invasive Non-Native Species Isolated Catchment Mapping V3. Report for the Environment Agency completed by Wallingford HydroSolutions Ltd

⁶ <http://www.nonnativespecies.org/index.cfm?pageid=143>

⁷ APEM (2020). STT Ecological Literature Review. APEM Scientific Report P00004288. Severn Thames Transfer Partnership, September 2020, v2.0 Final, 480 pp

2.2 ADDITIONAL DATA COLLECTED DURING GATE 1 AND GATE 2

To provide the necessary Gate 1 data and evidence to inform the environmental assessment associated with the STT SRO, an ecological monitoring programme was implemented by the STT Group in June 2020 (*the 2020 monitoring programme*). This monitoring programme initially consisted of 37 survey sites across the Severn and Thames catchments. The monitoring programme was subsequently updated to include sites associated with a Thames to Southern Transfer and the Oxford Canal option considered by Thames Water in WRMP19. The 2020 monitoring programme included various ecological features, including:

- Macroinvertebrate communities (spring and autumn 2020 and spring 2021 surveys);
- Macrophyte communities (summer 2020 surveys); and
- Targeted INNS (spring and summer 2020 and spring 2021 surveys).

The Gate 1 environmental assessments identified that the 2020 monitoring programme should be updated to include additional surveys and features. In particular, the available data and evidence in Gate 1 indicated that there was a lack of sufficient INNS data to describe the risk associated with the STT Solution. As such, the 2020 monitoring programme was amended to include targeted INNS surveys at additional survey sites, supplemented by the collection of samples for eDNA analysis. Target INNS surveys were not completed in autumn 2020. Any INNS identified as part of the wider monitoring programme (macroinvertebrate, macrophyte, fish, diatom, etc) will also be considered within the INNS assessments.

As noted in Section 2.1, the survey locations are presented in the supporting Excel workbook (*STT INNS Evidence Workbook*). The targeted surveys were completed adopting a Multi Habitat Survey (MHS) approach during the 2020 Gate 1 monitoring programme. Since first devised, the MHS has been refined for effective application at a range of lotic (rivers and canals) and lentic (still water) locations of variable size.

The MHS approach requires a combination of visual assessment and active sampling for possible INNS at one or more individual MHS sites. Each MHS site covers at least 200m of bank or shoreline if possible. The number of MHS sites required at each location is likely to vary as follows:

- Rivers and canals: 1 MHS site of at least 200 m;
- Ponds or small lakes (typically <2 km perimeter): 1 MHS site covering the entire perimeter (see below); and
- Larger lakes or reservoirs (typically 2-8 km perimeter): 2-4 MHS sites focused on key structures (see below).

The MHS approach comprises of the following;

- **Visual assessment**
 - To identify the presence of aquatic (floating and marginal) macrophytes, artificial structures or substrate (for subsequent sampling) and non-native fauna (e.g. colonies of molluscs or burrowing activity) to be aided by binoculars and/or bathyscope where necessary. At rivers and canals, the inspection covers at least 200m (optimised with the use of binoculars to cover both banks). At still waters, the perimeter is ideally walked in its entirety unless unsafe or otherwise impractical to do so.
 - During the course of the visual assessment, focal points for the active sampling elements of MHS are identified to include, where possible, the leeward shore (for macrophyte fragments and drifting organisms) and structures such as jetties, pontoons, draw-down towers or slipways.
- **Active macrophyte sampling**
 - This uses a series of grapnel throws (3x5) for each MHS. For rivers and canals, this means five throws (in a fan pattern) at each of the downstream, middle and upstream ends of the MHS length (ensuring that macrophyte beds or plants of interest, spotted during the visual assessment are actively sampled). For still waters, throws are made in patterns of five at points around the perimeter according to the overall number of MHS (sites) with 3x5 per MHS, so that larger waters are subject to greater effort. The DAFOR (Dominant, Abundant, Frequent, Occasional, Rare) abundance scale is assigned to any INNS that are found.
- **Targeted macroinvertebrate sampling**

- Sampling will be performed for three minutes from the bankside and/or shallow margins (where permitted). For rivers and canals, the time is split along the MHS length (ensuring that any features of specific interest are covered – see below). For still waters, samples will be taken at multiple points around the perimeter undertaking three minutes of sampling effort per MHS (site). For all location types use a combination of sweeps, dredges, scrapes and manual searching. Sampling actively targets multiple habitats where available, including soft, coarse and artificial substrate. This sampling will provide a single composite macroinvertebrate sample for each MHS site, such that larger waterbodies receive more sampling effort where safe/possible. The three-minute timing loosely facilitates a semi-quantitative approach although the proportion of effort allocated to each sampling element depends on the nature of the MHS site as follows:
 - The sweep element samples the water column with a long-handled net (>3 m length). This process, where possible, includes areas of soft and coarse substrate but should avoid collecting too much benthic substrate material. It also includes any available stands of vegetation or floating algal mats (the demon shrimp, *Dikerogammarus haemobaphes*, has been found in association with algae, mosses and higher plants);
 - Dredging, using a lightweight naturalists' dredge, may be used to sample the water column and substrate/water interface further from the bank (typically up to 10m) or where use of a long-handled net is not possible;
 - The scrape element will focus on artificial concrete banks or other hard substrate suitable for scraping with the metal net frame (some species such as the killer shrimp, *Dikerogammarus villosus*, is known to have a strong preference for coarse substrate and man-made submerged hard standing surfaces); and
 - The manual search will be for animals associated with or attached to submerged objects and plants or swimming at the water's surface.

The MHS method requires that surveys are supplemented by additional survey elements such as the collection of environmental DNA (eDNA). This has been done, with eDNA samples collected and sent for laboratory analysis as mentioned above.

To minimise the risk of the spread of disease or non-native species, strict biosecurity measures have been adopted such that only dry, clean or freshly disinfected equipment, including nets, boots and grapnels, are used.

3. CONCLUSIONS

3.1 SUMMARY OF BASELINE DATA, UNCERTAINTY AND DATA GAPS

The potential risk associated with the construction and operation of the STT Solution should be considered in the context of the scheme design for Gate 2, including any potential treatment that will be implemented to ensure water quality risks are sufficiently managed. The available baseline data is considered sufficient to inform the assessment of the risk of the scheme distributing INNS. The risk assessment should be completed using the EA's new INNS risk assessment tool for SROs and should also suggest changes to scheme design and mitigation measures in view of the potential measures as listed in the handbook for the EA's INNS risk assessment tool.

It is recommended that the baseline monitoring programme continues, in order to provide a minimum 3 year baseline. This will provide a robust baseline to inform the design of any treatment facilities to reduce the risk of INNS transfer to the River Thames catchment. The specific survey locations, monitoring that has been completed and recommended future programme is provided in Table 3-1.

Locations associated with the potential canal transfer have not been identified for further monitoring, as the canal transfer option will not be further considered in Gate 2 pending the outcome of the "potential futures" workstream and regional plan updates.

It is recommended that the survey methodologies applied in the 2021 monitoring programme should be used in future monitoring, to ensure consistency in the data.

Table 3-1 Survey locations for the STT Solution monitoring programme for INNS

NB Dates highlighted in green indicates surveys completed; dates highlighted in blue indicate recommended surveys to complete a 3-year baseline.

Site Nr	G 1 site code	River Vyrnwy U/S Conwy Description	NGR	Monitoring Programme			
				2020	2021	2022	2023
STT-01	M3	River Vyrnwy U/S SSSI	SJ0222317235	-			
STT-01a	M2	River Vyrnwy at Dolanog - Mill Lane (NRW macrophyte site)	SJ0318118954	-			
STT-01b	M4	River Vyrnwy at Pontrobart	SJ0274815326	-			
STT-03	-	River Vyrnwy D/S Meifod	SJ0683712739	-	-	-	-
STT-04	-	River Vyrnwy U/S Llanymynech	SJ1080012600	-	-	-	-
STT-05	-	River Vyrnwy near Meverley Green	SJ1956815645	-			
STT-05a	-	River Vyrnwy U/S Severn confluence	SJ2533119597	-	-	-	-
STT-05b	-	River Severn D/S Vyrnwy Confluence	SJ3197617389	-	-	-	-
STT-6a	M1	Discharge location on River Avon u/s Warwick for Minworth support	SJ3322316529				-
STT-06	-	Discharge location on River Avon for Minworth support option	SJ3509017329	-	-	-	-
STT-07a	W2	River Avon at Abbot's Salford	SP3305372491				
STT-08	W1	River Avon D/S Evesham	SP2739962452				
STT-08a	-	River Avon near Twyning	SP0797149927	-	-	-	-
STT-08b	-	Abstraction location on River Severn for transfer pipeline Deerhurst	SP0315144409	-	-	-	-
STT-08c	-	Discharge location on River Severn for Netheridge support	SO9055836630	-	-	-	-
STT-09	D1	Abstraction location on River Severn for Cotswold Canal transfer (Gloucester Dock)	SO8594129233				-
STT-10*	D2	Discharge location in Gloucester and Sharpness canal	SO8545028500			-	-
STT-11*	G1	Discharge location on River Severn for Netheridge support D/S Gloucester Docks	SO8269518594			-	-
STT-12*	G2	Abstraction location in Gloucester and Sharpness canal at Saul Junction	SO8267318300			-	-
STT-12a	-	Discharge location on River Frome for Cotswold Canal transfer at Saul Junction	SO8243218278	-	-	-	-
STT-13*	SJ1	Abstraction location on River Frome for Cotswold Canal transfer at Stroud	SO7565609338	-		-	-
STT-14*	SJ2	Discharge location on River Thames for Cotswold Canal transfer at Lechlade	SO7574709112	-		-	-
STT-15*	ST1	River Vyrnwy U/S Conwy	SO8547504598	-		-	-
STT-16*	L1	River Vyrnwy D/S Reservoir U/S Conwy	SU2112799327	-		-	-

* These sites will no longer be considered in the survey programme as the canal transfer will not be selected for Gate 2 assessments

