# rdWRMP24

# Appendix BB: Invasive and Non-Native Species Risk Assessment

# Contents

Executive summary 1

1 Introduction 3
1.1 Background and context 3
1.2 Thames Water rdWRMP 3
1.3 Scope of this report 4
1.4 WRMP24 option descriptions 4

2 INNS Assessment Methodology 14
2.1 INNS Level 1 screening 14
2.1.1 Overview 14
2.1.2 Frequency of Impact rating 14
2.1.3 Severity of Impact rating 14
2.2 INNS Level 2 Assessment 15
2.2.1 Magnitude of Risk rating 15
2.2.2 Assessment methodology 16
2.3 INNS In-combination effects assessment 17
2.3.1 Process A – Determination of option combinations for screening assessment 17
2.3.2 Process B – Assessment of additional in-combination risk 18
2.4 Limitations and assumptions 20
2.4.1 Generic 20
2.4.2 Level 1 screening 20
2.4.3 Level 2 assessment 21
2.4.4 In-combination assessments 21

3 Results and Discussion 23
3.1 INNS Level 1 screening results 23
3.2 INNS Level 2 assessment results 34
3.2.1 Results Summary 34
3.2.2 Abingdon Reservoir to Farmoor Reservoir pipeline option 35
3.2.3 Thames-Lee Tunnel extension from Lockwood PS to King George V Reservoir intake option 35
3.2.4 Oxford Canal - Transfer from Duke's Cut to Farmoor transfer option 35
3.2.5 Beckton Desalination 36
3.2.6 Oxford Canal to Duke's Cut (SWOX) 36
3.2.7 New Medmenham Surface Water Intake - 53 Ml/d 36
3.2.8 River Thames to Fobney transfer option (non-selected option) 36
3.3 SROs 37

3.3.1 SRO overview 37
3.3.2 London Water Recycling 38
3.3.3 Severn to Thames Transfer 39
3.3.4 SESRO 41
3.3.5 T2ST 42
3.3.6 T2AT 43

4 Alternative Plans Assessment 46
4.1 Introduction 46
4.2 Least Cost Plan Summary 46
4.3 Best Environment and Societal Plan Summary 50
4.4 In-combinations Effects Assessment 55
4.4.1 Least Cost Plan 55
4.4.2 Best Environment and Societal Plan 59

5 Best Value Plan Assessment 66
5.1 Best Value Plan Summary 66
5.2 In-combination effects 72

6 Conclusions and Next Steps 83
6.1 Conclusions 83
6.1.1 Level 1 screening 83
6.1.2 Level 2 assessment 83
6.1.3 LCP summary 85
6.1.4 BESP summary 85
6.1.5 BVP summary 86
6.1.6 In-combination effects 86
6.2 Next steps 87

A. Assumed Values for SAI-RAT 88

B. SAI-RAT Input Data 91
B.1 Abingdon Reservoir to Farmoor Reservoir pipeline SAI-RAT input data 91
B.2 Thames-Lee Tunnel extension from Lockwood PS to King George V Reservoir intake SAI-RAT input data 93
B.3 Oxford Canal - Transfer from Duke's Cut to Farmoor SAI-RAT input data 95
B.4 Beckton Desalination SAI-RAT input data 97
B.5 Oxford Canal - Duke's Cut (SWOX) SAI-RAT input data 101
B.6 New Medmenham Surface Water Intake - 53 Ml/d 107
B.7 River Thames to Fobney SAI-RAT input data (not selected) 110
B.8 London Water Recycling SRO 112
B.9 Severn to Thames Transfer SRO (STT) 112
B.10 South East Strategic Reservoir Option (SESRO) 112

B.11 Thames to Southern Transfer SRO 112
B.12 Thames to Affinity Transfer SRO 113

## Tables

Table 1.1: Feasible options 4
Table 2.1: Frequency of Impact risk criteria used to assess INNS risk 14
Table 2.2: Severity of Impact risk criteria used to assess INNS risk 15
Table 2.3: Magnitude of Risk calculation matrix used to determine INNS risk 15
Table 3.1: Summary of feasible options INNS Level 1 screening results 24
Table 3.2: Summary of Drought Permit option SEA INNS screening results 33
Table 3.3: Level 2 INNS risk assessment results 34
Table 3.4: Level 2 SRO SAI-RAT INNS risk assessment results 37
Table 4.1: List of options selected for the LCP 46
Table 4.2: List of options selected for the BESP 51
Table 4.3: In-combination results of LCP options 56
Table 4.4: Further assessment scores for LCP options 58
Table 4.5: In-combination results of BESP options 61
Table 4.6: Further assessment scores for BESP options 64
Table 5.1: List of options selected for the BVP 66
Table 5.2: In-combination results of BVP Situation 1 74
Table 5.3: In-combination results of BVP Situation 4 78
Table 5.4: In-combination results of BVP Situation 8 79
Table 5.5: Further assessment scores for BVP Situation 1 options 80
Table 5.6: Further assessment scores for BVP Situation 4 options 81

## Tables – Appendices

Table A. 1: Assumed values for staff visit and maintenance activities at assets. 88
Table A. 2: Assumed values for recreational activities at assets. 90

# Executive summary

All water companies in England and Wales including Thames Water must prepare and maintain a water resources management plan (WRMP). This sets out how to achieve a secure supply of water for customers and for a protected and enhanced environment. Under legislation a plan must be produced at least every five years and reviewed annually.

Planning is currently underway for the year 2024 onwards. In developing Revised Draft WRMP24 (rdWRMP24), Thames Water have undertaken an assessment of the potential risk of Invasive and Non-Native Species (INNS) transfer. The INNS assessment in parallel with a Strategic Environmental Assessment (SEA) ensures that an integrated approach to environmental assessment has been followed. The rdWRMP24 needs to comply with relevant legislation and planning guidance. Thames Water has assessed potential implications of its rdWRMP24 on the risk of transfer of INNS, both individually and in combination.

The Level 1 INNS screening process presented in this report has generated a coarse assessment of each option for INNS risk, based on the concept of risk as the product of the frequency and severity of INNS transfer risk due to the implementation of an option. An overall Magnitude of Risk rating was assigned to each option, and options were subject to a more detailed Level 2 assessment where any risk rating greater than Very Low was identified.

The Level 2 assessment methodology utilised the Environment Agency's Strategic Resource Option (SRO) Aquatic INNS Risk Assessment Tool (SAI-RAT) to quantify the INNS transfer risk associated with those options not screened out by Level 1 assessment. Whilst the Level 1 screening provided a coarse risk screening of those options likely to involve an INNS risk, the Level 2 assessment aimed to quantify the INNS risk using more detailed option information including precise location of transfer pathway, transfer volumes and existing INNS presence. The Level 2 assessments are based on the detailed conceptual design information available at the time the assessments were conducted.

Of the feasible options categorised for INNS risk in the Level 1 screenings, 49 options were given a risk rating of Very Low or None. Twenty-one options required a more detailed Level 2 assessment – eight options presented a Low risk, seven options presented a Moderate risk and six options were given a rating of High risk. Only those options selected in the Best Value Plan (BVP), Least Cost Plan (LCP) or Best Environment and Societal Plan (BESP) were progressed to the Level 2 assessment of this stage. A Level 2 assessment was also undertaken for SROs as part of the RAPID Gate 2 process and reported in the Gate 2 submission documents. The results have also been included in this report.

The primary risks identified with the assessed options were the transfer of raw water to a new location, and a desalination option the highest risk identified was associated with a short intake pipeline with a potential to spread INNS to a new location in the event of a pipe burst.

In-combination assessments were undertaken for each of the plans to identify and broadly categorise the additional risk level presented by options acting in combination, and the key results and conclusions are summarised as follows:

- LCP – Two option combinations may present a High additional risk, two option combinations may present a Medium risk and three options are likely to present a Very Low additional risk.
- BESP – Two option combinations may present a High additional risk, three may present a Medium additional risk and six are likely to present a Very Low additional risk.

- BVP Situation 1 – Two option combinations may present a High additional risk, four option combinations may present a Medium additional risk and six option combinations are likely to present Very Low additional risk.
- BVP Situation 4 – Two option combinations may present a High additional risk, two combinations may present a Medium additional risk, and three option combinations may present a Very Low additional risk.
- BVP Situation 8 – Only one option combination was progressed to Process B, and was assessed as presenting Very Low additional risk.
- Those options identified as presenting a Low, Medium or High additional risk were taken through to a further assessment stage where SAI-RAT assessments were combined, to generate a maximum component Risk Score and Overall Risk Score for each option combination.

For the option combinations initially assessed as High risk, mitigation is being considered for the constituent individual options. The SESRO SRO sets out mitigation to reduce INNS transfer risk at Abingdon. Upon further investigation it may be concluded that option combinations initially assessed as presenting a Medium additional are unlikely to significantly increase risk and therefore, additional mitigation may not be needed.

Across all plans, the highest SAI-RAT Risk Scores were generated by option combinations involving the Oxford Canal, Duke's Cut, Teddington DRA, New Medmenham Surface Water Intake, Farmoor and Abingdon Reservoirs. The specific interaction of these options with others will be the focus of further consideration of appropriate mitigation, though in-combination risks may be sufficiently offset by mitigation of individual options. SAI-RAT will also be used to identify potential mitigation and biosecurity measures, and these will be considered in future option development and assessment work at the project level

The following steps are recommended to progress the understanding of INNS risk through the option design and development process and to determine appropriate mitigation:

- INNS risk assessments will be revised as appropriate using the SAI-RAT for options which are taken forward, as more information becomes available through the design process.
- Appropriate mitigation will continue to be explored for all options which are progressed, including asset and water transfer elements. This will use the SAI-RAT biosecurity tab to identity potential biosecurity measures which may be most effective in reducing risk.
- In addition to standard mitigation practices adopted by water companies, engagement with the Canal and River Trust, the Environment Agency, and angling clubs will be considered to help to identify those measures which are most appropriate.
- Further consideration will be given on a case-by-case basis to the potential for combined risks through interaction with other options being taken forward. These updated assessments will aim to account for both inter- and intra-regional effects.
- For options which are likely to be implemented, the INNS risk associated with the construction phase will be considered and mitigated through best practice.

# 1 Introduction

## 1.1 Background and context

Water companies in England and Wales are required to produce a Water Resources Management Plan (WRMP) every five years. The WRMP sets out how a company intends to maintain the balance between supply and demand for water over a minimum of 25 years. In the development of a WRMP, water companies must follow the Environment Agency (EA) Water Resources Planning Guideline (WRPG)[1] and consider broader government policy objectives, ensuring the plan sets out how the company intends to maintain the balance between supply and demand for water over the long-term planning horizon and how to increase security of supply in each of the water resource zones (WRZs) making up its supply area.

The Thames Water supply area is situated within the Water Resources South East (WRSE) regional planning area. Therefore, all the water resource options considered as part of the Thames Water Resources Management Plan 2024 (WRMP24) have fed down from the selected options as part of the regional plan. For Thames Water's WRMP24 the Invasive Non-Native Species (INNS) assessments focus on the local scale, drawing on the higher-level work previously completed for the regional plans where applicable.

Assessment of the water resource options has been undertaken to identify potential option impacts on the environment while also considering potential mitigation measures. As part of the environmental assessment process to support the development of the WRSE Regional Plan and Thames Water WRMP24, INNS Level 1 screening and, where needed, INNS Level 2 assessments have been completed.

The INNS assessment process was undertaken alongside the development of the Thames WRMP24 to inform the decision-making process and integrate environmental considerations. The INNS assessment for the draft WRMP24 (dWRMP24) was presented in an INNS Report which was issued for consultation from November 2022 to March 2023. Comments received from the consultation process were reviewed and have been addressed where appropriate within this INNS Report. The dWRMP24 has been updated to the revised draft WRMP24 (rdWRMP24) reflecting additional modelling work undertaken to optimise the plan as well as consultation feedback. This report is the INNS Report for Thames Water's rdWRMP24 and forms part of Thames Water's rdWRMP24 documentation.

## 1.2 Thames Water rdWRMP

The rdWRMP24 is an adaptive plan to deal with uncertainties and future scenarios that will mean further investment is required (e.g. further future sustainability reductions). An adaptive planning approach uses branches to cover these uncertainties. WRSE and Thames Water selected a total of nine branches (hereafter referred to as 'situations'), which were derived based on combinations of the three key drivers: population and housing growth; climate change impact on deployable output (DO) for existing systems; and levels of abstraction reduction associated with delivering Environmental Destination scenarios. Section 10 in the rdWRMP24 provides further detail on the adaptive planning process.

As part of the regional plan and WRMP processes, a Best Value Plan (BVP), which forms the rdWRMP, and two alternative plans (a Least Cost Plan (LCP) and a Best Environment and

[1] Environment Agency (Apr 2023), Water Resources planning guideline. Available online at: https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline.

Societal Plan (BESP)) were developed in line with the WRPG. INNS Level 1 screening assessments have been undertaken for all of Thames Water's feasible options, including transfers, reservoirs, water recycling, desalination, groundwater sources and aquifer storage and recharge. Options such as demand management were screened out of the assessment owing to the characteristics of those options. Where options were selected for the rdWRMP24 or the two alternative plans, Level 2 INNS assessments were undertaken where required by the Level 1 screening results. Further information on the BVP Framework and the selection of the BVP and the two alternative plans is presented in Section 10 of the rdWRMP24.

## 1.3 Scope of this report

The scope of this report is to identify and evaluate the potential for Thames Water's feasible options to spread INNS – plants and animals which can cause harm to the environment and cost to the economy[2] .

The INNS assessment process included:

- Undertaking a high-level 'Level 1 screening' of the list of feasible options.
- Using the results of the Level 1 screening to identify options requiring a more detailed Level 2 INNS assessment. Those options screened as having a low, medium or high risk and which were selected in the BVP or the two alternative plans were taken through to Level 2 assessment.
- INNS assessments for the Strategic Resource Options (SROs) were undertaken as part of the SRO development and reported in the Gate 2 reports. The results of the INNS assessments are summarised in this report.

## 1.4 WRMP24 option descriptions

Table 1.1 summarises the feasible options which were given an INNS Level 1 screening, providing a general overview of the activities associated with each of them.

**Table 1.1: Feasible options**

| Option ID | Option name | Description overview |
|---|---|---|
| TWU_LON_HI-LRE_WT1_ALL_copperwtwmecana200/480/680 | Coppermills WTW - filtration pre-treatment 680Ml/d | Either a 200/480/680Ml/d Mecana filtration system for primary filtration of surface water at the Coppermills Water Treatment Works (WTW), including three new shaft connections, inlet pipework diversions, inlet pumping station (PS) and pipe bridge for return pipework. |
| TWU_LON_HI-DES_ALL_CNO_beckton desal 50/100/150 | Beckton Desalination | Abstraction of 187Ml/d raw water for production of 150Ml/d desalinated water (conveyance within option below). DO 142Ml/d for 150Ml/d capacity. The 50 and 100 options involve raw water abstraction for production of 50Ml/d and 100Ml/d desalinated water. |
| TWU_LON_HI-TFR_LON_CNO_beckton-coppermills | Beckton to Coppermills tunnel (treated) - Construction | Treated desalination water is to be conveyed via tunnel from Beckton desalination works to Coppermillls WTW for blending. (Part of the Beckton Desalination Scheme with the option above.) |
| TWU_LON_HI-TFR_SES_ALL_woodwtw-epsomdowns | Transfer - Woodmansterne to Epsom - Resource Element | Proposed new trunk mains to transfer potable water from Woodmansterne (SES) to Epsom including a new PS at Woodmansterne WTW. |

[2] GB Non-Native Species Secretariat, 2022. *Non-native species.* [online] Available at: https://www.nonnativespecies.org/non-native-species/ [Accessed 29 September 2022].

| Option ID | Option name | Description overview |
|---|---|---|
| TWU_SWX_HI-GRW_ALL_ALL_ashton keynes | Groundwater Development - Ashton Keynes borehole pumps - Removal of Constraints to DO | Installation of larger pumps and/or lowering of the pumps in some or all of five existing boreholes, abstracting from the confined Great Oolite aquifer. Change in operational philosophy to improve peak source output. |
| TWU_LON_HI-TFR_LON_ALL_nrv-groundimprov | New River Head - Ground improvements | Rehabilitation and recommissioning of disused groundwater source. This option comprises:<br>- ground stabilisation around the New River Head borehole, comprising the grouting of the potential voids created by sand migration<br>- installation of four near surface ground anchors placed at convenient locations around the borehole<br>- installation of a turbidity meter<br>- recommissioning of the licensed but currently disused groundwater source. |
| TWU_LON_HI-ROC_NET_CNO_hampton-battersea | TWRM extension - Hampton to Battersea - Construction | New ring main tunnel from Hampton to Battersea. |
| TWU_SWX_HI-TFR_KVZ_ALL_kennet-swox2.3 | Kennet Valley to SWOX Transfer - 2.3 Ml/d | The works proposed include: treated water pipeline from Pangbourne WTW to Cleeve WTW 9.4km (250dia), a PS at Pangbourne WTW (60kW), balance tank at Cleeve WTW (2 x the pipe volume), 800m (700dia) of replacement pipeline at the end of the Fobney WTW to Tilehurst Service Reservoir (SR) main to increase flow, increased pump capacity at Fobney WTW treated water PS from 18Ml/d to 23.88Ml/d. |
| TWU_SWX_HI-TFR_KVZ_ALL_kennet-swox6.7 | Kennet Valley to SWOX Transfer - 6.7 Ml/d | The works proposed include: treated water pipeline from Pangbourne WTW to Cleeve WTW 9.4km (350dia), a PS at Pangbourne WTW (150kW), balance tank at Cleeve WTW (2 x the pipe volume), 800m (700dia) of replacement pipeline at the end of the Fobney WTW to Tilehurst SR main to increase flow. Increased pump capacity at Fobney WTW treated water PS from 18Ml/d to 28.34Ml/d. |
| TWU_SWX_HI-IMP_SWX_CNO_oxc-dukes cutswox | Oxford Canal - Duke's Cut (SWOX) - Construction | Upgrades to the canal network to transfer 15Ml/d surplus from the Wolverhampton Levels to upstream of Duke's Cut. |
| TWU_UTC_HI-IMP_UTC_CNO_oxcanal-cropredy | Oxford Canal - Cropredy - Construction | 15Ml/d resource option for Oxford Canal to the River Thames transfer. Option includes transfer of water to canal at Cropredy for discharge to River Cherwell and subsequent discharge into the River Thames. |
| TWU_SWX_HI-TFR_SWX_ALL_dukescut-farmoor | Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor | 15Ml/d conveyance option from the Oxford Canal to Farmoor Reservoir, with abstraction from a point approximately 800m north of Duke's Cut on the Oxford Canal, discharging into the River Thames for subsequent re-abstraction at the existing Farmoor Reservoir intake. It has been assumed that, as the transfer will only be used in periods of low flow, no works will be required to upgrade the existing intake structure or treatment facilities at Farmoor Reservoir. |
| TWU_LON_HI-TFR_LON_ALL_lockwood ps-kgv res | Thames-Lee Tunnel extension from Lockwood PS to King George V Reservoir intake | New connection from Lockwood PS to the intake of KGV reservoir. |

| Option ID | Option name | Description overview |
|---|---|---|
| TWU_SWX_HI-TFR_HEN_ALL_henley-swox2.4 | Henley to SWOX Transfer – 2.4 Ml/d | The option is for a new main from New Farm service reservoir (SR) (Henley) to Nettlebed SR (SWOX). This will require a new 5.9km (250dia) main from New Farm to Nettlebed and a new PS at New Farm. 2.4Ml/d capacity. |
| TWU_SWX_HI-TFR_HEN_ALL_henley-swox5 | Henley to SWOX Transfer – 5 Ml/d | The option is for one new main from New Farm SR (Henley) to Nettlebed SR (SWOX). This will require a new 5.9km, 350mm diameter main from New Farm to Nettlebed and a new PS at New Farm. 5Ml/d capacity. |
| TWU_LON_HI-GRW_RE1_ALL_asrhortonkirby | Manager Aquifer Recharge - Horton Kirby ASR | Construction of pipelines between two existing ASR boreholes in the Lower Greensand aquifer to an existing WTW at Horton Kirby in Kent. Water abstracted from existing Chalk aquifer boreholes (via the mains supply) will be recharged into the two ASR boreholes during periods of water surplus and abstracted when needed and treated at the WTW. |
| TWU_SWA_HI-GRW_ALL_ALL_datchet do | Groundwater Development - Datchet Existing Source DO Increase | Increase capacity of Datchet site. |
| TWU_HEN_HI-TFR_KVZ_ALL_tw(kv)to(hen)con | Transfer - Kennet Valley to Henley - Conveyance Element | Existing option. Potable Water Transfer to Thames Water (Kennet Valley) to Thames Water (Henley) Conveyance. |
| TWU_LON_HI-GRW_ALL_ALL_s'fleet lic disagg | Groundwater Development - Southfleet & Greenhithe | Southfleet-Greenhithe licence disaggregation and new headworks and PS at borehole sites, new 3km main from Greenhithe to new WTW. DO benefit is 8Ml/d average, 9Ml/d peak. |
| TWU_LON_HI-GRW_ALL_ALL_addington gw | Groundwater Development - Addington | New abstraction borehole and upgrade to WTW. DO benefit 1Ml/d average, 1.5Ml/d peak. |
| TWU_SWX_HI-GRW_ALL_ALL_woods farm do | Groundwater Development - Woods Farm Existing Source Increase DO | New borehole to be constructed on site to bring DO up to licence (this is an additional 2.4Ml/d to average licence of 4.99Ml/d or an additional 2.91Ml/d to peak licence of 5.5Ml/d). The option includes a new borehole and a 1.4km raw water pipeline from the new satellite borehole to Woods Farm WTW. |
| TWU_GUI_HI-TFR_RZ5_ALL_sewtogui | Transfer - SEW to Guildford - Conveyance Element | 10Ml/d transfer from South East Water (Hogsback) to Mount SR Guildford. |
| TWU_LON_HI-ROC_WT1_CNO_kemptonwtw100/150/300 | New WTW at Kempton - 100Ml/d - Construction | 100/150/300Ml/d new capacity at WTW at Kempton treating raw reservoir water in west London. Purpose is to accommodate additional future demand. |
| TWU_SWX_HI-GRW_ALL_ALL_moulsford gw | Groundwater Development - Moulsford Groundwater Source | Construction of an abstraction borehole in the unconfined Chalk north of Streatley on the west bank of the River Thames. Water abstracted from the borehole will be treated at the existing Cleeve WTW located on the eastern side of the River Thames. DO benefit is 3.5Ml/d peak and 2Ml/d average. |
| TWU_SWA_HI-TFR_SWX_ALL_swoxswa48 | Transfer from WTW in Abingdon to SWA - 48Ml/d | 48Ml/d treated water pipeline from Abingdon WTW to Long Crendon to supply SWA. |
| TWU_SWA_HI-TFR_SWX_ALL_swoxswa72 | Transfer from WTW in Abingdon to SWA - 72Ml/d | 72Ml/d treated water pipeline from Abingdon WTW to Long Crendon to supply SWA. |
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx)con | SWA to SWOX Transfer - Conveyance Element | Existing transfer. Potable Water Transfer from SWA WRZ to SWOX WRZ. |

| Option ID | Option name | Description overview |
|---|---|---|
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx)con b | SWA to SWOX Transfer - Conveyance Element | Existing transfer. Bulk transfers within region (treated) |
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx)con c | SWA to SWOX Transfer - Conveyance Element | Existing transfer. Bulk transfers within region (treated) |
| TWU_KVZ_HI-TFR_UTC_ALL_thamestofobney | River Thames to Fobney Transfer | 40Ml/d raw water transfer option from River Thames to Fobney WTW to supply Kennet Valley WRZ. |
| TWU_SWX_HI-TFR_STR_ALL_abing-farmoor pipe | Abingdon Reservoir to Farmoor Reservoir pipeline | Construction of a transfer pipeline to convey 24Ml/d of raw water between a proposed reservoir at Abingdon and the existing Farmoor reservoir, in the SWOX WRZ. (Note: Abingdon reservoir creation is not part of this option.) The engineering scope includes the provision of a booster PS at the proposed Abingdon reservoir site to facilitate the transfer. Treatment would be provided at the existing WTW. |
| TWU_GUI_HI-GRW_ALL_ALL_dapdune lic disagg | Groundwater Development - Dapdune Licence Disaggregation | Licence disaggregation. DO benefit 0Ml/d average, 2.2Ml/d peak |
| TWU_KVZ_HI-GRW_ALL_ALL_mortimer recomm | Groundwater Development - Recommission Mortimer Disused Source | Refurbishment of two disused abstraction boreholes located on-site at the existing but disused Mortimer WTW. Water abstracted from the boreholes will be sourced from the underlying deep confined Chalk and treated at the disused WTW which will be upgraded for ammonia and iron removal and recommissioned. DO benefit 4.5Ml/d average and peak. |
| TWU_LON_HI-TFR_LON_ALL_crossness to beckton | Crossness to Beckton tunnel (treated) - Construction | Transfer of 190Ml/d desalinated water to Beckton site via pipeline inside tunnel beneath the Thames. |
| TWU_LON_HI-TFR_LON_CNO_beckton-crossness | Beckton to Crossness tunnel (raw) - Construction | The estuarine water from the Beckton site is to be conveyed under the River Thames via a tunnel to the Crossness desalination treatment site. |
| TWU_LON_HI-GRW_ALL_ALL_merton recommission | Groundwater Development - Merton Recommissioning | The option comprises the recommissioning and upgrade of the Merton Abbey WTW in order to treat the maximum peak DO of 8Ml/d from the Merton Abbey Well. DO benefit 7.86Ml/d peak, 2Ml/d average |
| TWU_LON_HI-REU_RE1_ALL_deephams reuse 46.5 | Deephams Water Recycling – 46.5 Ml/d, direct to KGV - Construction | Transfer of Deephams sewage treatment works (STW) final effluent to the new water reuse works with the following technology: pre-screens, ultrafiltration (UF), reverse osmosis (RO), ultraviolet (UV) treatment, inter-process pumping, buildings and disinfection, pH adjustment chemicals. Includes conveyance to KGV reservoir. |
| TWU_KGV_HI-REU_RE1_CNO_deephams reuse 46.5b | Deephams Water Recycling – 46.5 Ml/d, to TLT - Construction | Transfer of Deephams STW final effluent to the new water reuse works with the following technology: pre-screens, UF, RO, UV treatment, inter-process pumping, buildings and disinfection, pH adjustment chemicals. Includes conveyance to TLT extension. |
| TWU_LON_HI-GRW_ALL_ALL_london conchalk | Groundwater Development - Confined Chalk North London | New abstraction borehole. DO benefit 2Ml/d average and peak. |
| TWU_GUI_HI-TFR_SES_ALL_reigatetoguildford5/20 | Transfer - Reigate (SES) to Guildford 5Ml/d | Either a 5Ml/d or 20Ml/d transfer from Reigate (SES) to Guildford. |

| Option ID | Option name | Description overview |
|---|---|---|
| TWU_HON_HI-ROC_NET_CNO_cop'mills-honoroak | TWRM extension - Coppermills to Honor Oak - Construction | New ring main tunnel from Coppermills to Honor Oak. |
| TWU_KVZ_HI-GRW_ALL_ALL_east woodhay roc | Groundwater Development - East Woodhay borehole pumps Removal of Constraints to DO | Upgrade of pumps and pump control to increase DO. DO benefit 2.1Ml/d peak, 0Ml/d average. |
| TWU_GUI_HI-GRW_ALL_ALL_dapdune roc | Groundwater Development - Removal of Constraints to Dapdune DO | Removal of the current constraints on the DO at the Dapdune source. Increase in pump capacity at Dapdune boreholes with an additional 4 rapid gravity filters at Ladymead WTW to treat. |
| TWU_LON_HI-DES_ALL_ALL_crossnessdesal50/100 | Crossness Desalination | Development of a 50Ml/d or 100Ml/d desalination plant located south of Crossness, using brackish estuarine feedwater from the River Thames. Transfer of treated water to Coppermills WTW for blending. |
| TWU_LON_HI-GRW_ALL_ALL_addington asr | Managed Aquifer Recharge - Addington | Two new ASR boreholes near Addington PS, and one borehole refurbishment, 300m length of sewer for conditioning discharges, booster recharge pumps due to artesian head pressures in aquifer. DO benefit 3Ml/d average, 5Ml/d peak. |
| TWU_LON_HI-GRW_ALL_ALL_honor oak gw | Groundwater Development - Honor Oak | Two new abstraction boreholes, connections to existing WTW, DO benefit 1Ml/d average, 2.82Ml/d peak. |
| TWU_LON_HI-GRW_ALL_ALL_honoroak do | Groundwater Development - Increase DO of Existing Honor Oak Source | Upgrade of WTW to include well refurbishment including replacement well borehole pump, Coagulation and flocculation system including re-lift PS, replacement of sand filters, replacement of disinfection and dechlorination equipment, ammoniation, orthophosphoric acid, and connection to power supply. DO of 1.66Ml/d |
| TWU_LON_HI-GRW_ALL_ALL_streatham ar | Managed Aquifer Recharge - Streatham (SLARS2) | One new aquifer recharge (AR) borehole at Streatham PS and one borehole refurbishment, new 17Ml/d WTW. DO benefit is 4Ml/d average, 4.5Ml/d peak. |
| TWU_LON_HI-GRW_ALL_ALL_thames valley asr | Managed Aquifer Recharge - Thames Valley, South London | Two new ASR boreholes at Ashford WTW, 1km length of sewer for conditioning discharges, booster injection pumps due to artesian head pressures in aquifer. DO benefit 3Ml/d average, 5Ml/d peak. |
| TWU_LON_HI-GRW_ALL_CNO_kidbrooke slars | Managed Aquifer Recharge - Kidbrooke (SLARS1) Construction | The scheme comprises the upgrade of the existing borehole at the Rochester Way site, another at the Bromley Reservoir site and the construction of a new AR borehole on private land in Eltham Green. Six observation boreholes will be constructed for groundwater level monitoring, four at the Eltham Green site and two off-site the Eltham Green location. Benefit is 8.1Ml/d peak and 7Ml/d average. The scheme also includes: construction of a new 10Ml/d WTW located on the existing Kidbrooke borehole site to serve the Rochester Way, Bromley Reservoir and a new AR borehole, a 5.7km (300mm) raw water transfer main between Bromley Reservoir and new AR borehole, a 6.4km (400mm) bi-directional raw water transfer main between Rochester Way AR borehole and a new AR borehole via Kidbrooke WTW (3.5km between Rochester Way and Kidbrooke WTW, 2.6km between new borehole and Kidbrooke WTW), a 1.8km (450mm) treated water main between Kidbrooke WTW and Bermondsey (Well Hall PS). |

| Option ID | Option name | Description overview |
|---|---|---|
| TWU_LON_HI-GRW_ALL_CNO_merton ar | Managed Aquifer Recharge - Merton (SLARS3) Construction | The scheme comprises the upgrade of the existing well and adit system at the Merton Abbey WTW for recharge/abstraction purposes and the construction of a new AR borehole at the nearby Byegrove Road site. DO benefit is 5Ml/d average and 6Ml/d peak. The scheme also includes the construction of a new 4.5Ml/d WTW located at the existing Merton Abbey WTW site to serve the Byegrove Road AR borehole and the installation of a 1.1km raw water main from the Byegrove Road AR borehole to the new Merton Abbey WTW. |
| TWU_LON_HI-ROC_NET_ALL_barrowhillpump | Replace pump infrastructure at Barrow Hill - TWRM | Pump 6 at Barrow Hill is to be replaced. |
| TWU_LON_HI-ROC_WT1_CNO_eastlondonwtw100/150/200/300 | New East London WTW | 184Ml/d treatment works for reservoir water in London. Purpose is to accommodate additional future demand. Water for treatment could be supplied from various option types including wastewater reuse and water transfers. There are also 150Ml/d, 200Ml/d and 300Ml/d versions of the option. |
| TWU_LON_HI-ROC_WT1_ALL_eastlonwtwexisting | Available Treatment Capacity at Coppermills WTW | Existing supply option. Increase water treatment works (WTW) capacity |
| TWU_LON_HI-ROC_WT1_ALL_existing w lon wtw | Available Treatment Capacity at West London WTWs | Existing supply option. Increase water treatment works (WTW) capacity |
| TWU_LON_HI-TFR_LON_ALL_ch'ford s intake | Intake Capacity Increase - Chingford South | Increase capacity of Chingford South intake. |
| TWU_LON_HI-TFR_LON_ALL_datchet int-qm | Intake Capacity Increase - Datchet | Increase capacity of Datchet PS site. |
| TWU_LON_HI-TFR_LON_ALL_littleton int-qm | Intake Capacity Increase - Queen Mary | Increase capacity of Littleton intake PS site by 300Ml/d. |
| TWU_LON_HI-TFR_LON_ALL_newriverhead pump 4 | Replace New River Head Pump - TWRM | Pump 4 at New River Head is to be replaced. |
| TWU_LON_HI-TFR_LON_CNO_second spine tunnel | Raw Water System Upgrade - Tunnel from Walthamstow 5 to Coppermills - Construction | Second Spine Tunnel from break tank to Reservoir 5 upstream of Coppermills WTW. |
| TWU_LON_HI-TFR_LON_CNO_surbiton int-walton | Surbiton intake capacity increase with transfer to Walton inlet channel | Increase capacity of Surbiton intake. |
| TWU_LON_HI-TFR_LON_CNO_tlt upgrade – roc | Raw Water System Upgrade - TLT Removal of Constraints - Construction | TLT reinforcement for a section of the tunnel, a new shaft 6m diameter at a depth of 30m and a new air valve. |
| TWU_STR_HI-RSR_RE1_CNO_res_marsh gibbon | New Reservoir - Marsh Gibbon 30Mm3 - Construction | New non-impounding bunded reservoir situated within Oxfordshire, 2km south of Marsh Gibbon with a volume of 30Mm³/50Mm$^3$/70Mm$^3$. |
| TWU_SWA_HI-GRW_ALL_ALL_dorney do | Groundwater Development - Dorney Existing Source DO Increase | Drilling of one new borehole and provision of two new submersible pumps (two per borehole) to increase the overall site capacity up to the source DO. DO benefit 4.3Ml/d (peak). 300m pipeline to connect to existing raw feed pipeline which runs to WTW and 100m run-to-waste pipeline. |

| Option ID | Option name | Description overview |
|---|---|---|
| TWU_SWA_HI-GRW_ALL_ALL_taplowincreasedo | Groundwater Development - Taplow Existing Source DO Increase | Aims to increase SDO up to licensed quantities. This is expected to bring peak SDO from 44Ml/d to 50Ml/d. The scope is as follows: increase Taplow to peak licence (50Ml/d) by drilling a new chalk abstraction borehole at the Dorney WTW site but added to the Taplow abstraction licence. Adding two pumps, duty/stand-by fitted with variable speed drives (VSDs). 300m rising main and 300m run to waste. |
| TWU_SWA_HI-ROC_WT1_CNO_medmenhamwtw | New Medmenham Surface Water WTW | 24Ml/d treatment works for river water near Medmenham (SWA). Purpose is to accommodate additional future demand. Includes a treated water PS, treated water transfer pipeline and new storage reservoir at Widdenton. |
| TWU_SWA_HI-TFR_SWX_ALL_tw(swx)to(swa)con | Thames Water Horspath (SWOX) to Thames Water Ashenden (SWA) Conveyance | Existing supply. Bulk transfers into region (treated) |
| TWU_SWA_HI-TFR_HEN_ALL_henley-swa2.4 | Henley to SWA Transfer - 2.4 Ml/d | The option is for one new main from Sheeplands WTW (Henley) to Hambleden WTW (SWA), 2.4Ml/d. This will require a new 9.94km main from Sheeplands WTW and a new PS at Sheeplands. |
| TWU_SWA_HI-TFR_HEN_ALL_henley-swa5 | Henley to SWA Transfer – 5 Ml/d | The option is for one new main from Sheeplands WTW (Henley) to Hambleden WTW (SWA), 5Ml/d. This will require a new 9.94km main from Sheeplands WTW and a new PS at Sheeplands. |
| TWU_SWA_HI-TFR_UTC_ALL_medmenham intake 53/80 | New Medmenham Surface Water Intake - 53 Ml/d | The Medmenham intake element includes the construction of an intake structure on the River Thames located approximately 1.75km west of the village of Medmenham, close to the village of Mill End. In addition to the intake structure, a PS will be constructed. The intake structure, PS and raw water transfer main would supply water from the River Thames to a new water treatment works at Medmenham. The intake and all associated infrastructure will be constructed with an abstraction capacity of either 53Ml/d or 80Ml/d. |
| TWU_SWX_HI-ROC_WT1_ALL_radcotwtw | New WTW - Radcot | 24Ml/d treatment works for reservoir water in Radcot (SWOX). Purpose is to accommodate additional future demand. |
| TWU_WLJ_HI-ROC_NET_CNO_twrm shaft kempton | New shaft on the TWRM at Kempton - Construction | This option includes a new shaft on the TWRM to accommodate 800Ml/d of treated water flow from the expanded Kempton WTW. |
| TWU_WLJ_HI-TFR_WLJ_CNO_qm res-kempton wtw | Additional conveyance from Queen Mary Reservoir to Kempton WTW | New conveyance of raw water from Queen Mary Reservoir to Kempton WTW. |
| TWU_UTC_HI-RSR_RE1_CNO_res_chinnor_2 | Additional conveyance from Queen Mary Reservoir to Kempton WTW - Construction | New non-impounding bunded reservoir situated within Oxfordshire, 5km southwest of Chinnor with a volume of 30Mm³. |
| TWU_STT_HI-TFR_STT_ALL_stt-sesro | New Reservoir - Chinnor 30Mm3 - Construction | Potential increase in DO by integrating the Severn to Thames Transfer (STT) pipeline and the Abingdon Reservoir Strategic Resource Options (SROs). |
| TWU_LON_HI-OTH_ALL_ALL_didcot purchase | STT to SESRO Link | The option extends the current agreement which is in place from AMP7 between Thames Water and RWE. |
| TWU_LON_HI-TFR_SES_ALL_cheam-merton | Didcot Power Station Licence Trading | Proposed new trunk mains to transfer water from Cheam WTW (SES) to Merton Ring Main Shaft including a new PS at Cheam WTW. |

| Option ID | Option name | Description overview |
|---|---|---|
| **Strategic Resource Options** | | |
| Abingdon Reservoir (South East Strategic Reservoir Option – SESRO) | This is a new water storage reservoir in the Upper Thames catchment, south-west of Abingdon. Water would be abstracted from the River Thames during periods of high flow and pumped into the reservoir. When flow in the river is low and water is required in London, or the wider South East, water would be released back to the Thames for re-abstraction downstream. There are a range of sizes of reservoirs being considered including: 75Mm$^3$, 100Mm$^3$, 125Mm$^3$, 150Mm$^3$. | |
| Severn to Thames Transfer (STT) | This is a water transfer from the North West and Midlands to the South East to support the South East of England during drought events. The water would be provided from the River Severn itself, with additional sources of water provided by Severn Trent Water and United Utilities. The water would be moved from the River Severn to the River Thames by a new pipeline. | |
| Thames to Southern Transfer (T2ST) | A transfer of water from Thames Water to Southern Water's Hampshire area helping to improve resilience through better connectivity. The transfer is dependent on the prior development of new water resource sources, namely the STT or SESRO. The T2ST SRO involves two options for the transfer of potable water from a new WTW at the intake location to the west of A34 near Drayton, Oxfordshire, to the existing Yew Hill Water Supply Reservoir (WSR) near Winchester, Hampshire. The following water transfer route options were under review at Gate 2:<br>● Option B: Pipeline from the new WTW at the intake location to the west of A34 near Drayton, then continuing to the west of the A34 to Yew Hill WSR. Connects along the route to three existing assets – Beacon Hill WSR, Micheldever WSR and Crabwood WSR.<br>● Option C: Pipeline from the new WTW at the intake location to the west of A34 near Drayton, running to the east of the A34 between Newbury and Whitchurch, then continuing to west of A34 to Yew Hill WSR. Connects along the route to three existing assets – Beacon Hill WSR, Micheldever WSR and Crabwood WSR. | |
| Thames to Affinity Transfer (T2AT) | A transfer of raw water from Thames Water to Affinity Water. It would rely on new sources of water from one of the strategic resources options (STT, SESRO or London water recycling) contributing to a resilient water supply for Affinity Water.<br>● Lower Thames Reservoir Option – The Lower Thames Reservoir Option involves the abstraction of raw water from Thames Water's Wraysbury and Queen Mother reservoirs via a proposed connection into Affinity Water's existing tunnel at the existing Iver WTW. This raw water would then be diverted to a new WTW and drinking water would be subsequently conveyed to an existing SR in the vicinity of Harefield.<br>● Beckton Reuse Indirect Option – The Beckton Reuse Indirect Option involves the abstraction of raw water from the River Lee flood relief channel and transfer to a new WTW, followed by conveyance of the drinking water produced to an existing SR in the vicinity of Brookmans Park and directly into the existing drinking water transfer network. A proportion of the water would then be able to flow under gravity to the existing booster PS in the vicinity of North Mymms. Whilst a proportion of the raw water may arise naturally in the River Lee catchment, in terms of water resources the scheme would depend on the indirect transfer of recycled water from the Beckton Water Recycling option of the London Water Recycling SRO. The proposed abstraction point would be located on the River Lee flood relief channel, downstream of the outfall from the Beckton Water Recycling option. | |
| London Water Recycling | The solution aims to use treated wastewater to provide a reliable, sustainable supply of water to support the flow in the River Thames. It does this by treating wastewater effluent to a high standard and discharging it to the River Thames or to the River Lee where it can then be abstracted and used as a raw water resource. The water would be treated at a WTW to meet high quality drinking water standards. There are four potential schemes being looked at:<br>● Beckton Water Recycling – Transfer of recycled water from Beckton to the new water reuse works with the following technology: pre-screens, UF, RO, UV treatment, inter-process pumping, buildings and chemical additions. DO 89Ml/d for 100Ml/d Capacity. DO 130Ml/d for 150Ml/d capacity. Conveyance of treated water from Beckton to Lockwood PS. | |

| Option ID | Option name | Description overview |
|---|---|---|
| | | • Mogden Water Recycling – A portion of final effluent from Mogden STW would be conveyed to a new Advanced Water Recycling Plant (AWRP). The recycled water would be discharged into the River Thames upstream of the existing Thames Water Walton WTW Intake. The waste streams would be conveyed back to Mogden STW.<br>• Mogden South Sewer – A portion of untreated sewage would be abstracted from the South Sewer, which runs close to Kempton Park WTW and would be pumped to a new AWRP located at a site near Kempton WTW (AWRP site). The recycled water would then be pumped and discharged into the River Thames upstream of the existing Thames Water Walton WTW intake. Waste stream from RO concentrate would be transferred to the existing Mogden STW outfall through a new pipeline, while the other waste stream could be returned to the South Sewer which discharges into Mogden STW inlet works. There is an opportunity that all waste stream could be returned to the South Sewer, if capacity of Mogden STW allows. This option was not progressed through Gate 2 and therefore, is not included further within this report.<br>• Teddington Direct River Abstraction (DRA) – A portion of the final effluent from Mogden STW would be subject to tertiary treatment and transferred in a tunnel for discharge into the River Thames upstream of Teddington weir. An equal volume of water would be abstracted from the Thames upstream of the new outfall. Abstracted water would be pumped into the nearby Thames Lee Tunnel for transfer to Lockwood Reservoir, part of the Lee Valley reservoirs in East London. The Gate 2 assessment considered a 75Ml/d option and a 100Ml/d option. Progression of further studies and modelling by Thames Water has shown marginal increased environmental risks associated with the 100Ml/d option compared to the 75Ml/d option. Overall, these have been shown to be minimal in the work undertaken to date. The Environment Agency requires that any option minimises the level of detriment to the river Thames at this location. It has indicated that scheme sizes greater than 75Ml/d would not be environmental promotable. Taking account of these points, as well as representations received expressing concerns around the environment, health and recreation in relation to the scheme, the maximum size of Teddington DRA to be included in the rdWRMP and progressed to Gate 3 is 75Ml/d. |
| **Drought Permit Options** | | |
| TWU_GUI_RE-DRP_ALL_ALL_dp-shalford-guild | Shalford Drought Permit | Under normal conditions, the abstraction comprises 30Ml/d from the River Wey (licence number 28/39/30/0066, aggregated with abstraction from the Tillingbourne licence 28/39/30/319). Implementation of the drought permit would involve an increase to the existing surface water abstraction from the River Wey and removing the licence aggregates. The benefit would be 5Ml/d. The drought permit may be implemented for up to six consecutive months between May and December inclusive, although it could be implemented any time of year. The River Wey is a mainly rural catchment of mixed geology, with baseflow originating from both the Chalk and Lower Greensand aquifers. Shalford WTW treats surface water abstracted from both the River Wey and River Tillingbourne just upstream of their confluence. |
| TWU_HEN_RE-DRP_ALL_ALL_dp-sheep/harp-hen | Harpsden/Sheeplands Drought Permit | The Harpsden abstraction consists of three boreholes abstracting from the unconfined Chalk aquifer (that is overlain by superficial gravels). The River Thames is located about 750m east of the abstraction, with the settlement Lower Shiplake lying between the river and the abstraction. The abstraction is licensed in aggregate with the Sheeplands abstraction, a group of three boreholes, also abstracting from the Chalk. The Sheeplands boreholes are located 3km south east |

| Option ID | Option name | Description overview |
|---|---|---|
| | | of Harpsden, on the other side of the River Thames to the Harpsden boreholes. The proposed drought option will be to relax the aggregate condition of the current abstraction licence and increase total abstraction from both locations to 27.9Ml/d. Abstraction at Sheeplands will continue to be pumped at 11.4Ml/d, which is within the boundaries of the normal operating licence. Typically, 10.5Ml/d of water is abstracted from the Harpsden boreholes under the normal operating licence, therefore an increase of 6Ml/d during drought would be taken, amounting to a total output of 16.5Ml/d. |
| TWU_KVZ_RE-DRP_ALL_ALL_dp-playhatch-kv | Playhatch Drought Permit | The abstraction is located in the South-West Chilterns Chalk groundwater body. It consists of two boreholes abstracting from the Chalk. Normal abstraction is annual average abstraction 7.27Ml/d, peak abstraction 8.2Ml/d. Proposed abstraction is 2.8Ml/d to 4.1Ml/d, an increase in peak abstraction of existing licence from 8.2Ml/d to 12.3Ml/d and providing a benefit of 4.1Ml/d. The drought permit could be implemented at any time of year; however, it is anticipated to be applied for up to six consecutive months between May and December inclusive. There is no construction phase associated with this drought permit. |
| TWU_SWX_RE-DRP_ALL_ALL_dp-gatehampton-swox | Gatehampton Drought Permit | Under normal licence conditions, water is abstracted from the Cretaceous Chalk aquifer at Gatehampton. The Gatehampton abstraction consists of seven boreholes (four boreholes are within 100m of the River Thames; the other three are approximately 250m from the river). Normal abstraction: The existing abstraction licence (28/39/23/173) permits abstraction from the Chalk aquifer at Gatehampton at a peak day rate of 105Ml/d with an average rate per year and month of 95Ml/d and an annual maximum of 3,4770Ml/ year. The operation of the existing abstraction licence is limited by flow conditions in the River Thames at Caversham Gauging Station. When flows are less than 400Ml/d for five days, abstraction must be maintained at or below 101.5Ml/d. Proposed abstraction: 3.5Ml/d, a continuation of abstraction from boreholes beyond licence conditions. This would provide a benefit of 3.5Ml/d. There is no construction phase associated with this drought option. |

# 2 INNS Assessment Methodology

## 2.1 INNS Level 1 screening

### 2.1.1 Overview

The Level 1 screening is based on the concept of risk as the product of the frequency and severity of INNS being transferred as the result of a water resource management option during its operation. Therefore, the methodology involves an assessor determining a Frequency of Impact and Severity of Impact which are combined to give an overall Magnitude of Risk.

The Level 1 screening methodology is informed by the EA's Position Statement on managing the risk of INNS through raw water transfers[3]. The approach to reducing the risk of INNS transfer outlined within this document is focused upon the pathways that transfers create, rather than current INNS distribution. Therefore, the Magnitude of Risk generated by the Level 1 screening relates to the nature of any pathways created by water resource options and the impacts these pathways are likely to have. Thus, the severity of risk is greater if an option links previously unconnected waterbodies, or if it involves the transfer of raw fresh or saline water (rather than treated water or groundwater).

The Level 1 screening gives a broad indication of the likely level of INNS transfer risk associated with an option and determines the need for a more detailed Level 2 assessment, where further details such as transfer distance, INNS distribution, protected sites, and recreational activities are accounted for.

### 2.1.2 Frequency of Impact rating

Table 2.1 below shows the criteria for determining the Frequency of Impact rating. This categorisation gives a broad indication of the frequency of additional INNS transfer risk during operation, with a higher frequency considered to create a higher risk of INNS transfer.

**Table 2.1: Frequency of Impact risk criteria used to assess INNS risk**

| Frequency of Impact | Criteria |
|---|---|
| None | Does not occur/no impact for which to determine a frequency |
| Infrequent | Only occurs in emergency or during situations not considered part of the normal running of the option |
| Periodical | Will happen during start up or shut down, or periodically during routine maintenance or operation of the option |
| Regular | Will occur throughout the regular operation of the option |

### 2.1.3 Severity of Impact rating

Table 2.2 below shows the criteria for determining the Severity of Impact rating. This process categorises an option based on the connectivity it may create between waterbodies, with new hydrological connections between waterbodies posing a greater risk. Options involving

[3] Environment Agency, 2022. Position Statement. Managing the Risk of Spread of Invasive Non-Native Species Through Raw Water Transfers. [pdf]

waterbodies with an existing hydrological connection would pose less additional risk (Medium severity) as INNS may already be able to move between them. An option involving the transfer of raw water within sealed infrastructure would create a relatively low risk, though some risk would be associated with potential leakage. Options involving the transfer of treated water or groundwater unlikely to contain INNS are considered to present a Very Low additional risk, whilst options relating to licence or infrastructure changes may not involve additional water transfer and are considered to have no impact to INNS transfer risk.

**Table 2.2: Severity of Impact risk criteria used to assess INNS risk**

| Severity | Criteria |
|---|---|
| None | No additional severity of impact risk beyond risk associated with existing operations |
| Very Low | Treated water, effluent or groundwater – assumed no aquatic or riparian INNS present |
| Low | Existing pathway between waterbodies or treated water/groundwater/effluent with no risk of INNS being transferred |
| Medium | Change in volume of transfer between waterbodies which are already connected |
| High | New pathway between waterbodies not currently connected or potential to introduce new INNS not currently observed in the UK |

### 2.1.4 Progression to Level 2

All feasible options initially screened as having a Low, Moderate or High INNS transfer risk were progressed to Level 2 assessment (if they were selected in the BVP or the two alternative plans). Level 2 assessments have been undertaken for all SRO options as part of RAPID Gate 2 submission, unless impacts were from construction-phase risks only.

## 2.2 INNS Level 2 Assessment

### 2.2.1 Magnitude of Risk rating

Once Frequency of Impact and Severity of Impact were determined for an option, the results were combined to give an overall Magnitude of Risk rating as shown in Table 2.3 below. If 'None' is selected for Frequency of Impact and/or Severity of Impact, 'No additional risk' is assigned as the Magnitude of Risk level.

**Table 2.3: Magnitude of Risk calculation matrix used to determine INNS risk**

| Frequency/Severity | None | Infrequent | Periodical | Regular |
|---|---|---|---|---|
| **None** | 0 = No additional risk | 0 = No additional risk | 0 = No additional risk | 0 = No additional risk |
| **Very Low** | 0 = No additional risk | 1 = Very Low | 1 = Very Low | 1 = Very Low |
| **Low** | 0 = No additional risk | 2 = Low | 2 = Low | 3 = Low |
| **Medium** | 0 = No additional risk | 3 = Low | 4 = Moderate | 4 = Moderate |

| Frequency/Severity | None | Infrequent | Periodical | Regular |
|---|---|---|---|---|
| **High** | 0 = No additional risk | 4 = Moderate | 5 = High | 6 = High |

### 2.2.2 Assessment methodology

The Level 2 assessment methodology utilised the SRO Aquatic INNS Risk Assessment Tool (SAI-RAT)[4] developed by APEM on behalf of the EA to quantify the INNS risk associated with options, based on the conceptual design information currently available.

Risk assessments are processes by which the level of risk presented by certain hazards can be assessed, where hazards are anything that can cause harm. The level of risk is typically the combination of the chance and the extent of the harm which could be caused. In the case of this tool, the hazard is the potential movement of INNS along key pathways, and the risk is the chance of that movement occurring combined with the extent of the harm this could cause.

The tool takes a pragmatic pathway and source-pathway-receptor model approach to the assessment of INNS risk relating to assets and raw water transfers. A desk-based search for INNS within 1km of the source and pathway is undertaken. The list of High Impact INNS that were cross-referenced for these assessments is detailed within the *UK Technical Advisory Group on the Water Framework Directive Revised classification of aquatic alien species according to their level of impact*[5] revised classification of aquatic alien species – this includes aquatic and riparian species.

The SAI-RAT takes the form of a Microsoft Excel spreadsheet, into which data and information about water transfer options are entered by the assessor to automatically generate an overall risk score. Risk scores are presented as a percentage of the highest potential score, with a higher score signifying an increased risk of introducing and transferring INNS.

The SAI-RAT requires a significant amount of information about options to be entered in order to assess the level of risk. As many of the feasible options are in an early stage of conceptualisation, the full range of information was not available for all options. It is likely that a failure to complete fields in the absence of information would result in the general under-estimation of risk; therefore, an alternate approach was adopted for the assessment of INNS risk for feasible options. This method was adopted to find a consistent way to populate the tool for the options with limited information available. This approach uses pre-determined default values for criteria where information is not yet available. Appropriate default 'assumed values' were agreed during a workshop in June 2022 (attended by water companies undertaking INNS risk assessments for WRMP24 and assessors working on their behalf). These assumed values are intended to represent the most likely or realistic input values. The use of assumed values in this way gives an estimation of a typical interaction with a pathway or asset, allowing a cautious assessment of risk to be made in the absence of specific information. Assumed values are detailed in Annex A.

The decision process for entering information into this risk assessment tool is shown below:

[4] APEM, 2021. SRO Aquatic INNS Risk Assessment Tool (SAI-RAT) – User Guide. Produced on behalf of the Environment Agency [pdf].

[5] UK TAG WFD, 2015. UK Technical Advisory Group on the Water Framework Directive Revised classification of aquatic alien species according to their level of impact. [online]. Available at: https://www.wfduk.org/sites/default/files/Media/Assessing%20the%20status%20of%20the%20water%20environment/UKTAG%20classification%20of%20alien%20species%20working%20paper%20v7.6.pdf [Accessed 26 September 2022].

1. For any given criterion, if information is available for the option, this should be entered into the tool.
2. If information is not available, 'Unknown' should be selected, if available. Selecting 'Unknown' within the tool results in a median risk score being added for that criterion.
3. If 'Unknown' is not available to select, an assumed value should be entered.

The SAI-RAT input data used for options that progressed to INNS Level 2 assessment is presented in Annex B.

## 2.3 INNS In-combination effects assessment

In-combination effects assessments were carried out for options within the following Thames Water rdWRMP plans:

- BVP Situation 1, Situation 4 and Situation 8
- LCP Situation 4
- BESP Situation 4

Potential interaction of Thames Water options with other water company plans should be assessed as a part of regional planning.

There is no defined methodology for undertaking an INNS in-combination effects assessment. Therefore, the methodology below has been developed and discussed with the EA.

### 2.3.1 Process A – Determination of option combinations for screening assessment

The aim of this process is to identify all combinations of two or more water resource options which have the potential to interact and therefore require a further screening assessment. A flowchart for this process (Process A) is shown in Figure 2.1 below.

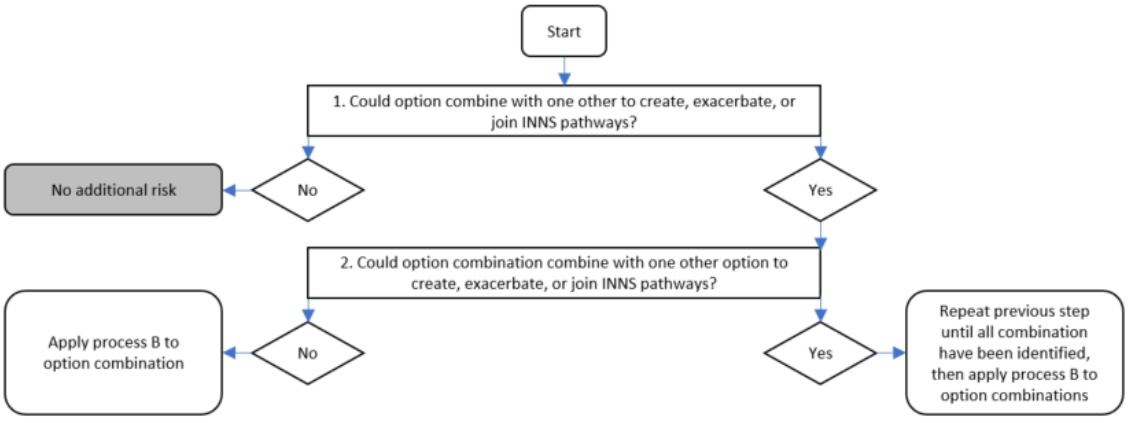


**Figure 2.1: Process A – flow diagram of process to determine option combinations for screening assessment**

Within this process, two options must initially be selected for an in-combination screening. The first step in the decision process is to determine, if these options may potentially interact – such as through shared assets, pipelines, or waterbodies.

Questions that may aid in this process are:

1. Could combining of options create a new INNS pathway, additional to any created by the individual options?

2. Could combining of options increase the risk of INNS transfer along an existing pathway, additional to the risk generated from individual options?
3. Could INNS pathways combine to create greater connectivity than that created by the individual options?

Information that may help in the process includes waterbody catchment mapping[6] and isolated catchment mapping[7].

If an option combination is determined to be unlikely to create any in-combination effects, the result is classed as 'No additional risk', and no further assessment is recommended.

If it has been assessed that it is possible for an option to generate in-combination effects, the potential for interaction with other water resource options should first be assessed. The option should be cross-referenced with a list of all other proposed options to determine whether further combinations of options could lead to in-combination effects. This process should be repeated until all combinations which could potentially generate in-combination effects have been determined.

All combinations of options identified during this process should be assessed to indicate the level of additional INNS transfer risk they present, and therefore the need for further assessment and mitigation. This process (Process B) is described in Section 2.3.2.

### 2.3.2 Process B – Assessment of additional in-combination risk

The flowchart for the assessment of additional INNS transfer risk identified by water resource option combinations identified in Process A is shown in Figure 2.2.

[6] Environment Agency, 2021. Catchment Data Explorer. [online] Available at: https://environment.data.gov.uk/catchment-planning/ [Accessed 5 April 2023].

[7] Environment Agency 2018. Invasive Non-Native Species Isolated Catchment Mapping. v3.


**Figure 2.2: Stage B – Flow diagram of process for assessment of additional in-combination risk**

Step 1 in this process differentiates between option combinations which will only result in the additional transfer of raw or partially treated water which may contain INNS and water unlikely to contain INNS, such a treated water, effluent or groundwater. Option combinations involving the additional transfer of water unlikely to contain INNS only are assessed as presenting Very low additional risk. Option combinations involving the additional transfer of water which may contain INNS are progressed to Step 2.

Step 2 screens out those option combinations which may present a High additional INNS transfer risk, as they may cause the transfer of raw or partially treated water to an isolated catchment. Isolated catchments are those without natural or man-made connectivity to other catchments[8]. Such option combinations would be of the highest priority for mitigation. Option combinations not involving a connection to an isolated catchment are progressed to Step 3.

Step 3 screens out option combinations that may create a link between surface waterbodies that are not already connected. The creation of a new link between waterbodies has the potential to spread INNS to new areas and habitats, and therefore these option combinations are also assessed as presenting a High additional INNS transfer risk. Option combinations that would

[8] Environment Agency 2018. Invasive Non-Native Species Isolated Catchment Mapping. v3.

not create a new link between waterbodies that have no existing connectivity are progressed to Step 4.

Step 4 identifies option combinations which create new links between surface waterbodies which are already connected. In these cases, INNS pathways between these waterbodies may already exist; therefore, such cases may present less additional risk than would be the case if there was no existing connection. Option combinations that would create a new link between waterbodies with existing connectivity are given a rating of Medium additional INNS transfer risk. Options not screened out in this step are progressed to Step 5.

Open water transfers have the additional risk of interaction with wildlife and human activities, which have the potential to transfer INNS from other sources and therefore represent a higher additional risk than closed transfers. Options progressed to Step 5 that involve open water transfer are given a rating of Low additional risk, whilst remaining options are progressed to Step 6.

Step 6 classifies all remaining option combinations as either of Low or Very Low additional risk. Very Low additional risk is assigned to option combinations typically involving very localised raw water transfers within a site where a pipe burst or washout would not lead to INNS transfer to a new location, whereas Low risk is given to option combinations with the potential for transfer of INNS to a new location through pipe bursts or washout.

## 2.4 Limitations and assumptions

### 2.4.1 Generic

Options including river support, river restoration, investigations into eel passage, INNS pathways and INNS mitigation – may affect INNS habitat suitability or dispersal; however, these are outside the scope of this report and best assessed on a case-by-case basis during the final design and construction phase, using the conclusions of this report to identify priority options for mitigation.

Desalination options were treated with the same methodology as used for freshwater options, as saline or brackish environments may harbour invasive species with a tolerance for different salinity levels.

Assessments within this report are based on operational INNS transfer risk. Construction-phase risks, which are not accounted for in the SAI-RAT, are best evaluated and mitigated on a case-by-case basis at a more advanced stage in option design and implementation. Construction-phase impacts will be assessed at the appropriate phase of option design to ensure that any construction-phase impacts will be appropriately mitigated, and that biosecurity best practice will be followed.

Mitigation will be further addressed during further design and construction phases. Mitigation for the SROs is discussed within their respective RAPID Gate 2 reports.

### 2.4.2 Level 1 screening

The Level 1 screening assessments are based on operational INNS transfer risk in accordance with the focus on pathways outlined within the EA position statement on raw water transfers. Construction-phase impacts are best evaluated and mitigated on a case-by-case basis and at a more advanced stage in option design and implementation. Construction-phase impacts will be assessed at the appropriate phase of option design to ensure that any construction-phase impacts will be appropriately mitigated, and that biosecurity best practice will be followed.

In accordance with the EA position statement on raw water transfers, the Level 1 screening does not account for INNS distribution and other specific local considerations. By progressing all

options screened as Low, Moderate or High risk to a Level 2 assessment, all options which may be affected by local issues, such as important nature conservation sites or high impact INNS, are subject to this more detailed risk assessment. By their nature, it is unlikely that those options initially screened as presenting No additional risk or Very Low risk would be affected by such local issues, as these options will not involve the transfer of raw water likely to contain INNS.

Where no information was available regarding the frequency of water transfers for these options, it was assumed transfer frequency would be Regular, which may not provide a true reflection of the overall frequency of risk within the risk assessment but represents a precautionary approach.

### 2.4.3 Level 2 assessment

The Level 2 assessments are based on operational INNS transfer risk, as the SAI-RAT does not account for construction-phase impacts, which are best evaluated and mitigated on a case-by-case basis at a more advanced stage in option design and implementation. Construction-phase impacts will be assessed at the appropriate phase of option design, to ensure that any construction-phase impacts will be appropriately mitigated, and that biosecurity best practice measures will be followed.

Several input values within the risk assessment tool were not known at this stage of the design and therefore the value ‘Unknown’ was selected. Selecting Unknown within the tool results in a median risk score being added for that criterion.

As described in Section 2.2.1, ‘assumed values’ (detailed in Annex A) were used where ‘Unknown’ was not available as an option within the tool. For this purpose, it was assumed that staff visits to WTWs will be frequent. Whilst staff visits to reservoirs may still be frequent, maintenance activities are likely to be less so.

The overall level of risk indicated may be subject to change as further information about options becomes available and more representative input data can be entered.

Recommendations for operational-phase biosecurity measures are not being considered at this stage due to the limited information available for many options at this strategic stage of planning. Biosecurity recommendations for SROs may be discussed within their respective RAPID Gate 2 reports.

### 2.4.4 In-combination assessments

The in-combination effects assessments described in this report are based on options with the Thames Water rdWRMP. Potential interactions with other water company options are not included within this report and should be considered as a part of regional planning.

The determination of option combinations for assessment, and the assessment of risk may be limited by the information available at the time of assessment. As such, screening results may only be indicative of additional INNS transfer risk. This is considered proportionate to the strategic stage of planning that the WRMP represents and will be developed further as the plan options are progressed through further stages of design.

The methodology assumes treatment standards are met at treatment works, and broadly categorises water into raw water, partially treated water (which may contain INNS), treated water and effluent. The effects of partial treatment, such as for the purposes of reducing INNS risk, is therefore best assessed on a case-by-case basis using a more detailed assessment technique.

The results of such screening assessments may exclude the impact of mitigation, if this has not yet been determined.

The EA INNS Isolated Catchment Mapping[9] defines the limit of INNS spread between natural waterbodies as the tidal limit of the watercourse.

This methodology is based on additional operational INNS transfer risk in accordance with the focus on pathways outlined within the EA position statement on raw water transfers. Construction-phase impacts are best evaluated and mitigated on a case-by-case basis and at a more advanced stage in option design and implementation. Construction-phase impacts will be assessed at the appropriate phase of option design, to ensure that that any construction-phase

It is noted that through abstraction and transfer of water, effects on habitats from reduced or increased flows may alter habitat suitability or dispersal of INNS already present in a waterbody. Such effects would not be accounted for within this methodology, and any such changes may need to be investigated at a later stage of option development.

[9] Environment Agency 2018. Invasive Non-Native Species Isolated Catchment Mapping. v3

# 3 Results and Discussion

## 3.1 INNS Level 1 screening results

Table **3.1** below summarises the results from the INNS risk screening assessment of the feasible options. The results of the Gate 2 INNS assessments for the SROs are reported separately in Section 3.3 below.

The Drought Permit options were assessed as part of the Thames Drought Plan environmental assessment process. The assessment was undertaken as part of the SEA and therefore did not follow the INNS methodology discussed in Section 2. The results are presented in Table 3.2.

Of the feasible options, 13 options resulted in a rating of No additional risk of INNS transfer. Thirty-six options were given a result of Very Low risk, as these are associated with the transfer of groundwater or treated water, which are considered unlikely to contain INNS.

Eight options were given a Low risk – Thames to Fobney (TWU_KVZ_HI-TFR_UTC_ALL_thamestofobney), Medmenham intake (TWU_SWA_HI-TFR_UTC_ALL_medmenham intake 53), Beckton desalination (TWU_LON_HI-DES_ALL_CNO_beckton desal 50/100/150), Beckton to Crossness tunnel (raw) - Construction (TWU_LON_HI-TFR_LON_CNO_beckton-crossness), Crossness Desalination (Blended) – 50/100Ml/day Enhancement (TWU_LON_HI-DES_ALL_ALL_crossnessdesal50/100), Second Spine Tunnel from break tank to Reservoir 5 upstream of Coppermills WTW (TWU_LON_HI-TFR_LON_CNO_second spine tunnel), Radcot WTW (TWU_SWX_HI-ROC_WT1_ALL_radcotwtw) and Additional conveyance from Queen Mary Reservoir to Kempton WTW (TWU_WLJ_HI-TFR_WLJ_CNO_qm res-kempton wtw) – as they involve the movement of raw water to a water treatment facility via a sealed pipeline or intake pipeline, with a risk associated with potential pipe bursts or leakage of raw water containing INNS.

Seven options were given a Moderate rating – The Lockwood PS to KGV Reservoir option (TWU_LON_HI-TFR_LON_ALL_lockwood ps-kgv res), Oxford Canal to Duke's Cut option (TWU_SWX_HI-IMP_SWX_CNO_oxc-dukes cutswox ), Streatham Aquifer Recharge (TWU_LON_HI-GRW_ALL_ALL_streatham ar), Managed Aquifer Recharge - Thames Valley, South London (TWU_LON_HI-GRW_ALL_ALL_thames valley asr), Intake Capacity Increase - Datchet (TWU_LON_HI-TFR_LON_ALL_datchet int-qm), Intake Capacity Increase - Queen Mary (TWU_LON_HI-TFR_LON_ALL_littleton int-qm) and Surbiton intake capacity increase with transfer to Walton inlet channel (TWU_LON_HI-TFR_LON_CNO_surbiton int-walton) as these involve a change in volume of transfer between waterbodies which are already connected.

Six options were given a rating of High risk – (Abingdon to Farmoor pipeline (TWU_SWX_HI-TFR_STR_ALL_abing-farmoor pipe), Oxford Canal - Transfer from Duke's Cut to Farmoor transfer (TWU_SWX_HI-TFR_SWX_ALL_dukescut-farmoor), Marsh Gibbon Reservoir (TWU_STR_HI-RSR_RE1_CNO_res_marsh gibbon), Groundwater Development - Taplow Existing Source DO Increase (TWU_SWA_HI-GRW_ALL_ALL_taplowincreasedo), Chinnor Reservoir 30Mm3 (TWU_UTC_HI-RSR_RE1_CNO_res_chinnor_2) and STT-SESRO Link (TWU_STT_HI-TFR_STT_ALL_stt-sesro), as they involve the transfer of raw water between waterbodies which are assumed to be currently unconnected or creation of a new reservoir.

**Table 3.1: Summary of feasible options INNS Level 1 screening results**

| Option ID | Description of Risk | Frequency | Severity | Risk Magnitude | Level 2 assessment advised |
|---|---|---|---|---|---|
| TWU_SWX_HI-TFR_HEN_ALL_henley-swox5 | Transfer of treated water within region – physical transfer of treated water (between two locations assumed currently unconnected) – no INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_GUI_HI-TFR_RZ4_ALL_sewtogui | Transfer of treated water within region – physical transfer of treated water (between two locations assumed currently unconnected) – no INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_LON_HI-TFR_LON_ALL_lockwood ps-kgv res | Change in volume of untreated water transferred between two locations assumed to be already connected.<br>Additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal. | Regular | Medium | 4 = Moderate | Yes |
| TWU_KVZ_HI-TFR_UTC_ALL_thamestofobney | Physical transfer of untreated water within region (between two locations assumed currently unconnected) – assumes any transferred INNS would be treated/removed at water treatment facility.<br>Additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal. | Regular | Low | 3 = Low | Yes |
| TWU_LON_HI-GRW_ALL_ALL_addington gw | Groundwater abstraction – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_LON_HI-GRW_ALL_ALL_s'fleet lic disagg | Groundwater abstraction – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Regular | Very Low | 1 = Very Low | No |

| Option ID | Description of Risk | Frequency | Severity | Risk Magnitude | Level 2 assessment advised |
|---|---|---|---|---|---|
| TWU_LON_HI-GRW_RE1_ALL_asrhortonkirby | Aquifer recharge/artificial recharge (AR) – physical transfer of untreated water (between two locations assumed currently already connected). Assumes that recharge is over short term and/or intermittent according to conditions, and that water will be re-extracted for use at a later date. Very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_LON_HI-ROC_NET_CNO_hampton-battersea | Capacity expansion of treated water (no INNS risk as water will be free from INNS) – construction-phase risks only. Excluded from these assessments and assumed to be evaluated and mitigated as appropriate. | None | None | 0 = No additional risk | No |
| TWU_LON_HI-ROC_WT1_CNO_kemptonwtw100/150/300 | Increase WTW capacity – no risk of transfer/movement of INNS with this option type. Construction-phase risks only – excluded from these assessments and assumed to be evaluated and mitigated as appropriate. | None | None | 0 = No additional risk | No |
| TWU_LON_HI-ROC_WT1_CNO_eastlondonwtw100/150/200/300 | Increase WTW capacity – no risk of transfer/movement of INNS with this option type. Construction-phase risks only – excluded from these assessments and assumed to be evaluated and mitigated as appropriate. | None | None | 0 = No additional risk | No |
| TWU_SWA_HI-GRW_ALL_ALL_datchet do | Groundwater sources – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_SWA_HI-TFR_SWX_ALL_swoxswa48 | Transfer of treated water within region – physical transfer of treated water (between two locations assumed currently unconnected) – no INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_SWA_HI-TFR_SWX_ALL_swoxswa72 | Transfer of treated water within region – physical transfer of treated water (between two locations assumed currently unconnected) – no INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |

| Option ID | Description of Risk | Frequency | Severity | Risk Magnitude | Level 2 assessment advised |
|---|---|---|---|---|---|
| TWU_SWX_HI-GRW_ALL_ALL_moulsford gw | Groundwater sources – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_SWX_HI-GRW_ALL_ALL_woods farm do | Groundwater sources – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_SWX_HI-TFR_STR_ALL_abing-farmoor pipe | Physical transfer of untreated water (between two locations assumed to be currently unconnected).<br>Additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows, and sludge disposal. | Regular | High | 6 = High | Yes |
| TWU_GUI_HI-GRW_ALL_ALL_dapdune lic disagg | Groundwater sources – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_KVZ_HI-GRW_ALL_ALL_mortimer recomm | Groundwater sources – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_SWX_HI-TFR_SWX_ALL_dukescut-farmoor | Physical transfer of untreated water (between two locations assumed to be currently unconnected).<br>Additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows, and sludge disposal. | Regular | High | 6 = High | Yes |
| TWU_LON_HI-ROC_WT1_ALL_eastlonwtwexisting | Existing option. No risk of transfer/movement of invasive or non-native species. | N/A | N/A | 0 = No additional risk | No |
| TWU_LON_HI-ROC_WT1_ALL_existing w lon wtw | Existing option. No risk of transfer/movement of invasive or non-native species. | N/A | N/A | 0 = No additional risk | No |
| TWU_LON_HI-TFR_LON_ALL_newriverhead pump 4 | Transfer of treated water within region – physical transfer of treated water (between two locations assumed currently unconnected) – no INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |

| Option ID | Description of Risk | Frequency | Severity | Risk Magnitude | Level 2 assessment advised |
|---|---|---|---|---|---|
| TWU_SWA_HI-ROC_WT1_CNO_medmenham wtw | Increase WTW capacity – no risk of transfer/movement of INNS with this option type. | None | None | 0 = No additional risk | No |
| TWU_HEN_HI-TFR_KVZ_ALL_tw(kv)to(hen)con | Existing transfer of treated water within region – physical transfer of treated water (between two locations assumed currently unconnected) – no INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx) con | Existing transfer of treated water within region – physical transfer of treated water (between two locations assumed currently unconnected) – no INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx) con b | Existing transfer of treated water within region – physical transfer of treated water (between two locations assumed currently unconnected) – no INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx) con c | Existing transfer of treated water within region – physical transfer of treated water (between two locations assumed currently unconnected) – no INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_SWA_HI-TFR_UTC_ALL_medmenham intake 53 | Physical transfer of untreated water between two locations assumed currently unconnected. Assumes any transferred INNS would be treated/removed at water treatment facility. Additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal | Regular | High | 3 = Low | Yes |
| TWU_SWX_HI-IMP_SWX_CNO_oxc-dukes cutswox (includes Oxford Canal to Cropredy TWU_UTC_HI-IMP_UTC_CNO_oxcanal-cropredy) | Change in volume of transfer between waterbodies which are already connected Additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows, and sludge disposal. | Regular | High | 4 = Moderate | Yes |
| TWU_HON_HI-ROC_NET_CNO_cop'mills-honoroak | Capacity expansion of treated water (no INNS risk as water will be free from INNS) – construction-phase risks only. Excluded from these assessments and assumed to be evaluated and mitigated as appropriate. | None | None | 0 = No additional risk | No |

| Option ID | Description of Risk | Frequency | Severity | Risk Magnitude | Level 2 assessment advised |
|---|---|---|---|---|---|
| TWU_KGV_HI-REU_RE1_CNO_deephams reuse 46.5b | Reclaimed water, water re-use, effluent re-use – very limited risk as the source water is likely to be entirely free of INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_LON_HI-REU_RE1_ALL_deephams reuse 46.5 | Reclaimed water, water re-use, effluent re-use – very limited risk as the source water is likely to be entirely free of INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_LON_HI-DES_ALL_CNO_beckton desal 50/100/150 | Potential for intake pipe bursts causing water to be released to the environment (creating pathway for the transfer of INNS). (Assumes any transferred INNS would be treated/removed at water treatment facility) | Infrequent | Medium | 3= Low | Yes |
| TWU_LON_HI-GRW_ALL_ALL_addington asr | Groundwater or treated sources – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_LON_HI-GRW_ALL_ALL_london conchalk | Groundwater sources – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_LON_HI-GRW_ALL_ALL_merton recommission | Groundwater sources – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_LON_HI-GRW_ALL_CNO_kidbrooke slars | Groundwater sources – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_LON_HI-GRW_ALL_CNO_merton ar | Groundwater sources – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_LON_HI-TFR_LON_CNO_beckton-coppermills | Transfer of treated water within region – physical transfer of treated water (between two locations assumed currently unconnected) – no INNS risk as assumed treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |

| Option ID | Description of Risk | Frequency | Severity | Risk Magnitude | Level 2 assessment advised |
|---|---|---|---|---|---|
| TWU_LON_HI-TFR_SES_ALL_cheam-merton | Transfer of treated water within region – physical transfer of treated water (between two locations assumed currently unconnected) – no INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_SWX_HI-TFR_HEN_ALL_henley-swox2.4 | Transfer of treated water within region – physical transfer of treated water (between two locations assumed currently unconnected) – no INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_LON_HI-OTH_ALL_ALL_didcot purchase | Existing option.<br>No risk of transfer/movement of invasive or non-native species with this option type. | N/A | N/A | 0 = No additional risk | No |
| TWU_LON_HI-LRE_WT1_ALL_copperwtwmecana200/480/680 | No risk of transfer/movement of invasive or non-native species with this option type | N/A | N/A | 0 = No additional risk | No |
| TWU_LON_HI-TFR_SES_ALL_woodwtw-epsomdowns | Physical transfer of treated water between two locations assumed currently unconnected. No INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_SWX_HI-GRW_ALL_ALL_ashton keynes | Groundwater source – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Infrequent | Very Low | 1 = Very Low | No |
| TWU_LON_HI-TFR_LON_ALL_nrv-groundimprov | Groundwater source – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Infrequent | Very Low | 1 = Very Low | No |
| TWU_SWX_HI-TFR_KVZ_ALL_kennet-swox2.3 | Physical transfer of treated water between two locations assumed currently unconnected. No INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_SWX_HI-TFR_KVZ_ALL_kennet-swox6.7 | Physical transfer of treated water between two locations assumed currently unconnected. No INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_LON_HI-TFR_LON_ALL_crossness to beckton | Physical transfer of desalinated water between two locations assumed currently unconnected. Assumes desalination prior to transfer would remove INNS. | Regular | Very Low | 1 = Very Low | No |

| Option ID | Description of Risk | Frequency | Severity | Risk Magnitude | Level 2 assessment advised |
|---|---|---|---|---|---|
| TWU_LON_HI-TFR_LON_CNO_beckton-crossness | Physical transfer of untreated water between two locations assumed currently unconnected. Assumes any transferred INNS would be treated/removed at desalination plant.<br>Risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal. | Infrequent | Medium | 3 = Low | Yes |
| TWU_GUI_HI-TFR_SES_ALL_reigatetoguildford5/20 | Physical transfer of treated water between two locations assumed currently unconnected. No INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_KVZ_HI-GRW_ALL_ALL_east woodhay roc | No risk of transfer/movement of invasive or non-native species with this option type. | N/A | N/A | 0 = No additional risk | No |
| TWU_LON_HI-DES_ALL_ALL_crossnessdesal50/100 | Physical transfer of untreated water between two locations assumed currently unconnected. Assumes any transferred INNS would be treated/removed at desalination plant/WTW.<br>Risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal. | Infrequent | Medium | 3 = Low | Yes |
| TWU_LON_HI-GRW_ALL_ALL_honor oak gw | Groundwater source – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Infrequent | Very Low | 1 = Very Low | No |
| TWU_LON_HI-GRW_ALL_ALL_honoroak do | Groundwater source – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Infrequent | Very Low | 1 = Very Low | No |
| TWU_LON_HI-GRW_ALL_ALL_streatham ar | Physical transfer of untreated water. Assumes that groundwater recharge is over short term and/or intermittent according to conditions, and that water will be re-extracted for use at a later date. | Periodical | Medium | 4 = Moderate | Yes |
| TWU_LON_HI-GRW_ALL_ALL_thames valley asr | Physical transfer of untreated water. Assumes that groundwater recharge is over short term and/or intermittent according to conditions, and that water will be re-extracted for use at a later date. | Periodical | Medium | 4 = Moderate | Yes |
| TWU_LON_HI-ROC_NET_ALL_barrowhillpump | No risk of transfer/movement of invasive or non-native species with this option type. | N/A | N/A | 0 = No additional risk | No |
| TWU_LON_HI-TFR_LON_ALL_ch'ford s intake | No risk of transfer/movement of invasive or non-native species with this option type. | N/A | N/A | 0 = No additional risk | No |

| Option ID | Description of Risk | Frequency | Severity | Risk Magnitude | Level 2 assessment advised |
|---|---|---|---|---|---|
| TWU_LON_HI-TFR_LON_ALL_ datchet int-qm | Physical transfer of untreated water between two locations with existing connection.<br>Additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal. | Regular | Medium | 4 = Moderate | Yes |
| TWU_LON_HI-TFR_LON_ALL_ littleton int-qm | Physical transfer of untreated water between two locations with existing connection.<br>Additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal. | Regular | Medium | 4 = Moderate | Yes |
| TWU_LON_HI-TFR_LON_CNO _second spine tunnel | Physical transfer of untreated water between two locations assumed currently unconnected. Assumes any transferred INNS would be treated/removed at WTW.<br>Additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal. | Regular | Low | 3 = Low | Yes |
| TWU_LON_HI-TFR_LON_CNO _surbiton int-walton | Physical transfer of untreated water between two locations with existing connection.<br>Additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal. | Regular | Medium | 4 = Moderate | Yes |
| TWU_LON_HI-TFR_LON_CNO _tlt upgrade – roc | No risk of transfer/movement of invasive or non-native species with this option type. | N/A | N/A | 0 = No additional risk | No |
| TWU_STR_HI-RSR_RE1_CNO _res_marsh gibbon | New reservoirs represent new natural habitats for birds, which could pick up INNS and transfer to other local waterbodies.<br>New reservoirs may form new recreational usage increasing the risk of INNS transfer to other waterbodies via recreational equipment (e.g. kayaking, fishing etc.)<br>Operational risks include overflows, sludge disposal etc.<br>Range of construction-phase risks.<br>Additionally, physical transfer of untreated water presents additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal. | Regular | High | 6 = High | Yes |
| TWU_SWA_HI-GRW_ALL_ALL _dorney do | Groundwater source – very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not permit any additional inputs of INNS. | Infrequent | Very Low | 1 = Very Low | No |

| Option ID | Description of Risk | Frequency | Severity | Risk Magnitude | Level 2 assessment advised |
|---|---|---|---|---|---|
| TWU_SWA_HI-GRW_ALL_ALL_taplowincreasedo | New reservoirs represent new natural habitats for birds, which could pick up INNS and transfer to other local waterbodies.<br>New reservoirs may form new recreational usage increasing the risk of INNS transfer to other waterbodies via recreational equipment (e.g. kayaking, fishing etc.)<br>Operational risks include overflows, sludge disposal etc.<br>Range of construction-phase risks.<br>Additionally, physical transfer of untreated water presents additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal. | Regular | High | 6 = High | Yes |
| TWU_SWA_HI-TFR_HEN_ALL_henley-swa2.4 | Physical transfer of treated water between two locations assumed currently unconnected. No INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_SWA_HI-TFR_HEN_ALL_henley-swa5 | Physical transfer of treated water between two locations assumed currently unconnected. No INNS risk as treated water will be free from INNS. | Regular | Very Low | 1 = Very Low | No |
| TWU_SWX_HI-ROC_WT1_ALL_radcotwtw | Physical transfer of untreated water between two locations assumed currently unconnected. Assumes any transferred INNS would be treated/removed at WTW.<br>Additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal. | Regular | Low | 3 = Low | Yes |
| TWU_WLJ_HI-ROC_NET_CNO_twrm shaft kempton | No risk of transfer/movement of invasive or non-native species with this option type. | N/A | N/A | 0 = No additional risk | No |
| TWU_WLJ_HI-TFR_WLJ_CNO_qm res-kempton wtw | Physical transfer of untreated water between two locations assumed currently unconnected. Assumes any transferred INNS would be treated/removed at WTW.<br>Additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal. | Regular | Low | 3 = Low | Yes |

| Option ID | Description of Risk | Frequency | Severity | Risk Magnitude | Level 2 assessment advised |
|---|---|---|---|---|---|
| TWU_UTC_HI-RSR_RE1_CNO_res_chinnor_2 | New reservoirs represent new natural habitats for birds, which could pick up INNS and transfer to other local waterbodies.<br>New reservoirs may form new recreational usage increasing the risk of INNS transfer to other waterbodies via recreational equipment (e.g. kayaking, fishing etc.)<br>Operational risks include overflows, sludge disposal etc.<br>Range of construction-phase risks.<br>Additionally, physical transfer of untreated water presents additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal. | Regular | High | 6 = High | Yes |
| TWU_STT_HI-TFR_STT_ALL_stt-sesro | Physical transfer of untreated water between two locations assumed currently unconnected.<br>Additional risks from pipeline washout, pipeline bursts, washwater discharge, overflows and sludge disposal. | Regular | High | 6 = High | Yes |

### Table 3.2: Summary of Drought Permit option SEA INNS screening results

| Option ID | Potential residual effect on sensitive receptors (assuming good practice construction methods) Commentary | Residual adverse effect significance | Residual beneficial effect significance |
|---|---|---|---|
| TWU_GUI_RE-DRP_ALL_ALL_dp-shalford-guild | Given the negligible magnitude of impacts of the drought permit on hydrology and water quality, no impacts in invasive species are anticipated. | None | None |
| TWU_HEN_RE-DRP_ALL_ALL_dp-sheep/harp-hen | The negligible hydrological impact of drought permit implementation is unlikely to result in any change to the potential spread or dispersal of invasive species. | Negligible adverse | None |
| TWU_KVZ_RE-DRP_ALL_ALL_dp-playhatch-kv | The EAR reports for the following invasive flora species Japanese knotweed (*Fallopia japonica*), Giant hogweed (*Heracleum mantegazzianum*), Himalayan balsam (*Impatiens glandulifera*), as these invasive plant species listed can utilise flow of the watercourse for dispersal but are not reliant on it, implementation of the drought permit will therefore not increase dispersal. For other invasive flora species Australian swamp stonecrop (*Crassula helmsii*); parrot's feather (*Myriophyllum aquaticum*); floating pennywort (*Hydrocotyle* | None | None |

| Option ID | Potential residual effect on sensitive receptors (assuming good practice construction methods) Commentary | Residual adverse effect significance | Residual beneficial effect significance |
|---|---|---|---|
| | *ranunculoides*); water fern (*Azolla filiculoides*) and Nuttall's pondweed (*Elodea nuttallii*), the EAR reports although the species may be susceptible to changes in flow and level, given the negligible impact magnitude on surface waters this is unlikely to occur. | | |
| TWU_SWX_RE-DRP_ALL_ALL_dp-gatehampton-swox | The EAR reports the implementation of the drought permit will not increase dispersal of invasive flora species. For other invasive species significant effects are unlikely due to the negligible impact on surface waters. | None | None |

## 3.2 INNS Level 2 assessment results

### 3.2.1 Results Summary

A summary of the INNS Level 2 assessment results for options selected in the BVP or the two alternative plans is presented below in Table 3.3. It should be noted that the River Thames to Fobney option has not been selected for the rdWRMP24, however, it was selected in the dWRMP24 and an assessment was undertaken. Therefore, it has been included below for completeness.

**Table 3.3: Level 2 INNS risk assessment results**

| Option ID | Option name | Level 1 Risk Magnitude | Component(s) | Level 2 risk score |
|---|---|---|---|---|
| TWU_SWX_HI-TFR_STR_ALL_abing-farmoor pipe | Abingdon to Farmoor pipeline | High | Abingdon to Farmoor transfer | 32.02% |
| TWU_LON_HI-TFR_LON_ALL_lockwood ps-kgv res | Thames Lee Tunnel (TLT) extension from Lockwood Pumping Station (PS) to King George V (KGV) Reservoir intake | Moderate | Lockwood PS to KGV Reservoir transfer | 54.06% |
| TWU_SWX_HI-TFR_SWX_ALL_dukescut-farmoor | Oxford Canal - Transfer from Duke's Cut to Farmoor | High | Oxford Canal to River Thames transfer | 35.31% |
| TWU_LON_HI-DES_ALL_CNO_beckton desal 150 | Beckton Desalination – 150Ml/d | Low | Intake and Beckton Desalination plant | 43.07% |
| TWU_SWX_HI-IMP_SWX_CNO_oxc-dukes cutswox | Oxford Canal – Duke's Cut (SWOX) | Moderate | Oxford Canal to Duke's Cut | 31.69% |
| TWU_SWA_HI-TFR_UTC_ALL_medmenham intake 53 | Medmenham intake – 53 | Low | Intake and transfer to WTW | 26.26% |
| **Non-selected option** | | | | |

| Option ID | Option name | Level 1 Risk Magnitude | Component(s) | Level 2 risk score |
|---|---|---|---|---|
| TWU_KVZ_HI-TFR_UTC_ALL_thamestofobney | River Thames to Fobney transfer | Low | River Thames to Fobney transfer | 28.64% |

### 3.2.2 Abingdon Reservoir to Farmoor Reservoir pipeline option

The Abingdon to Farmoor pipeline option was assessed as having a risk score of 32.02%.

The principal risk relating to this option is the creation of a pathway between reservoir waterbodies, which could facilitate the movement of INNS between these waterbodies and potentially increase the rate of INNS spread within the wider environment.

Mitigation measures were discussed at a workshop with the EA. The SESRO SRO includes space for a WTW which is likely to substantially reduce the risk. Additional space and capacity could be found within the planned site to contain any process required for mitigation. This will be explored further in Gate 3.

### 3.2.3 Thames-Lee Tunnel extension from Lockwood PS to King George V Reservoir intake option

The Lockwood PS to KGV Reservoir option was assessed as having a risk score of 54.06%.

The principal risk relating to this option is the creation of a pathway between waterbodies, which could facilitate the movement of INNS between these waterbodies and potentially increase the rate of INNS spread within the wider environment. However, as these reservoirs and the River Lee form a network at this location, it is likely that a common INNS community is present throughout.

Mitigation measures were discussed at a workshop with the EA. Proposed mitigation includes adding in the capacity for water to pass directly into KGV Reservoir, rather than into the River Lee as currently set out. The requirement for more extensive mitigation options is dependent on better understanding of the way the transfer will be operated. At present this is not clear, and therefore there is no clear requirement for other mitigation at present. This understanding will be developed appropriate to the requirement for this option.

### 3.2.4 Oxford Canal - Transfer from Duke's Cut to Farmoor transfer option

The Oxford Canal - Transfer from Duke's Cut to Farmoor transfer option assessment resulted in an INNS risk score of 35.31%.

This assessment generated a higher risk score due to the source and receptor both being open waterbodies with potential for high levels of recreational activity, which increases the chance of new INNS being introduced. Though the existing level of connectivity between these two waterbodies is unknown, any additional connections between them will introduce the likelihood of INNS transfer between waterbodies. There is also additional risk of the potential spread of INNS through pipe bursts between source and receptor, as this option crosses several ditches and streams as well as the River Evenlode. While the level of connection between the Oxford Canal and these waterbodies is not clear, a pipe burst may functionally create a new connection.

Mitigation measures were discussed at a workshop with the EA. It is considered that the risk level at this stage does not indicate a requirement for specific mitigation to be added to the option. However, mitigation requirements will be reviewed as the option design progresses.

### 3.2.5 Beckton Desalination

The Beckton Desalination intake transfer and desalination plant assessment resulted in an overall INNS risk score of 43.07%.

The principal risk associated with this option is the transfer of raw water through the intake pipeline (from the intake in the tidal Thames to the new desalination plant) and transfer of raw water between the storage lagoons; and the desalination plant could form a new pathway for INNS transmissions in the event of a pipeline burst or leak between the source and receptor. The current proposed site of the Beckton Desalination plant lies to the north of Beckton Sewage treatment works which is to the west of the River Roding. The River Roding flows into the tidal Thames downstream of the abstraction point of the River Thames, therefore a pipe burst may functionally create a new connection and result in the transfer and introduction of new INNS.

As the option is developed, mitigation proportionate to the level of risk will be considered and the EA will be consulted to determine the appropriate level of mitigation measures in relation to the potential risk of INNS transfer.

### 3.2.6 Oxford Canal to Duke's Cut (SWOX)

The Oxford Canal to Duke's Cut transfer assessment resulted in an overall score of 31.69 %.

The principal risk associated with this option is the use of open waterbodies to transfer additional flows and the length of this transfer, which crosses several WFD waterbody catchments. The additional flows may facilitate INNS transfer throughout the canal and to the receptor. As it is assumed recreation and angling will take place throughout the Oxford Canal, this will likely contribute to the risk of INNS being transferred down the canal system.

It is likely that the Canal and River Trust, the Environment Agency, and angling clubs would be well placed to advise on mitigation options which are proportional to the nature of the option, and they will be consulted as the option progresses through detailed design.

### 3.2.7 New Medmenham Surface Water Intake - 53 Ml/d

The Medmenham intake option assessment resulted in an overall risk score of 26.26%.

The principal risk associated with this option would be the spread of INNS through pipe bursts between source and receptor. However, the current proposed pipeline route does not cross any channels, with the closest being Hamble Brook which is approximately 150m away at its closest point.

As the option is further developed, mitigation proportionate to the level of risk will be considered and the EA consulted to determine the appropriate level of mitigation measures in relation to the potential risk of INNS transfer.

### 3.2.8 River Thames to Fobney transfer option (non-selected option)

The River Thames to Fobney transfer option assessment resulted in an INNS risk score of 28.64%.

The potential risk of this option would be the spread of INNS through pipe bursts between source and receptor. The principal waterbody at risk from pipe bursts would be the Holy Brook, which flows into the River Kennet (which then joins the River Thames further downstream). Holy Brook is culverted for long sections, so the extent of its current ecological connectivity to the River Kennet and Thames catchments is currently unclear, and a pipe burst may functionally create a new connection. The pipeline route would also cross some smaller watercourses within the Holy Brook catchment which could be at risk from pipe bursts.

This assessment was based upon unknown connectivity between the River Thames and Fobney WTW, which had the effect of selecting a median risk score in the SAI-RAT. The overall risk level was somewhat increased by known recreational uses within the River Thames (navigation and angling). Given the input data used, the possible risk scores generated by SAI-RAT for this option would range from 27.64% (more than three connections between source and receptor) to 29.64% (no connections between source and receptor).

Mitigation measures were discussed at a workshop with the EA. The pipeline route for the option was re-aligned and now largely mitigates the risk of pipe burst to Holy Brook. It is considered that the risk level at this stage does not indicate requirement for specific mitigation to be added to the option. However, mitigation requirements will be reviewed as the option design progresses.

## 3.3 SROs

### 3.3.1 SRO overview

A summary of the INNS assessments for the SROs is presented in this section. The INNS risk assessments were undertaken as part of the SRO Gate 2 process and have been summarised below. The assessment process undertaken for all SROs follows the same process as described in 2.2.2, however as more information is typically available, a greater level of detail is used to undertake the Level 2 assessment.

The scores generated provide a relative risk score and allow for comparison of different scenarios within an option and individual components, including volumetric transfer design and presence of recreational use. Comparison of risk scores between options should be used with caution – particularly when comparing assets and transfers – and professional judgment should be applied when identifying high risk components of a given scheme.

Table 3.4 provides a summary overview of the SRO Level 2 risk scores, with further detail provided in Sections 3.3.2 to 3.3.6 below.

**Table 3.4: Level 2 SRO SAI-RAT INNS risk assessment results**

| SRO | Option name | Component(s) | SRO Level 2 risk score |
|---|---|---|---|
| London Water Recycling | Teddington DRA | Teddington DRA – 50Ml/d / 75Ml/d | 50Ml/d – 55.88%<br>75Ml/d – 56.88% |
| | Beckton Water Recycling | - | N/A – SAI-RAT not considered necessary as scheme would not increase INNS transfer risk |
| | Mogden Water Recycling | - | N/A – SAI-RAT not considered necessary as scheme would not increase INNS transfer risk |
| STT | River Severn to River Thames Transfer | Lake Vyrnwy direct discharge<br>River Vyrnwy bypass<br>Shrewsbury redeployment<br>Mythe redeployment<br>Minworth treated effluent transfer<br>Netheridge treated effluent transfer<br>Deerhurst abstraction | N/A<br>52%-53% depending on volume<br>N/A<br>N/A<br>N/A<br>47%-50% depending on volume |

| SRO | Option name | Component(s) | SRO Level 2 risk score |
|---|---|---|---|
| SESRO | Main reservoir | 150Mm$^3$ capacity reservoir<br>125Mm$^3$ capacity reservoir<br>100Mm$^3$ capacity reservoir<br>75Mm$^3$ capacity reservoir<br>30Mm$^3$+100Mm$^3$ capacity phased reservoir<br>80Mm$^3$+42Mm$^3$ capacity phased reservoir | A range of 21.27%-88.46% depending on scenario i.e. recreational use type and intensity.<br>Most likely scenario – 57.90%<br>Size option has a negligible influence on asset INNS risk. |
| | Raw water intake | Raw water transfer | 61.63%-63.13% depending on scenario i.e. washout frequency |
| | Raw water discharge | Raw water transfer | 47.88%-53.88% depending on scenario i.e. volumetric discharge associated with scheme size option, and recreation at source (reservoir), |
| | Emergency drawdown | Raw water transfer | 57.13%-61.25% depending on scenario i.e. recreational use at source (reservoir). |
| T2ST | Option B | Water transfers<br>Assets | 35.73%<br>10.94% |
| | Option C | Water transfers<br>Assets | 35.73%<br>10.94% |
| T2AT | Lower Thames Reservoir | Water transfers<br>Assets | 37.03%<br>17.16% |
| | Beckton Reuse Indirect | Water transfers<br>New assets | 31.32%<br>16.99% |

### 3.3.2 London Water Recycling

The INNS risk assessments for the options under the London Water Recycling SRO are presented in the Gate 2 Submission *'London Water Recycling SRO – INNS Assessment Report'* and a summary taken from the Gate 2 Report is provided below.

London Water Recycling SRO is set out as four source options, three of which were continued to Gate 2. These options propose utilising wastewater or final effluent from Mogden sewage treatment works (STW) to a maximum total reduction of 200 Ml/d, with differing London water recycling scheme discharge locations in the freshwater River Thames. The fourth option is in east London, utilising final effluent from Beckton STW – which is transfer to Lockwood pumping station, part of Thames Water's Lee Valley reservoirs in North London.

A summary of the risks associated with each option is provided below:

**Beckton Water Recycling**

The Beckton water recycling scheme was not assessed using the SAI-RAT tool. It is not likely that the introduction or transfer of INNS will occur during the operation of this option, as the effluent discharge is treated in several steps prior to discharge into the freshwater River Lee Diversion, which eliminates all pathways that are likely to introduce or transfer INNS during normal operation.

Major changes in flow would be expected in all schemes, which have the potential to increase the distribution of INNS within the freshwater Lee Diversion Channel in the absence of consideration of other drivers. The 300Ml/d scheme has the most major predicted effects when compared to the other options.

Modelling predicts negligible effects on water quality within the Lee Diversion Channel, with slight increases in dissolved oxygen, and minor decreases in phosphate. This suggests that changes to water quality are unlikely to have a significant effect on INNS distribution within the river. As the option develops, likely environmental impacts and potential mitigation will be outlined within the environmental statement.

**Mogden Water Recycling**

The Mogden water recycling scheme was not assessed using the SAI-RAT tool as the volume discharged would be advanced treated effluent, eliminating all pathways that are likely to introduce or transfer INNS during normal operation.

Minor changes in physico-chemical conditions within the Thames are expected, with changes in flow conditions and localised changes in velocity, along with minor changes in oxygen saturation, phosphorous and pH. These changes in conditions may have minor impacts on the distribution of INNS within the freshwater River Thames, although they are not expected to be major and widespread. As the option develops, likely environmental impacts and potential mitigation will be outlined within the environmental statement.

**Teddington DRA**

The SAI-RAT assessment found the 75Ml/d option had the greatest risk involving the transfer of INNS between the River Thames and Lee Valley Reservoirs when compared to the other component options of the Teddington DRA scheme. This is solely down to the increased volume when compared to the 50Ml/d option, as all other variables within the SAI-RAT calculator remain the same for each of the new Teddington DRA options, though the difference in risk is marginal.

Changes in velocity, flow, and water quality within the freshwater Thames due to the Teddington DRA scheme may cause some changes in conditions that could affect distribution of INNS, including changes in dissolved oxygen, temperature, ammonia, biochemical oxygen demand (BOD), suspended solids and pH. However, these changes would be minor, and it is unlikely that they will cause widespread changes in distribution of INNS within the River Thames. The potential effects on INNS are predicted to be greater for the 75Ml/d option than for the 50Ml/d option.

The current 195Ml/d TLT transfer that is in operation between the Thames and Lee was also assessed using the SAI-RAT tool, and it was found to have the highest risk score when compared to any of the new Teddington DRA scheme options. This is again due to higher volumes of water being transferred, and due to it being in year-round, continuous, variable flow operation compared to the occasional frequency of operation of the Teddington DRA schemes.

During this stage of the design development, specific option mitigation has not been discussed. As the option design progresses, consideration will be given to the development of mitigation to target specific risk and broader mitigation measures which are most likely to be feasible and effective for the control of INNS. As the option develops, likely environmental impacts and potential mitigation will be outlined within the environmental statement.

### 3.3.3 Severn to Thames Transfer

The INNS risk assessment for the STT SRO is presented in the Gate 2 Submission *'STT Solution – INNS Assessment Report'* and a summary taken from the Gate 2 Report is provided below.

The Severn Thames Transfer provides additional raw water resources of 300 to 500Ml/d to the South East of England. The water would be provided from flows in the River Severn and

transferred via an interconnector to the River Thames. Additional sources of water will also be provided by Severn Trent Water and United Utilities.

A summary of the risks associated with each option is provided below:

**Shrewsbury redeployment and Mythe redeployment**

The Shrewsbury and Mythe redeployment components were not assessed, as the redeployment of licensed abstraction does not require the construction of infrastructure, transfer of raw water or maintenance to implement. Therefore, the SAI-RAT assessment is not relevant for these components as there is no action required to implement the scheme which may be perceived to affect the distribution of INNS.

**Minworth and Netheridge effluent transfer**

The Minworth and Netheridge effluent transfer components were not assessed using the SAI-RAT tool. It is not likely that the introduction or transfer of INNS will occur during the operation of these options as the water is derived from sewage effluent and will be subject to further treatment before release, eliminating all pathways that are likely to introduce or transfer INNS during normal operation.

**River Vyrnwy Bypass**

The Vyrnwy Bypass component was assessed based on two potential operational volumes, 180Ml/d and 205Ml/d, scoring 52% and 53%, respectively.

Both options have the potential to transfer INNS from Vyrnwy Reservoir (via the aqueduct) to the River Severn downstream of the confluence with the River Vyrnwy. There are currently four-valve chambers proposed for the scheme and the bypass pipeline route travels through three operational catchments. Therefore, should an unintentional discharge occur during operation, there is a potential for raw water to be discharged and INNS to enter new catchments and watercourses in which no upstream hydrological link exists.

The findings of the Gate 2 INNS risk assessments will continue to inform future design iterations, including design mitigation. During this stage of the design development, specific option mitigation has not been discussed. As the option design progresses, consideration will be given to the development of mitigation to target specific risk and broader mitigation measures which are most likely to be feasible and effective for the control of INNS.

**Deerhurst abstraction**

The Deerhurst abstraction component was assessed based upon three operational volumes of 300Ml/d, 400Ml/d and 500Ml/d, scoring 47%, 48% and 50%, respectively. The Deerhurst abstraction sweetening flow of 20Ml/d was also assessed, scoring 48%. The Deerhurst abstraction volumes score marginally lower than all Vyrnwy Bypass options. The destination of the transfer is a WTW which is located within the same operation catchment as the abstraction location. Thus, the risk of transferring INNS during all three scenarios is considered to be relatively low during the normal operation of the transfer.

The findings of the Gate 2 INNS risk assessments will continue to inform future design iterations, including design mitigation. During this stage of the design development, specific option mitigation has not been discussed. As the option design progresses consideration will be given to the development of mitigation to target specific risk and broader mitigation measures which are most likely to be feasible and effective for the control of INNS.

### 3.3.4 SESRO

The INNS risk assessment for the SESRO SRO is presented in the Gate 2 Submission *'SESRO Environmental Appraisal Report (Aquatic)'* and a summary taken from the Gate 2 Report is provided below.

The main reservoir was assessed using the SAI- RAT tool and examined the potential risks of INNS introduction and spread to and from SESRO, via transfer pathways that may become active once the reservoir is operational. The SAI-RAT assessment scenarios completed for SESRO have taken into consideration different variations of INNS pathway-frequency to understand how this will alter risk. This included most likely ('baseline') scenarios and a range of other scenarios; from no recreational activities at the site to a 'worst-case scenario', in which all possible INNS pathways (as identified by SAI-RAT) are presumed to be present at their maximum level.

In relation to the risk assessment of the asset (the proposed reservoir), under 'baseline' conditions, the site was assessed to have a final asset risk score of 57.90%. The removal of all recreation (terrestrial and aquatic), as well as the removal of aquatic recreation only, would result in the reservoir having a final asset risk score of 21.27% or 33.65%, respectively. Conversely, should all recreational activities (e.g. angling, water sports, boating and walking) occur at maximum frequency, or all INNS pathways (including both operational and recreational activities) occur at maximum frequency, the final asset risk score could become 78.28% or 88.46%, respectively.

The results highlight the risk of unmitigated recreational activities for INNS transfer, especially activities within waterbodies. The size of the reservoir has no specific bearing on the viability of the identified activities and so was not considered within the asset assessment; in this case, option size is essentially irrelevant as a differentiator of overall asset risk.

A key challenge of INNS risk management for the SRO programme, including SESRO, is balancing the risk of INNS transfer and spread with providing high quality multi-purpose and accessible public assets. It is highly unlikely that recreational access to SESRO, in all its forms, would be excluded purely on the basis of INNS risk management requirements. Therefore, some INNS risks will inevitably remain within the final plans for SESRO, balanced against wider aspirations for the use of the asset, and mitigated where possible based on available biosecurity measures.

All raw water transfer scenarios from river to reservoir (and vice versa) were assessed to have a narrower range of potential risk. The different scenarios applied accounted for differences of INNS pathway-frequency, which included recreation requirements at the source of the transfer and design parameters of the reservoir and the transfer itself (e.g. number of washout points). Risk scores developed for the raw water intake to SESRO ranged from 61.63% to 63.12% (baseline i.e. most likely scenario – 61.63%), whilst risk scores for the raw water discharge ranged from 47.88% to 53.88% (baseline is most likely scenario – 50.13%). Whilst a degree of variation in risk score was apparent between the scenarios, the lack of significant change in risk score highlights that the inherent risk of unmitigated movements of large water volumes is a key factor in driving the risk score for raw water transfers. As the activity of transferring water from river to reservoir (and vice versa) is intrinsic to SESRO, further design mitigation is likely to be the key to reducing INNS transfer risk.

The provision of an emergency drawdown from the reservoir has been assessed as a separate element of SESRO due to the difference in operation to the main intake/outlet transfer. The emergency drawdown was assessed to be higher risk than the main raw water transfers to and from the reservoir, with risk scores of 57.13%, 60.13% and 61.25% for low, medium and high recreational and operational asset use scenarios, respectively. These scenarios accounted for varying levels of recreational and operational activities. For comparison, the baseline risk score

for the main reservoir discharge transfer was 50.13%. As with the main raw water transfer risk assessment, the activity of transferring water from a reservoir to a river is inherently risky and therefore, design mitigation is again likely to be the key to reducing INNS transfer risk.

A generalised biosecurity module included within the SAI–RAT identifies a potential selection of suitable biosecurity measures. Further consideration of these measures should be undertaken as part of subsequent design stages, and based on an initial assessment of the efficacy and feasibility of implementing the measures. Potential options for mitigation are provided in the *Gate 2 Report Appendix A6.3 INNS Mitigation Measures Appraisal* and the outcomes are summarised in the Gate 2 Report Table 6.24 and Table 6.25. Measures include recreational management such as using site supplied equipment, boot brushing stations, wash down facilities and measures such as incorporation of passive filtration (fish screens or conveyor screens).

The findings of the Gate 2 INNS risk assessments will continue to inform future SESRO design iterations, including design mitigation for the raw water transfers and plans for the recreational use of the asset, including appropriate biosecurity measures. During subsequent project stages, option refinement would result in fewer scenarios, and more focus on developing and embedding design mitigation and broader mitigation measures most likely to be feasible and effective for the control of INNS.

It should be noted that terrestrial INNS species may be present on the SESRO site and there is potential for the invasive plant species to be transferred to other locations during the construction phase. SAI-RAT excludes construction risks as part of the risk profile. Best practice control methods will be used during construction to treat areas where invasive species are found and prevent their spread. Any terrestrial INNS that may arise on-site during the operational phase will be dealt with as appropriate.

### 3.3.5 T2ST

The INNS risk assessment for the T2ST SRO is presented in the Gate 2 Submission *'T2ST Environmental Appraisal Report Annex B1"* and a summary taken from the Gate 2 Report is provided below.

The transfer components of the T2ST SRO resulted in risk scores of 35.73%, and risk scores of 10.94% for the WTW asset components. As water transfer Option B and Option C do not differ significantly in their conceptual design, the data and information input to the EA INNS risk assessment tool were identical for the two options and as such there was no difference in the resulting risk scores.

The risk score of 35.73% is considered to be an overestimate of the INNS risk, as treatment of raw water at the new WTW at the intake location prior to transfer will eliminate any INNS at source (which is not accounted for within the SAI-RAT). Additionally, transfer via a pipeline rather than an open watercourse will reduce the likelihood the introduction of INNS along the transfer route. At no point during the normal operation of the T2ST transfer will raw or treated water be discharged to an open waterbody. Treated water may occasionally be discharged to nearby water courses or waterbodies from washout or maintenance points along the pipeline route, which could facilitate the spread of existing INNS downstream. Therefore, consideration should be given to the incorporation of INNS mitigation measures in the design and operation of washout and maintenance points along the pipeline route.

The INNS risk score associated with the new WTW at the intake location was calculated as 10.94%. The generation of this asset risk score was largely based on assumptions about WTW operational processes (e.g. frequency of personnel visits and maintenance). Although the asset risk score was relatively low, it is thought that the most likely pathway of INNS spread associated with the SRO will be the movement of personnel and vehicles from the WTW

following contact with untreated water. The asset INNS risk score should be reviewed at a later stage when operational procedures have been developed for the new WTW at the intake location.

The risk assessment tool identified a range of biosecurity measures to mitigate the risk associated with key pathways of INNS spread that will be introduced by the proposed water transfers and new assets. Of the biosecurity options presented in the tool, several High and Medium confidence measures have already been incorporated into the conceptual design, including the treatment of water at source by chlorination, ozone and ultra violet sterilisation.

### 3.3.6 T2AT

**Lower Thames Reservoir**

The INNS risk assessment for the Lower Thames Reservoir option is presented in the Gate 2 Submission *'T2AT Environmental Appraisal Report Lower Thames Reservoir Option"* and a summary taken from the Gate 2 Report is provided below.

The INNS assessment was split into water transfers and assets as follows:

- Water transfers:
  - Section 1 – Shaft 6 (Queen Mother/Wraysbury Reservoirs) to new raw water PS within the site of the existing Iver WTW via existing tunnel
  - Section 2 - New raw water PS to new WTW via new pipeline
  - Section 3 - New WTW to an existing SR in the vicinity of Harefield via new pipeline
- Assets:
  - Raw water PS
  - New WTW

Of the three water transfer sections, Section 1 was found to have the highest associated INNS risk, with a score of 44.25%. Section 2 had a risk score of 34.10%. Section 3 generated the lowest risk score at 32.73%.

Section 3 generated the lowest risk score on account of the source being a WTW. Whereas the first two sections of the transfer contain raw water, Section 3 contains potable water (this is acknowledged in the risk assessment tool through the selection of source type as 'water treatment site'). As such, there is considered to be no risk of introducing new INNS to either the pathway or receptor. The risk score generated for Section 3 is associated with a higher operation frequency and greater transfer distance than for Sections 1 and 2, though in reality this section of transfer poses a negligible INNS risk.

Although raw water is not discharged to an open waterbody at any point along the transfer route, the sections that contain raw water have a higher score due to the risk of INNS introduction to the environment via leaks or washout of raw water from the pipeline/tunnel, or movement of INNS due to operational procedures (e.g. contamination of personnel clothing, equipment or vehicles that come into contact with raw water). Additionally, water transfer via a tunnel, as in Section 1, poses a greater risk of INNS spread than water transfer via a pipeline, hence the higher score for Section 1 than for Section 2. The fact that Section 2 terminates at a WTW also contributes to the lower score.

It is considered that the most likely pathway of INNS spread associated with the new assets would be the movement of personnel and vehicles from the sites following contact with raw water. Both of the proposed assets generated a lower risk score for introducing and spreading INNS. The new WTW scored slightly higher due to the higher frequency of maintenance and removal of waste sludge onto land.

The average risk score for the water transfers was 37.03%, and for the new assets this was 17.16%. The overall average risk associated with the Lower Thames Reservoir Option was 27.09%.

The risk assessment tool identified a range of biosecurity measures to mitigate the risk associated with key pathways of INNS spread that may be introduced by the proposed water transfers and assets. Only Section 1 and Section 2 of the transfer would benefit from biosecurity or mitigation measures as these involve the transfer of raw water. Such measures would likely have minimal benefit, as the risk would be related to rare accidental leaks of raw water from the closed system. As Section 3 transfers potable water through a closed system, biosecurity and mitigation are not necessary as the risk posed by INNS is negligible.

The overall INNS risk associated with the operation of assets is considered to be relatively low as staff and equipment entering raw water is not planned as part of routine operation. The greatest risks identified within the risk assessment are associated with the introduction of INNS from outside sources  such as attached to personnel and vehicles entering the site and INNS being transferred away from the asset via the same pathways. The new WTW also poses an additional risk of INNS transfer through the removal of waste sludge from the site onto land. As the assets involved in the transfer are intended to be sealed, the likelihood of INNS transmission through the pathways identified within the risk assessment is negligible and implementation of biosecurity measures would likely have little to no risk reduction benefit. Medium and High confidence measures should be considered if the evolving design involves a point in the system being temporarily or permanently unsealed; however, based on the current design this is not considered to be the case.

While recreational activities would not occur at the source of this transfer (Shaft 6), angling is likely to be present at Wraysbury Reservoir and therefore contributes to the risk of INNS being transferred through the pipeline and pumping station. The Canal and River Trust, the Environment Agency and angling clubs, would be well-placed to advise on mitigation options which are likely to be adopted.

**Beckton Reuse Indirect**

The INNS risk assessment for the Beckton Reuse Indirect option is presented in the Gate 2 Submission *'T2AT Environmental Appraisal Report Beckton Reuse Indirect Option''* and a summary taken from the Gate 2 Report is provided below.

The INNS assessment was split into water transfers and assets as follows:

- Water Transfers:
  - Section 1 – River Lee Flood Relief Channel to the new WTW via new pipeline
  - Section 2 – New WTW to Brookmans Park SR via new pipeline
  - Section 3 - Brookmans Park SR to booster PS in the vicinity of North Mymms via new pipeline
- Assets:
  - River Lee intake
  - Raw water PS
  - New WTW

Of the three water transfer sections, Section 1 was found to have the highest associated INNS risk with a score of 35.60%. Section 2 of the transfer generated the lowest risk score at 27.98%. Section 3 had a risk score of 30.38%.

Section 1 generated the highest risk score as it involves the transfer of raw water from the source river, whereas potable water is transferred along Sections 2 and 3. Although raw water is

not intentionally discharged to an open waterbody at any point along Section 1 of the transfer route, a higher score is assigned to account for the risk of INNS introduction to the environment via leaks or washout of raw water from the pipeline, or movement of INNS due to operational procedures (e.g. contamination of personnel clothing, equipment or vehicles that come into contact with raw water). INNS have been identified in the source waters of the River Lee. As the River Lee is accessible to the public and is used by local angling clubs, there is risk of further INNS introduction to the source waters and consequently to Section 1 of the transfer.

Sections 2 and 3 of the transfer contain potable rather than raw water, which accounts for the lower-risk scores generated for these two sections compared to Section 1. The slight difference in risk score between Section 2 and Section 3 can be accounted for by the difference in transfer distance and highest order site designation within 1km of the receptor site. The INNS risk presented by Section 2 and 3 is considered to be negligible as there is no opportunity for raw water to be discharged into the environment.

All of the proposed assets generated a lower risk score for introducing and spreading INNS. The new WTW scored slightly higher due to the higher frequency of maintenance and removal of waste sludge onto land. However, as all assets form sealed structures, contact with raw water is not planned as part of routine operation.

The average risk score for the water transfers was 31.32% and for the new assets 16.99%. The overall average INNS risk associated with the Beckton Reuse Indirect Option was found to be 24.15%.

The risk assessment tool identified a range of biosecurity measures to mitigate the risk associated with key pathways of INNS spread that would be introduced by the proposed water transfers and assets.

Only Section 1 of the transfer would benefit from biosecurity or mitigation measures as the only section which would involve the transfer of raw water. Such measures would likely have minimal benefit as the risk would be related to rare accidental leaks of raw water from the closed system. As Section 2 and 3 transfer drinking water through a closed system, biosecurity and mitigation are not necessary as the risk posed by INNS is negligible.

Angling by members and day ticket holders is conducted on the River Lee and is likely controlled by either the Canal and River Trust or an angling club; therefore, such organisations provide a mechanism for disseminating biosecurity information and influencing practices. The Canal and River Trust, the Environment Agency and angling clubs, would be well placed to advise on mitigation options which are likely to be adopted.

The overall INNS risk associated with the operation of assets is considered relatively low as staff and equipment entering the raw water is not planned as part of routine operation. The greatest risks identified within the risk assessment are associated with the introduction of INNS from outside sources such as attached to personnel and vehicles entering the site and INNS being transferred from the asset. The proposed Beckton Reuse Indirect WTW also poses an additional risk of INNS transfer through the removal of waste sludge from the site onto land. As the assets involved in the transfer are intended to be sealed, the likelihood of INNS transmission through the pathways identified within the risk assessment is negligible and implementation of biosecurity measures would likely have negligible risk reduction benefit. Medium and High confidence measures should be considered if the evolving design involves a point in the system being temporarily or permanently unsealed; however, based on the current design this is not considered to be the case.

# 4 Alternative Plans Assessment

## 4.1 Introduction

This Chapter presents the results of the INNS assessments for the two alternative plans:

- The Least Cost Plan (LCP) – provides a benchmark to appraise other programmes against and meets the statutory requirements for the plan.
- Best Environment and Societal Plan (BESP) – has been developed based on maximising environmental considerations through use of the environmental metrics derived from the environmental assessment process.

## 4.2 Least Cost Plan Summary

The following options were selected for the LCP and are shown below in Table 4.1. Seventeen options were assessed as having a Very Low INNS risk and were not subject to a Level 2 INNS risk assessment. Four options were included in the Level 2 assessment – Medmenham Intake (Low risk), Oxford Canal to Duke's Cut, (Moderate risk), Oxford Canal - Transfer from Duke's Cut to Farmoor (High risk) and Abingdon to Farmoor (High risk). Six options are components of SROs and were assessed through the Gate 2 process, with results summarised within this report and included below

**Table 4.1: List of options selected for the LCP**

| Option ID | Option name | L1 Assessment Result | L2 Assessment Result |
|---|---|---|---|
| TWU_GUI_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Guildford High Basket | N/A | N/A |
| TWU_GUI_EF-LKR_ALL_ALL_dmp gui gov c+2 | Guildford Demand: Gov C+2 | N/A | N/A |
| TWU_GUI_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Guildford High Basket | N/A | N/A |
| TWU_GUI_HI-TFR_RZ4_ALL_sewtogui | SouthEast Water to Guildford | 1= Very Low | N/A |
| TWU_GUI_RE-OTH_ALL_ALL_media - guilfd | Media Campaigns - Guildford | N/A | N/A |
| TWU_GUI_RE-OTH_ALL_ALL_neub - guilfd | NEUB - Guildford | N/A | N/A |
| TWU_GUI_RE-OTH_ALL_ALL_tub - guilfd | TUB - Guildford | N/A | N/A |
| TWU_HEN_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Henley High Basket | N/A | N/A |
| TWU_HEN_EF-LKR_ALL_ALL_dmp hen gov c+2 | Henley Demand: Gov C+2 | N/A | N/A |

| Option ID | Option name | L1 Assessment Result | L2 Assessment Result |
|---|---|---|---|
| TWU_HEN_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Henley High Basket | N/A | N/A |
| TWU_HEN_RE-OTH_ALL_ALL_media - henley | Media Campaigns - Henley | N/A | N/A |
| TWU_HEN_RE-OTH_ALL_ALL_neub - henley | NEUB - Henley | N/A | N/A |
| TWU_HEN_RE-OTH_ALL_ALL_tub - henley | TUB - Henley | N/A | N/A |
| TWU_KEM_HI-TFR_TED_ALL_tedd-kempton | Teddington to Kempton Conveyance Element | N/A- SRO | Part of London Water Recycling SRO (Teddington DRA) – risk score 55.88-56.88% |
| TWU_KVZ_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Kennet Valley High Basket | N/A | N/A |
| TWU_KVZ_EF-LKR_ALL_ALL_dmp kvz gov c+2 | Kennet Valley Demand: Gov C+2 | N/A | N/A |
| TWU_KVZ_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Kennet Valley High Basket | N/A | N/A |
| TWU_KGV_HI-TFR_TED_ALL_teddingtondrated/tlt | Direct River Abstraction - Teddington to Thames Lee Tunnel Shaft 75 MLD | N/A- SRO | Part of London Water Recycling SRO (Teddington DRA) – risk score 55.88-56.88% |
| TWU_KVZ_HI-GRW_ALL_ALL_mortimer recomm | Groundwater Development - Recomission Mortimer Disused Source | 1= Very Low | N/A |
| TWU_KVZ_HI-TFR_T2S_ALL_t2st cul to speen | Interzonal transfer (T2ST): Kennet Valley spur to Speen (10Ml/d) | N/A- SRO | Part of T2ST SRO – RWT risk score 35.73%<br>Asset risk score 10.94% |
| TWU_KVZ_RE-DRP_ALL_ALL_dp-playhatch-kv | DP-Playhatch-KV | N/A | N/A |
| TWU_KVZ_RE-OTH_ALL_ALL_media - kv | Media Campaigns - Kennet Valley | N/A | N/A |
| TWU_KVZ_RE-OTH_ALL_ALL_neub - kv | NEUB - Kennet Valley | N/A | N/A |
| TWU_KVZ_RE-OTH_ALL_ALL_tub - kv | TUB - Kennet Valley | N/A | N/A |
| TWU_LON_BG-CAT_ALL_ALL_cm_p1_darent cray | Catchment Portfolio: Darent and Cray | N/A | N/A |
| TWU_LON_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction London High Basket | N/A | N/A |

| Option ID | Option name | L1 Assessment Result | L2 Assessment Result |
|---|---|---|---|
| TWU_LON_EF-LKR_ALL_ALL_dmp lon gov c+2 | London Demand: Gov C+2 | N/A | N/A |
| TWU_LON_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction London High Basket | N/A | N/A |
| TWU_LON_HI-GRW_ALL_ALL_addington gw | Groundwater Development - Addington | 1= Very Low | N/A |
| TWU_LON_HI-GRW_ALL_ALL_s'fleet lic disagg | Groundwater Development - Southfleet & Greenhithe | 1= Very Low | N/A |
| TWU_LON_HI-ROC_WT1_ALL_eastlonw twexisting | Available Treatment Capacity at Coppermills WTW | 0= No additional risk | N/A |
| TWU_LON_HI-ROC_WT1_ALL_existing w lon wtw | Available Treatment Capacity at West London WTWs | 0= No additional risk | N/A |
| TWU_LON_HI-ROC_WT1_CNO_kempto nwtw100 p1 | New WTW at Kempton - 100Ml/d - Construction | N/A | N/A |
| TWU_LON_HI-TFR_LON_ALL_newriverh ead pump 4 | Replace New River Head Pump - TWRM | 1= Very Low | N/A |
| TWU_LON_RE-OTH_ALL_ALL_media - london | Media - London | N/A | N/A |
| TWU_LON_RE-OTH_ALL_ALL_neub - london | NEUB - London | N/A | N/A |
| TWU_LON_RE-OTH_ALL_ALL_tub - london | TUB - London | N/A | N/A |
| TWU_STR_HI-RSR_RE1_CNO_abingdo n150(lon) | New Reservoir - SESRO 150Mm3 - Construction | N/A- SRO | Part of SESRO SRO – Asset risk score 21.27%-88.46% depending on scenario |
| TWU_SWA_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Slough, Wycombe and Aylesbury High Basket | N/A | N/A |
| TWU_SWA_EF-LKR_ALL_ALL_dmp swa gov c+2 | Slough, Wycombe and Aylesbury Demand: Gov C+2 | N/A | N/A |
| TWU_SWA_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Slough, Wycombe and Aylesbury High Basket | N/A | N/A |
| TWU_SWA_HI-GRW_ALL_ALL_datchet do | Groundwater Development - Datchet Existing Source DO Increase | 1= Very Low | N/A |
| TWU_SWA_HI-ROC_WT1_CNO_medme nhamwtw ph1 | New Medmenham Surface Water WTW Ph1 - Construction | 0= No additional risk | N/A |

| Option ID | Option name | L1 Assessment Result | L2 Assessment Result |
|---|---|---|---|
| TWU_SWA_HI-TFR_SWX_ALL_tw(swx)to(swa)con | Thames Water Horspath (SWOX) to Thames Water Ashenden (SWA) Conveyance | N/A | N/A |
| TWU_SWA_HI-TFR_UTC_ALL_medmenham intake 53 | M New Medmenham Surface Water Intake - 53 Ml/d | 3= Low | 26.26% |
| TWU_SWA_RE-OTH_ALL_ALL_media - swa | Media Campaigns - SWA | N/A | N/A |
| TWU_SWA_RE-OTH_ALL_ALL_neub - swa | NEUB - SWA | N/A | N/A |
| TWU_SWA_RE-OTH_ALL_ALL_tub - swa | TUB - SWA | N/A | N/A |
| TWU_SWX_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Swindon and Oxfordshire High Basket | N/A | N/A |
| TWU_SWX_EF-LKR_ALL_ALL_dmp swx gov c+2 | Swindon and Oxfordshire Demand: Gov C+2 | N/A | N/A |
| TWU_SWX_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Swindon and Oxfordshire High Basket | N/A | N/A |
| TWU_SWX_HI-GRW_ALL_ALL_moulsford gw | Groundwater Development - Moulsford Groundwater Source | 1= Very Low | N/A |
| TWU_SWX_HI-GRW_ALL_ALL_woods farm do | Groundwater Development - Woods Farm Existing Source Increase DO | 1= Very Low | N/A |
| TWU_SWX_HI-IMP_SWX_CNO_oxc-dukes cutswox | Oxford Canal – Duke's Cut (SWOX) – Construction | 4= Moderate | 31.69% |
| TWU_SWX_HI-TFR_STR_ALL_abing-farmoor pipe | Abingdon to Farmoor Reservoir pipeline | 6= High | 32.02% |
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx)con | SWA to SWOX Transfer - Conveyance Element | 1= Very Low | N/A |
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx)con b | Thames Water Radnage (SWA) to Thames Water Bledlow (SWOX) Conveyance | 1= Very Low | N/A |
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx)con c | Thames Water Stokenchurch (SWA) to Thames Water Chinnor (SWOX) Conveyance | 1= Very Low | N/A |
| TWU_SWX_HI-TFR_SWX_ALL_dukescut-farmoor | Dukes Cut to Farmoor | 6= High | 35.31% |
| TWU_SWX_RE-DRP_ALL_ALL_dp-gatehampton-swox | Gatehampton Drought Permit | N/A | N/A |

| Option ID | Option name | L1 Assessment Result | L2 Assessment Result |
|---|---|---|---|
| TWU_SWX_RE-OTH_ALL_ALL_media – swox | Media – SWOX | N/A | N/A |
| TWU_SWX_RE-OTH_ALL_ALL_neub – swox | NEUB – SWOX | N/A | N/A |
| TWU_SWX_RE-OTH_ALL_ALL_tub – swox | TUB – SWOX | N/A | N/A |
| TWU_TED_HI-RAB_RE1_CNO_teddington dra 75 | Teddington DRA 75 MLD – Construction | N/A- SRO | Part of London Water Recycling SRO (Teddington DRA) – risk score 55.88-56.88% |
| TWU_TED_HI-TFR_TED_ALL_teddingtondramog/ted | Transfer of Treated Effluent from Mogden to Teddington 75Ml/d | N/A- SRO | Part of London Water Recycling SRO (Teddington DRA) – risk score 55.88-56.88% |
| TWU_LON_HI-GRW_ALL_ALL_londonconchalk | Groundwater Development - Confined Chalk North London | 1= Very Low | N/A |
| TWU_LON_HI-GRW_ALL_ALL_mertonrecommission | Groundwater Development - Merton Recommissioning | 1= Very Low | N/A |
| TWU_LON_HI-GRW_ALL_CNO_mertonar | Merton Aquifer Recharge (SLARS3) – Construction | 1= Very Low | N/A |
| TWU_LON_HI-GRW_RE1_ALL_asrhortonkirby | Manager Aquifer Recharge - Horton Kirby ASR | 1= Very Low | N/A |
| TWU_LON_HI-TFR_SES_ALL_cheam-merton | Cheam to Merton – London Ring Main | 1= Very Low | N/A |
| TWU_SWX_HI-TFR_HEN_ALL_henley-swox2.4 | Henley to SWOX Transfer – 2.4 Ml/d | 1= Very Low | N/A |
| TWU_WLJ_HI-ROC_NET_CNO_twrmshaft kempton | New shaft on the TWRM at Kempton | 0= No additional risk | N/A |

## 4.3 Best Environment and Societal Plan Summary

The following options were selected for the BESP and are listed below in Table 4.2. Seventeen options were assessed as having a Very Low risk INNS risk and were not subject to a Level 2 INNS risk assessment. Four options were included in the Level 2 assessment – Medmenham Intake (Low risk), Oxford Canal to Duke's Cut (Moderate risk), Oxford Canal - Transfer from Duke's Cut to Farmoor (High risk) and Abingdon to Farmoor (High risk). Six options are components of SROs and were assessed through the Gate 2 process, with results summarised within this report and included below.

### Table 4.2: List of options selected for the BESP

| Option ID | Option name | L1 Assessment Result | L2 Assessment Result |
|---|---|---|---|
| TWU_GUI_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Guildford High Basket | N/A | N/A |
| TWU_GUI_EF-LKR_ALL_ALL_dmp gui gov c+2 | Guildford Demand: Gov C+2 | N/A | N/A |
| TWU_GUI_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Guildford High Basket | N/A | N/A |
| TWU_GUI_HI-TFR_RZ4_ALL_sewtogui | SouthEast Water to Guildford | 1= Very Low | N/A |
| TWU_GUI_RE-DRP_ALL_ALL_dp-shalford-guild | Shalford Drought Permit | N/A | N/A |
| TWU_GUI_RE-OTH_ALL_ALL_media – guilfd | Media – Guilfd | N/A | N/A |
| TWU_GUI_RE-OTH_ALL_ALL_neub – guilfd | NEUB – Guilfd | N/A | N/A |
| TWU_GUI_RE-OTH_ALL_ALL_tub – guilfd | TUB – Guilfd | N/A | N/A |
| TWU_HEN_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Henley High Basket | N/A | N/A |
| TWU_HEN_EF-LKR_ALL_ALL_dmp hen gov c+2 | Henley Demand: Gov C+2 | N/A | N/A |
| TWU_HEN_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Henley High Basket | N/A | N/A |
| TWU_HEN_HI-TFR_KVZ_ALL_tw(kv)to(hen)con | Transfer - Kennet Valley to Henley - Conveyance Element | N/A | N/A |
| TWU_HEN_RE-DRP_ALL_ALL_dp-sheep/harp-hen | Sheeplands/Harpsden Drought Permit | N/A | N/A |
| TWU_HEN_RE-OTH_ALL_ALL_media – Henley | Media – Henley | N/A | N/A |
| TWU_HEN_RE-OTH_ALL_ALL_neub – Henley | NEUB – Henley | N/A | N/A |
| TWU_HEN_RE-OTH_ALL_ALL_tub – Henley | TUB – Henley | N/A | N/A |
| TWU_KEM_HI-TFR_TED_ALL_tedd-kempton | Teddington to Kempton Conveyance Element | N/A- SRO | Part of London Water Recycling SRO (Teddington DRA) – risk score 55.88-56.88% |

| Option ID | Option name | L1 Assessment Result | L2 Assessment Result |
|---|---|---|---|
| TWU_KVZ_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Kennet Valley High Basket | N/A | N/A |
| TWU_KVZ_EF-LKR_ALL_ALL_dmp kvz gov c+2 | Kennet Valley Demand: Gov C+2 | N/A | N/A |
| TWU_KVZ_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Kennet Valley High Basket | N/A | N/A |
| TWU_KGV_HI-TFR_TED_ALL_teddingtondrated/tlt | Direct River Abstraction – Teddington to Thames Lee Tunnel Shaft 100 MLD | N/A- SRO | Part of London Water Recycling SRO (Teddington DRA) – risk score 55.88-56.88% |
| TWU_KVZ_HI-GRW_ALL_ALL_mortimer recomm | Groundwater Development - Recomission Mortimer Disused Source | 1= Very Low | N/A |
| TWU_KVZ_HI-TFR_T2S_ALL_t2st cul to speen | Interzonal transfer (T2ST): Kennet Valley spur to Speen (10Ml/d) | N/A- SRO | Part of T2ST SRO – RWT risk score 35.73%<br>Asset risk score 10.94% |
| TWU_KVZ_RE-DRP_ALL_ALL_dp-playhatch-kv | Playhatch Drought Permit | N/A | N/A |
| TWU_KVZ_RE-OTH_ALL_ALL_media – kv | Media – KV | N/A | N/A |
| TWU_KVZ_RE-OTH_ALL_ALL_neub – kv | NEUB – KV | N/A | N/A |
| TWU_KVZ_RE-OTH_ALL_ALL_tub – kv | TUB – KV | N/A | N/A |
| TWU_LON_BG-CAT_ALL_ALL_cm_p1_darent cray | Catchment Portfolio: Darent and Cray | N/A | N/A |
| TWU_LON_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction London High Basket | N/A | N/A |
| TWU_LON_EF-LKR_ALL_ALL_dmp lon gov c+2 | London Demand: Gov C+2 | N/A | N/A |
| TWU_LON_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction London High Basket | N/A | N/A |
| TWU_LON_HI-GRW_ALL_ALL_addington gw | Groundwater Addington | 1= Very Low | N/A |
| TWU_LON_HI-GRW_ALL_ALL_s'fleet lic disagg | Groundwater Development - Southfleet & Greenhithe | 1= Very Low | N/A |
| TWU_LON_HI-ROC_WT1_ALL_eastlonwtwexisting | Available Treatment Capacity at Coppermills WTW | 0= No additional risk | N/A |

| Option ID | Option name | L1 Assessment Result | L2 Assessment Result |
|---|---|---|---|
| TWU_LON_HI-ROC_WT1_ALL_existing w lon wtw | Existing West London spare treatment capacity | 0= No additional risk | N/A |
| TWU_LON_RE-OTH_ALL_ALL_media – London | Media – London | N/A | N/A |
| TWU_LON_RE-OTH_ALL_ALL_neub – London | NEUB – London | N/A | N/A |
| TWU_LON_RE-OTH_ALL_ALL_tub – London | TUB – London | N/A | N/A |
| TWU_SWA_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Slough, Wycombe and Aylesbury High Basket | N/A | N/A |
| TWU_SWA_EF-LKR_ALL_ALL_dmp swa gov c+2 | Slough, Wycombe and Aylesbury Demand: Gov C+2 | N/A | N/A |
| TWU_SWA_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Slough, Wycombe and Aylesbury High Basket | N/A | N/A |
| TWU_STR_HI-RSR_RE1_CNO_abingdon75(lon) | Reservoir Abingdon 75 (Lon) – Construction | N/A- SRO | Part of SESRO SRO – Asset risk score 21.27%-88.46% depending on scenario |
| TWU_SWA_HI-GRW_ALL_ALL_datchet do | Groundwater Development - Datchet Existing Source DO Increase | 1= Very Low | N/A |
| TWU_SWA_HI-ROC_WT1_CNO_medmenhamwtw ph1 | Medmenham WTW Ph1 – Construction | 0= No additional risk | N/A |
| TWU_SWA_HI-TFR_SWX_ALL_tw(swx)to(swa)con | Thames Water Horspath (SWOX) to Thames Water Ashenden (SWA) Conveyance | N/A | N/A |
| TWU_SWA_HI-TFR_UTC_ALL_medmenham intake 53 | Medmenham intake – 53 | 3= Low | 26.26% |
| TWU_SWA_RE-OTH_ALL_ALL_media – swa | Media – SWA | N/A | N/A |
| TWU_SWA_RE-OTH_ALL_ALL_neub – swa | NEUB – SWA | N/A | N/A |
| TWU_SWA_RE-OTH_ALL_ALL_tub – swa | TUB – SWA | N/A | N/A |
| TWU_SWX_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Swindon and Oxfordshire High Basket | N/A | N/A |
| TWU_SWX_EF-LKR_ALL_ALL_dmp swx gov c+2 | Swindon and Oxfordshire Demand: Gov C+2 | N/A | N/A |

| Option ID | Option name | L1 Assessment Result | L2 Assessment Result |
|---|---|---|---|
| TWU_SWX_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Swindon and Oxfordshire High Basket | N/A | N/A |
| TWU_SWX_HI-GRW_ALL_ALL_moulsford gw | Groundwater Development - Moulsford Groundwater Source | 1= Very Low | N/A |
| TWU_SWX_HI-GRW_ALL_ALL_woods farm do | Groundwater Development - Woods Farm Existing Source Increase DO | 1= Very Low | N/A |
| TWU_SWX_HI-IMP_SWX_CNO_oxc-dukes cutswox | Oxford Canal – Duke's Cut (SWOX) – Construction | 4= Moderate | 31.69% |
| TWU_SWX_HI-TFR_HEN_ALL_henley-swox5 | Henley to SWOX Transfer – 5 Ml/d | 1= Very Low | N/A |
| TWU_SWX_HI-TFR_STR_ALL_abing-farmoor pipe | Abingdon to Farmoor Reservoir pipeline | 6= High | 32.02% |
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx)con | SWA to SWOX Transfer - Conveyance Element | 1= Very Low | N/A |
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx)con b | Thames Water Radnage (SWA) to Thames Water Bledlow (SWOX) Conveyance | 1= Very Low | N/A |
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx)con c | Thames Water Stokenchurch (SWA) to Thames Water Chinnor (SWOX) Conveyance | 1= Very Low | N/A |
| TWU_SWX_HI-TFR_SWX_ALL_dukescut-farmoor | Oxford Canal - Transfer from Duke's Cut to Farmoor | 6= High | 35.31% |
| TWU_SWX_RE-DRP_ALL_ALL_dp-gatehampton-swox | DP-Gatehampton-SWOX | N/A | N/A |
| TWU_SWX_RE-OTH_ALL_ALL_media – swox | Media Campaigns- SWOX | N/A | N/A |
| TWU_SWX_RE-OTH_ALL_ALL_neub – swox | NEUB - SWOX | N/A | N/A |
| TWU_SWX_RE-OTH_ALL_ALL_tub – swox | TUB - SWOX | N/A | N/A |
| TWU_TED_HI-RAB_RE1_CNO_teddington dra 75 | Teddington Direct River Abstraction (Indirect Water Recycling) 75 MLD - Construction | N/A- SRO | Part of London Water Recycling SRO (Teddington DRA) – risk score 55.88-56.88% |
| TWU_TED_HI-TFR_TED_ALL_teddingtondramog/ted | Transfer of Treated Effluent from Mogden to Teddington 75Ml/d | N/A- SRO | Part of London Water Recycling SRO (Teddington DRA) – risk score 55.88-56.88% |

| Option ID | Option name | L1 Assessment Result | L2 Assessment Result |
|---|---|---|---|
| TWU_LON_HI-DES_ALL_CNO_beckton desal 100p1 | Beckton Desalination - Phase 1: 100 Ml/d - Construction | 3= Low | 43.07% |
| TWU_LON_HI-GRW_ALL_ALL_london conchalk | Groundwater Development - Confined Chalk North London | 1= Very Low | N/A |
| TWU_LON_HI-GRW_ALL_ALL_merton recommission | Groundwater Development - Merton Recommissioning | 1= Very Low | N/A |
| TWU_LON_HI-GRW_ALL_CNO_kidbrooke slars | Managed Aquifer Recharge - Kidbrooke (SLARS1) Construction | 1= Very Low | N/A |
| TWU_LON_HI-GRW_ALL_CNO_merton ar | Managed Aquifer Recharge - Merton (SLARS3) Construction | 1= Very Low | N/A |
| TWU_LON_HI-GRW_RE1_ALL_asrhortonkirby | Manager Aquifer Recharge - Horton Kirby ASR | 1= Very Low | N/A |
| TWU_LON_HI-TFR_LON_CNO_beckton-coppermills | Beckton to Coppermills tunnel (treated) - Construction | 1= Very Low | N/A |
| TWU_LON_HI-TFR_SES_ALL_cheam-merton | Cheam to Merton - London Ring Main | 1= Very Low | N/A |

## 4.4 In-combinations Effects Assessment

### 4.4.1 Least Cost Plan

The following SROs and non-SROs from the LCP were included in the in-combination effects assessment:

- Abingdon Reservoir to Farmoor Reservoir pipeline
- Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor
- Oxford Canal – Duke's Cut (SWOX)
- New Medmenham Surface Water Intake - 53 Ml/d
- New Reservoir - SESRO 150Mm3 - Construction
- Teddington DRA[10]
- Interzonal transfer (T2ST): Kennet Valley spur to Speen (10Ml/d) (Culham to Speen Spur)

#### 4.4.1.1 Process A Results

Following Process A (See Section 2.3 for description), the following option combinations were determined to interact through common sources and receptors through direct or indirect connectivity:

- Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and Medmenham intake

[10]The following transfer options were assessed under Teddington DRA: TWU_KEM_HI-TFR_TED_ALL_tedd-kempton, TWU_KGV_HI-TFR_TED_ALL_teddingtondrated/tlt, TWU_TED_HI-RAB_RE1_CNO_teddington dra 75, and TWU_TED_HI-TFR_TED_ALL_teddingtondramog/ted.

- Oxford Canal to Duke's Cut and Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor
- Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and Teddington DRA
- Oxford Canal to Duke's Cut and Teddington DRA
- SESRO and New Medmenham Surface Water Intake - 53 Ml/d
- SESRO and Teddington DRA
- New Medmenham Surface Water Intake - 53 Ml/d and Teddington DRA
- Oxford Canal to Duke's Cut, Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor, Abingdon Reservoir to Farmoor Reservoir pipeline and SESRO

#### 4.4.1.2 Process B Results

Following Process B (See Section 2.3 for description), an assessment was made for the INNS risk associated with each combination of options, and a risk rating was assigned. These results are presented below in Table 4.3. The in-combination assessment results for the LCP show that two option combination are considered High additional risk, two option combinations are considered Medium risk and three options are considered Very Low additional risk. For the high risk options, mitigation such as a WTW at Abingdon was discussed as part of the Level 2 assessments and would help reduce effects. The SESRO SRO also sets out INNS mitigation to reduce effects at Abingdon, reported within the Gate 2 reports and summarised within this report. It is likely that mitigation measures can be incorporated into the options design and through discussion with the Environment Agency to reduce risks.

The medium risk options identified to have potential in-combination effects are a significant distance away from each other; given the distances between these options, further investigation may conclude no additional effects and therefore, mitigation may not be required.

**Table 4.3: In-combination results of LCP options**

| Option combination | Description of risk | Result |
|---|---|---|
| Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and New Medmenham Surface Water Intake - 53 Ml/d | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Options are connected through the River Thames as raw water will be discharged into the River Thames before being abstracted into Farmoor Reservoir and raw water from the Thames will be abstracted ~ 90km downstream as part of the Medmenham Intake option. The River Thames is connected to Oxford Canal through Duke's Cut and in Oxford City centre. Existing connections may mean that a similar INNS community already exists in the River Thames therefore the additional risk may actually be lower. | Medium additional risk.<br><br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. |
| Oxford Canal to Duke's Cut and Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor | Option combination will create a hydrological link between surface waterbodies which are currently unconnected and will increase INNS risk at Farmoor reservoir. INNS risk will be increased as a result of increased flow down Oxford Canal and the Duke's Cut channel. | High additional risk.<br>Mitigation requirements will be reviewed as the option design progresses which may enable INNS risk to be reduced. |

| Option combination | Description of risk | Result |
|---|---|---|
| Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and Teddington DRA | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Options are connected through the River Thames as raw water will be discharged into the River Thames before being abstracted into Farmoor Reservoir, and raw water from the Thames will be abstracted ~150km downstream. The River Thames is connected to Oxford Canal through Duke's Cut and in Oxford City centre. Existing connections may mean that a similar INNS community already exists in the River Thames therefore the additional risk may actually be lower. | Medium additional risk.<br><br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. |
| Oxford Canal to Duke's Cut and Teddington DRA | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Options are connected through the River Thames. The River Thames is connected to Oxford Canal through Duke's Cut and in Oxford City centre. Existing connections may mean that a similar INNS community already exists in the River Thames therefore the additional risk may actually be lower. | Medium additional risk.<br><br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. |
| SESRO and New Medmenham Surface Water Intake - 53 Ml/d | Both abstract from the same source (River Thames, 60km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| SESRO and Teddington DRA | Both abstract from the same source (River Thames, 100km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| Medmenham Intake and Teddington DRA | Both abstract from the same source (River Thames, 60km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |

| Option combination | Description of risk | Result |
|---|---|---|
| Oxford Canal to Duke's Cut, Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor, Abingdon Reservoir to Farmoor Reservoir pipeline and SESRO | Option combination will create a hydrological link between surface waterbodies which are currently unconnected. Oxford Canal - Transfer from Duke's Cut to Farmoor and Oxford to Duke's Cut options are indirectly connected to SESRO reservoir through the Abingdon to Farmoor option. INNS risk will increase as a result of increased flow down Oxford Canal through Duke's Cut and potential recreation at SESRO may increase risk of INNS transmission to Farmoor. | High additional risk.<br>Potential to reduce risk through WTW at Abingdon as discussed in the Level 2 assessment. The SESRO SRO also sets out INNS mitigation to reduce effects at Abingdon reported within the Gate 2 reports and summarised within this report. |

#### 4.4.1.3 Further assessment results

Following Process B, any option combinations resulting in a final score of Low, Medium or High additional risk were recommended for further assessment using SAI-RAT. option assessments were therefore combined to provide maximum component Risk Scores and Overall Risk Scores for each option combination. The results are shown in Table 4.4.

These results may help to confirm the priority for mitigation measures, which can be incorporated into the options design and developed through discussion with the Environment Agency.

**Table 4.4: Further assessment scores for LCP options**

| Option name | Process B outcome | SAI-RAT maximum score (%) | SAI-RAT average score (%) |
|---|---|---|---|
| Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and New Medmenham Surface Water Intake - 53 Ml/d | Further assessment with SAI-RAT recommended. Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. | 56.50 (Oxford Canal - Transfer from Duke's Cut to Farmoor RWT) | 30.79 |
| Oxford Canal to Duke's Cut and Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor | Further assessment recommended. The SAI-RAT recommends potential biosecurity mitigation measures to reduce effect which should be explored as the option design develops. | 56.50 (Oxford Canal - Transfer from Duke's Cut to Farmoor RWT) | 33.50 |
| Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and Teddington DRA | Further assessment with SAI-RAT recommended. Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. | 64.00 (Teddington DRA highest transfer volume) | 49.65 (maximum Teddington DRA score) |

| Option name | Process B outcome | SAI-RAT maximum score (%) | SAI-RAT average score (%) |
|---|---|---|---|
| Oxford Canal to Duke's Cut and Teddington DRA | Further assessment with SAI-RAT recommended. Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. | 64.00 (Teddington DRA highest transfer volume) | 44.29 (maximum Teddington DRA score) |
| SESRO and New Medmenham Surface Water Intake - 53 Ml/d | Further assessment not recommended | N/A | N/A |
| SESRO and Teddington DRA | Further assessment not recommended | N/A | N/A |
| New Medmenham Surface Water Intake - 53 Ml/d and Teddington DRA | Further assessment not recommended | N/A | N/A |
| Oxford Canal to Duke's Cut, Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor, Abingdon Reservoir to Farmoor Reservoir pipeline and SESRO | Further assessment recommended. The SAI-RAT recommends potential biosecurity mitigation measures to reduce effects. Potential to reduce risk through WTW at Abingdon as discussed in the Level 2 assessment. The SESRO SRO also sets out INNS mitigation to reduce effects at Abingdon, reported within the Gate 2 reports and summarised within this report. | 66.13 (Wyrley and Essington Canal to Duke's Cut) | 45.08 |

### 4.4.2 Best Environment and Societal Plan

The following SROs and Non-SRO options from the BESP were included in the in-combination effects assessment:

- Abingdon Reservoir to Farmoor Reservoir pipeline
- Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor
- Beckton Desalination – 100Ml/d
- Oxford Canal – Duke's Cut (SWOX)
- New Medmenham Surface Water Intake - 53 Ml/d
- Teddington DRA[10]
- New Reservoir - SESRO 75Mm3 - Construction
- Interzonal transfer (T2ST): Kennet Valley spur to Speen (10Ml/d) (Culham to Speen Spur)

#### 4.4.2.1 Process A Results

Following Process A (See Section 2.3 for description), the following option combinations were determined to interact through common sources and receptors through direct or indirect connectivity:

- Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and Beckton Desalination

- Oxford Canal to Duke's Cut and Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor
- Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and Medmenham intake
- Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and Teddington DRA
- Oxford Canal to Duke's Cut and Teddington DRA
- SESRO and Medmenham Intake
- SESRO and Teddington DRA
- SESRO and Beckton Desalination
- Beckton Desalination and Medmenham Intake
- Beckton Desalination and Teddington DRA
- Medmenham intake and Teddington DRA
- Abingdon to Farmoor, Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor, Oxford Canal to Duke's Cut and SESRO

#### 4.4.2.2 Process B Results

Following Process B (See Section 2.3 for description), an assessment was made for the INNS risk associated with each combination of options, and a risk rating was assigned. These are presented below in Table 4.5. The in-combination assessment for the BESP shows that two option combination are considered High additional risk, three are considered Medium risk and six are considered Very Low additional risk. For the high risk options, mitigation such as a WTW at Abingdon was discussed as part of the Level 2 assessments and would help reduce effects. The SESRO SRO also sets out INNS mitigation to reduce effects at Abingdon, reported within the Gate 2 reports and summarised within this report. It is likely that mitigation measures can be incorporated into the options design and through discussion with the Environment Agency to reduce risks.

The medium risk options are a significant distance away from each other; given the distances between these options, further investigation may conclude no additional effects and therefore mitigation may not be needed.

### Table 4.5: In-combination results of BESP options

| Option combination | Description of risk | Result |
|---|---|---|
| Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and Beckton Desalination | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Options are connected through the River Thames as raw water will be discharged into the River Thames before being abstracted into Farmoor Reservoir, and raw water from the Thames will be abstracted ~170km downstream as part of the Beckton Desalination option. The River Thames is connected to Oxford Canal through Duke's Cut and in Oxford City centre therefore existing connections may mean that a similar INNS community already exists in the River Thames therefore the additional risk may actually be lower. | Medium additional risk.<br><br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. |
| Oxford Canal to Duke's Cut and Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor | Option combination will create a hydrological link between surface waterbodies which are currently unconnected and will increase INNS risk at Farmoor reservoir. INNS risk will be increased as a result of increased flow down Oxford Canal and the Duke's Cut channel. | High additional risk. Mitigation requirements will be reviewed as the option design progresses which may enable INNS risk to be reduced. |
| Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and New Medmenham Surface Water Intake - 53 Ml/d | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Options are connected through the River Thames as raw water will be discharged into the River Thames before being abstracted into Farmoor Reservoir, and raw water from the Thames will be abstracted ~ 90km downstream as part of the Medmenham Intake option. The River Thames is connected to Oxford Canal through Duke's Cut and in Oxford City centre. Existing connections may mean that a similar INNS community already exists in the River Thames therefore the additional risk may actually be lower. | Medium additional risk.<br><br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. |

| Option combination | Description of risk | Result |
|---|---|---|
| Oxford Canal - Transfer from Duke's Cut to Farmoor and Teddington DRA | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Options are connected through the River Thames as raw water will be discharged into the River Thames before being abstracted into Farmoor Reservoir and raw water from the Thames will be abstracted ~150km downstream. The River Thames is connected to Oxford Canal through Duke's Cut and in Oxford City centre. Existing connections may mean that a similar INNS community already exists in the River Thames therefore the additional risk may actually be lower. | Medium additional risk.<br><br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. |
| Oxford Canal to Duke's Cut and Teddington DRA | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Options are connected through the River Thames. The River Thames is connected to Oxford Canal through Duke's Cut and in Oxford City centre. Existing connections may mean that a similar INNS community already exists in the River Thames therefore the additional risk may actually be lower. | Medium additional risk.<br><br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. |
| SESRO and New Medmenham Surface Water Intake - 53 Ml/d | Both abstract from the same source (River Thames, 60km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| SESRO and Teddington DRA | Both abstract from the same source (River Thames, 100km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| SESRO and Beckton Desalination | Both abstract from the same source (River Thames, 160km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |

| Option combination | Description of risk | Result |
|---|---|---|
| Beckton Desalination and Medmenham Intake | Both abstract from the same source (River Thames, ~80km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| Beckton Desalination and Teddington DRA | Both abstract from the same source (River Thames, 40km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| New Medmenham Surface Water Intake - 53 Ml/d and Teddington DRA | Both abstract from the same source (River Thames, 60km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| Oxford Canal to Duke's Cut, Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor, Abingdon Reservoir to Farmoor Reservoir pipeline and SESRO | Option combination will create a hydrological link between surface waterbodies which are currently unconnected. Oxford Canal - Transfer from Duke's Cut to Farmoor and Oxford to Duke's Cut options are connected to the Abingdon to Farmoor option through Farmoor. INNS risk will increase as a result of increased flow down Oxford Canal through Duke's Cut, and potential recreation at Abingdon to Farmoor source may increase risk of INNS transmission to Farmoor. | High additional risk. Potential to reduce risk through WTW at Abingdon as discussed in the Level 2 assessment. The SESRO SRO also sets out INNS mitigation to reduce effects at Abingdon. reported within the Gate 2 reports and summarised within this report. |

#### 4.4.2.3 Further assessment results

Following Process B, any option combinations resulting in a final score of Low, Medium or High additional risk were recommended for further assessment using SAI-RAT. Individual option assessments were therefore combined to provide maximum component Risk Scores and Overall Risk Scores for each option combination. The results are shown in Table 4.6.

These results may help to confirm the priority for mitigation measures, which can be incorporated into the options design and developed through discussion with the Environment Agency.

### Table 4.6: Further assessment scores for BESP options

| Option name | Process B outcome | SAI-RAT maximum score (%) | SAI-RAT average score (%) |
|---|---|---|---|
| Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and Beckton Desalination | Further assessment with SAI-RAT recommended. Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. | 62.25 (River Thames to RW Lagoons RWT) | 40.48 |
| Oxford Canal to Duke's Cut and Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor | Further assessment recommended. The SAI-RAT recommends potential biosecurity mitigation measures to reduce effect which should be explored as the option design develops. | 56.50 (Oxford Canal - Transfer from Duke's Cut to Farmoor RWT) | 33.50 |
| Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and New Medmenham Surface Water Intake - 53 Ml/d | Further assessment with SAI-RAT recommended. Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. | 56.50 (Oxford Canal - Transfer from Duke's Cut to Farmoor RWT) | 30.79 |
| Oxford Canal - Transfer from Duke's Cut to Farmoor and Teddington DRA | Further assessment with SAI-RAT recommended. Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. | 64.00 (Teddington DRA highest transfer volume) | 49.65 (maximum Teddington DRA score) |
| Oxford Canal to Duke's Cut and Teddington DRA | Further assessment with SAI-RAT recommended. Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. | 64.00 (Teddington DRA highest transfer volume) | 44.29 (maximum Teddington DRA score) |
| SESRO and New Medmenham Surface Water Intake - 53 Ml/d | Further assessment not recommended | N/A | N/A |
| SESRO and Teddington DRA | Further assessment not recommended | N/A | N/A |
| SESRO and Beckton Desalination | Further assessment not recommended | N/A | N/A |
| Beckton Desalination and New Medmenham Surface Water Intake - 53 Ml/d | Further assessment not recommended | N/A | N/A |
| Beckton Desalination and Teddington DRA | Further assessment not recommended | N/A | N/A |
| New Medmenham Surface Water Intake - 53 Ml/d and Teddington DRA | Further assessment not recommended | N/A | N/A |

| Option name | Process B outcome | SAI-RAT maximum score (%) | SAI-RAT average score (%) |
|---|---|---|---|
| Oxford Canal to Duke's Cut, Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor, Abingdon Reservoir to Farmoor Reservoir pipeline and SESRO | Further assessment recommended. The SAI-RAT recommends potential biosecurity mitigation measures to reduce effects. Potential to reduce risk through WTW at Abingdon as discussed in the Level 2 assessment. The SESRO SRO also sets out INNS mitigation to reduce effects at Abingdon, reported within the Gate 2 reports and summarised within this report. | 66.13 (Wyrley and Essington Canal to Duke's Cut) | 45.08 |

# 5 Best Value Plan Assessment

## 5.1 Best Value Plan Summary

The following options were selected for the Best Value Plan (BVP) and are listed in Table 5.1 below.

For Situation 1, 10 options were assessed as having a Very Low risk INNS risk and were not subject to a Level 2 INNS risk assessment. Six options were included in the Level 2 assessment. This includes the Medmenham Intake (Low risk), Beckton Desalination 150 Ml/d (Low risk), Oxford Canal to Duke's Cut (Moderate risk), Lockwood PS to KGV Reservoir (Moderate risk), Oxford Canal - Transfer from Duke's Cut to Farmoor (High risk) and Abingdon to Farmoor (High risk). Five options are components of SROs and were assessed through the Gate 2 process, with results summarised within this report and included below (for all Situations).

For Situation 4, 12 options were assessed as having a Very Low risk INNS risk and were not subject to a Level 2 INNS risk assessment. Four options were included in the Level 2 assessment. This includes the Medmenham Intake (Low risk), Oxford Canal to Duke's Cut (Moderate risk), Oxford Canal - Transfer from Duke's Cut to Farmoor (High risk) and Abingdon to Farmoor (High risk). Five options are components of SRO and were assessed through the Gate 2 process, with results summarised within this report.

For Situation 8, six options were assessed as having a Very Low risk INNS risk and were not subject to a Level 2 INNS risk assessment. No options were included in the Level 2 assessment. Four options are components of SRO and were assessed through the Gate 2 process, with results summarised within this report.

**Table 5.1: List of options selected for the BVP**

| Option ID | Option Name | Situation 1 | Situation 4 | Situation 8 | L1 Result | L2 Result |
|---|---|---|---|---|---|---|
| TWU_GUI_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Guildford High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_GUI_EF-LKR_ALL_ALL_dmp gui gov c+2 | Guildford Demand: Gov C+2 | Yes | Yes | Yes | N/A | N/A |
| TWU_GUI_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Guildford High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_GUI_HI-TFR_RZ4_ALL_sewtogui | SouthEast Water to Guildford | Yes | Yes | No | 1= Very Low | N/A |
| TWU_GUI_RE-DRP_ALL_ALL_dp-shalford-guild | Shalford Drought Permit | No | Yes | Yes | N/A | N/A |
| TWU_GUI_RE-OTH_ALL_ALL_media - guilfd | Media Campaigns - Guildford | Yes | Yes | Yes | N/A | N/A |
| TWU_GUI_RE-OTH_ALL_ALL_neub - guilfd | NEUB - Guildford | Yes | Yes | No | N/A | N/A |
| TWU_GUI_RE-OTH_ALL_ALL_tub - guilfd | TUB - Guildford | Yes | Yes | Yes | N/A | N/A |

| Option ID | Option Name | Situation 1 | Situation 4 | Situation 8 | L1 Result | L2 Result |
|---|---|---|---|---|---|---|
| TWU_HEN_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Henley High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_HEN_EF-LKR_ALL_ALL_dmp hen gov c+2 | Henley Demand: Gov C+2 | Yes | Yes | Yes | N/A | N/A |
| TWU_HEN_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Henley High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_HEN_HI-TFR_KVZ_ALL_tw(kv)to(hen)con | Transfer - Kennet Valley to Henley - Conveyance Element | Yes | Yes | No | N/A | N/A |
| TWU_HEN_RE-DRP_ALL_ALL_dp-sheep/harp-hen | Shalford Drought Permit | No | Yes | Yes | N/A | N/A |
| TWU_HEN_RE-OTH_ALL_ALL_media - henley | Media Campaigns - Henley | Yes | Yes | Yes | N/A | N/A |
| TWU_HEN_RE-OTH_ALL_ALL_neub - henley | NEUB - Henley | Yes | Yes | Yes | N/A | N/A |
| TWU_HEN_RE-OTH_ALL_ALL_tub - henley | TUB - Henley | Yes | Yes | Yes | N/A | N/A |
| TWU_KEM_HI-TFR_TED_ALL_tedd-kempton | Teddington to Kempton Resource Element | Yes | Yes | Yes | N/A- SRO | Part of London Water Recycling SRO (Teddington DRA) - risk score 55.88-56.88%" |
| TWU_KVZ_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Kennet Valley High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_KVZ_EF-LKR_ALL_ALL_dmp kvz gov c+2 | Kennet Valley Demand: Gov C+2 | Yes | Yes | Yes | N/A | N/A |
| TWU_KVZ_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Kennet Valley High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_KGV_HI-TFR_TED_ALL_teddingtondrated/tlt | Direct River Abstraction - Teddington to Thames Lee Tunnel Shaft 75 MLD | Yes | Yes | Yes | N/A- SRO | Part of London Water Recycling SRO (Teddington DRA) - risk score 55.88-56.88%" |
| TWU_KVZ_HI-GRW_ALL_ALL_mortimer recomm | Groundwater Development - Recommission Mortimer Disused Source | Yes | Yes | No | 1= Very Low | N/A |

| Option ID | Option Name | Situation 1 | Situation 4 | Situation 8 | L1 Result | L2 Result |
|---|---|---|---|---|---|---|
| TWU_KVZ_HI-TFR_T2S_ALL_t2st cul to speen | T2ST Spur to Kennet Valley - Speen | Yes | Yes | No | N/A- SRO | Part of T2ST SRO – RWT risk score 35.73%<br>-Asset risk score 10.94% |
| TWU_KVZ_RE-DRP_ALL_ALL_dp-playhatch-kv | Playhatch Drought Permit | Yes | Yes | Yes | N/A | N/A |
| TWU_KVZ_RE-OTH_ALL_ALL_media - kv | Media Campaigns - Kennet Valley | Yes | Yes | Yes | N/A | N/A |
| TWU_KVZ_RE-OTH_ALL_ALL_neub - kv | NEUB - Kennet Valley | Yes | Yes | No | N/A | N/A |
| TWU_KVZ_RE-OTH_ALL_ALL_tub - kv | TUB - Kennet Valley | Yes | Yes | Yes | N/A | N/A |
| TWU_LON_BG-CAT_ALL_ALL_cm_p1_darent cray | Catchment Portfolio: Darent and Cray | Yes | Yes | No | N/A | N/A |
| TWU_LON_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction London High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_LON_EF-LKR_ALL_ALL_dmp lon gov c+2 | London Demand: Gov C+2 | Yes | Yes | Yes | N/A | N/A |
| TWU_LON_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction London High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_LON_HI-GRW_ALL_ALL_addington gw | Groundwater Development - Addington | Yes | Yes | Yes | 1= Very Low | N/A |
| TWU_LON_HI-GRW_ALL_ALL_s'fleet lic disagg | Groundwater Development - Southfleet & Greenhithe | Yes | Yes | No | 1= Very Low | N/A |
| TWU_LON_HI-ROC_WT1_ALL_eastlon wtwexisting | Available Treatment Capacity at Coppermills WTW | Yes | Yes | Yes | 0= No additional risk | N/A |
| TWU_LON_HI-ROC_WT1_ALL_existing w lon wtw | Available Treatment Capacity at West London WTWs | Yes | Yes | Yes | 0= No additional risk | N/A |
| TWU_LON_HI-ROC_WT1_CNO_kempto nwtw100 p1 | New WTW at Kempton - 100Ml/d - Construction | Yes | Yes | No | N/A | N/A |
| TWU_LON_HI-TFR_LON_ALL_newriver head pump 4 | Replace New River Head Pump - TWRM | Yes | Yes | No | 1= Very Low | N/A |
| TWU_LON_RE-OTH_ALL_ALL_media - london | Media Campaigns - London | Yes | Yes | Yes | N/A | N/A |
| TWU_LON_RE-OTH_ALL_ALL_neub - london | NEUB - London | Yes | Yes | Yes | N/A | N/A |

| Option ID | Option Name | Situation 1 | Situation 4 | Situation 8 | L1 Result | L2 Result |
|---|---|---|---|---|---|---|
| TWU_LON_RE-OTH_ALL_ALL_tub - london | TUB - London | Yes | Yes | Yes | N/A | N/A |
| TWU_STR_HI-RSR_RE1_CNO_abingdon150(lon) | New Reservoir - SESRO 150Mm3 - Construction | Yes | Yes | Yes | N/A- SRO | Part of SESRO SRO -Asset risk score 21.27% - 88.46% depending on scenario |
| TWU_SWA_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Slough, Wycombe and Aylesbury High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_SWA_EF-LKR_ALL_ALL_dmp swa gov c+2 | Slough, Wycombe and Aylesbury Demand: Gov C+2 | Yes | Yes | Yes | N/A | N/A |
| TWU_SWA_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Slough, Wycombe and Aylesbury High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_SWA_HI-GRW_ALL_ALL_datchet do | Groundwater Development - Datchet Existing Source DO Increase | Yes | Yes | No | 1= Very Low | N/A |
| TWU_SWA_HI-ROC_WT1_CNO_medmenhamwtw ph1 | New Medmenham Surface Water WTW Ph1 - Construction | Yes | Yes | No | 0= No additional risk | N/A |
| TWU_SWA_HI-TFR_SWX_ALL_tw(swx)to(swa)con | Thames Water Horspath (SWOX) to Thames Water Ashenden (SWA) Conveyance | Yes | Yes | No | N/A | N/A |
| TWU_SWA_HI-TFR_UTC_ALL_medmenham intake 53 | New Medmenham Surface Water Intake - 53 Ml/d | Yes | Yes | No | 3= Low | 26.26% |
| TWU_SWA_RE-OTH_ALL_ALL_media - swa | Media Campaigns - SWA | Yes | Yes | Yes | N/A | N/A |
| TWU_SWA_RE-OTH_ALL_ALL_neub - swa | NEUB - SWA | Yes | Yes | No | N/A | N/A |
| TWU_SWA_RE-OTH_ALL_ALL_tub - swa | TUB - SWA | Yes | Yes | Yes | N/A | N/A |
| TWU_SWX_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Swindon and Oxfordshire High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_SWX_EF-LKR_ALL_ALL_dmp swx gov c+2 | Swindon and Oxfordshire Demand: Gov C+2 | Yes | Yes | Yes | N/A | N/A |
| TWU_SWX_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Swindon and Oxfordshire High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_SWX_HI-GRW_ALL_ALL_moulsford gw | Groundwater Development - Moulsford Groundwater Source | Yes | Yes | Yes | 1= Very Low | N/A |

| Option ID | Option Name | Situation 1 | Situation 4 | Situation 8 | L1 Result | L2 Result |
|---|---|---|---|---|---|---|
| TWU_SWX_HI-GRW_ALL_ALL_woods farm do | Groundwater Development - Woods Farm Existing Source Increase DO | Yes | Yes | No | 1= Very Low | N/A |
| TWU_SWX_HI-IMP_SWX_CNO_oxc-dukes cutswox | Oxford Canal - Duke's Cut (SWOX) - Construction | Yes | Yes | No | 4= Moderate | 31.69% |
| TWU_SWX_HI-TFR_HEN_ALL_henley-swox5 | Henley to SWOX Transfer– 5 Ml/d | No | Yes | No | 1= Very Low | N/A |
| TWU_SWX_HI-TFR_STR_ALL_abing-farmoor pipe | Abingdon Reservoir to Farmoor Reservoir pipeline | Yes | Yes | No | 6= High | 32.02% |
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx)con | SWA to SWOX Transfer - Conveyance Element | Yes | Yes | Yes | 1= Very Low | N/A |
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx)con b | SWA to SWOX Transfer - Conveyance Element | Yes | Yes | Yes | 1= Very Low | N/A |
| TWU_SWX_HI-TFR_SWA_ALL_tw(swa)to(swx)con c | SWA to SWOX Transfer - Conveyance Element | Yes | Yes | Yes | 1= Very Low | N/A |
| TWU_SWX_HI-TFR_SWX_ALL_dukescut-farmoor | Oxford Canal - Transfer from Duke's Cut to Farmoor | Yes | Yes | No | 6= High | 35.31% |
| TWU_SWX_RE-DRP_ALL_ALL_dp-gatehampton-swox | Gatehampton Drought Permit | Yes | Yes | Yes | N/A | N/A |
| TWU_SWX_RE-OTH_ALL_ALL_media - swox | Media Campaign - SWOX | Yes | Yes | Yes | N/A | N/A |
| TWU_SWX_RE-OTH_ALL_ALL_neub - swox | NEUB - SWOX | Yes | Yes | Yes | N/A | N/A |
| TWU_SWX_RE-OTH_ALL_ALL_tub - swox | TUB - SWOX | Yes | Yes | Yes | N/A | N/A |
| TWU_TED_HI-RAB_RE1_CNO_teddington dra 75 | Teddington Direct River Abstraction (Indirect Water Recycling) 75 MLD - Construction | Yes | Yes | Yes | N/A- SRO | Part of London Water Recycling SRO (Teddington DRA) - risk score 55.88-56.88 |
| TWU_TED_HI-TFR_TED_ALL_teddingtondramog/ted | Transfer of Treated Effluent from Mogden to Teddington 75Ml/d | Yes | Yes | Yes | N/A | N/A |
| TWU_HON_HI-ROC_NET_CNO_cop'mills-honoroak | TWRM extension - Coppermills to Honor Oak - Construction | Yes | No | No | 0= No additional risk | N/A |
| TWU_KGV_HI-REU_RE1_CNO_deephams reuse 46.5b | Deephams Water Recycling – 46.5 Ml/d, to TLT - Construction | Yes | No | No | 1= Very Low | N/A |

| Option ID | Option Name | Situation 1 | Situation 4 | Situation 8 | L1 Result | L2 Result |
|---|---|---|---|---|---|---|
| TWU_KGV_HI-TFR_KGV_ALL_lockwood ps-kgv res | Thames-Lee Tunnel extension from Lockwood PS to King George V Reservoir intake | Yes | No | No | 4 = Moderate | 54.06% |
| TWU_LON_HI-DES_ALL_CNO_beckton desal 150 | Beckton Desalination | Yes | No | No | 3= Low | 43.07% |
| TWU_LON_HI-GRW_ALL_ALL_addington asr | Managed Aquifer Recharge - Addington | Yes | No | No | 1= Very Low | N/A |
| TWU_LON_HI-GRW_ALL_ALL_london conchalk | Groundwater Development - Confined Chalk North London | Yes | No | No | 1= Very Low | N/A |
| TWU_LON_HI-GRW_ALL_ALL_merton recommission | Groundwater Development - Merton Recommissioning | Yes | No | No | 1= Very Low | N/A |
| TWU_LON_HI-GRW_ALL_CNO_kidbrooke slars | Managed Aquifer Recharge - Kidbrooke (SLARS1) Construction | Yes | No | No | 1= Very Low | N/A |
| TWU_LON_HI-GRW_ALL_CNO_merton ar | Managed Aquifer Recharge - Merton (SLARS3) Construction | Yes | No | No | 1= Very Low | N/A |
| TWU_LON_HI-GRW_RE1_ALL_asrhortonkirby | Manager Aquifer Recharge - Horton Kirby ASR | Yes | Yes | Yes | 1= Very Low | N/A |
| TWU_LON_HI-TFR_LON_CNO_beckton-coppermills | Beckton to Coppermills tunnel (treated) - Construction | Yes | No | No | 1= Very Low | N/A |
| TWU_LON_HI-TFR_SES_ALL_cheam-merton | Cheam to Merton - London Ring Main | Yes | No | No | 1= Very Low | N/A |
| TWU_LON_HI-OTH_ALL_ALL_didcot purchase | Didcot Power Station Licence Trading | Yes | Yes | Yes | 0= No additional risk | N/A |
| TWU_GUI_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Guildford High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_GUI_EF-LKR_ALL_ALL_dmp gui gov c+2 | Guildford Demand: Gov C+2 | Yes | Yes | Yes | N/A | N/A |
| TWU_GUI_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Guildford High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_GUI_HI-TFR_RZ4_ALL_sewtogui | SouthEast Water to Guildford | Yes | Yes | No | 1= Very Low | N/A |
| TWU_GUI_RE-DRP_ALL_ALL_dp-shalford-guild | Shalford Drought Permit | No | Yes | Yes | N/A | N/A |
| TWU_GUI_RE-OTH_ALL_ALL_media - guilfd | Media Campaigns - Guildford | Yes | Yes | Yes | N/A | N/A |
| TWU_GUI_RE-OTH_ALL_ALL_neub - guilfd | NEUB - Guildford | Yes | Yes | No | N/A | N/A |

| Option ID | Option Name | Situation 1 | Situation 4 | Situation 8 | L1 Result | L2 Result |
|---|---|---|---|---|---|---|
| TWU_GUI_RE-OTH_ALL_ALL_tub - guilfd | TUB - Guildford | Yes | Yes | Yes | N/A | N/A |
| TWU_HEN_EF-CRE_ALL_ALL_consump basket high | Consumption Reduction Henley High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_HEN_EF-LKR_ALL_ALL_dmp hen gov c+2 | Henley Demand: Gov C+2 | Yes | Yes | Yes | N/A | N/A |
| TWU_HEN_EF-LKR_ALL_ALL_leakage basket high | Leakage Reduction Henley High Basket | Yes | Yes | Yes | N/A | N/A |
| TWU_HEN_HI-TFR_KVZ_ALL_tw(kv)to(hen)con | Transfer - Kennet Valley to Henley - Conveyance Element | Yes | Yes | No | N/A | N/A |
| TWU_SWX_HI-TFR_HEN_ALL_henley-swox2.4 | Henley to SWOX Transfer – 2.4 Ml/d | Yes | No | No | 1= Very Low | N/A |
| TWU_WLJ_HI-ROC_NET_CNO_twrm shaft kempton | New shaft on the TWRM at Kempton - Construction | Yes | Yes | No | 0= No additional risk | N/A |

## 5.2 In-combination effects

The following SROs and non-SROs from the three BVP Situation lists were included in the in-combination effects assessment:

**Situation 1:**

- Abingdon Reservoir to Farmoor Reservoir pipeline
- Thames-Lee Tunnel extension from Lockwood PS to King George V Reservoir intake
- Oxford Canal – Transfer from Oxford Canal – Transfer from Duke's Cut to Farmoor
- Beckton Desalination
- Oxford Canal – Duke's Cut (SWOX)
- New Medmenham Surface Water Intake - 53 Ml/d
- Teddington DRA[10]
- New Reservoir – SESRO 150Mm3 – Construction
- T2ST Spur to Kennet Valley - Speen

**Situation 4:**

- Abingdon Reservoir to Farmoor Reservoir pipeline
- Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor
- Oxford Canal – Duke's Cut (SWOX)
- New Medmenham Surface Water Intake - 53 Ml/d Teddington DRA[10]
- New Reservoir - SESRO 150Mm3 – Construction
- T2ST Spur to Kennet Valley - Speen

**Situation 8:**

- New Reservoir - SESRO 150Mm3 – Construction
- Teddington DRA[10]

#### 5.2.1.1 Process A Results

Following Process A (see section 2.3.1 for description), the following option combinations were determined to potentially connect directly or indirectly, for example through common sources or receptors.

**Situation 1:**

- Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and Beckton Desalination
- Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and New Medmenham Surface Water Intake - 53 Ml/d
- Oxford Canal to Duke's Cut and Oxford Canal - Transfer from Duke's Cut to Farmoor
- Oxford Canal - Transfer from Oxford Canal - Transfer from Duke's Cut to Farmoor and Teddington DRA
- Oxford Canal to Duke's Cut and Teddington DRA
- SESRO and New Medmenham Surface Water Intake - 53 Ml/d
- SESRO and Teddington DRA
- SESRO and Beckton Desalination
- Beckton Desalination and Medmenham Intake
- Thames-Lee Tunnel extension from Lockwood PS to King George V Reservoir intake Beckton Desalination and Teddington DRA
- New Medmenham Surface Water Intake - 53 Ml/d and Teddington DRA
- Oxford Canal to Duke's Cut, Oxford Canal - Transfer from Duke's Cut to Farmoor, Abingdon to Farmoor and SESRO

**Situation 4:**

- Oxford Canal - Transfer from Duke's Cut to Farmoor and New Medmenham Surface Water Intake - 53 Ml/d
- Oxford Canal - Duke's Cut (SWOX) - Construction and Oxford Canal - Transfer from Duke's Cut to Farmoor
- SESRO and New Medmenham Surface Water Intake - 53 Ml/d
- SESRO and Teddington DRA
- Oxford Canal - Transfer from Duke's Cut to Farmoor and Teddington DRA
- Oxford Canal - Duke's Cut (SWOX) - Construction and Teddington DRA
- New Medmenham Surface Water Intake - 53 Ml/d and Teddington DRA
- Oxford Canal - Duke's Cut (SWOX) - Construction, Oxford Canal - Transfer from Duke's Cut to Farmoor, Abingdon to Farmoor and SESRO

**Situation 8**

- SESRO and Teddington DRA

#### 5.2.1.2 Process B Results

Following Process B (See section 2.3.2 for description), an assessment was made for the INNS risk associated with each option combination identified in Process A, and a risk rating was assigned.

**Situation 1**

The assessment results of Situation 1 options are presented below in Table 5.2. The In-combination assessment shows two option combinations could present a High additional risk, four option combinations could present a Medium risk and six option combinations are likely to present a Very Low additional risk.

For the High additional risk options, mitigation such as a WTW at Abingdon was discussed as part of the Level 2 assessments and would help reduce effects. The SESRO SRO also sets out INNS mitigation to reduce effects at Abingdon, reported within the Gate 2 reports and summarised within this report. It is likely that mitigation measures can be incorporated into the options design and through discussion with the Environment Agency to reduce risks. Some of the medium risk options are a significant distance away from each other; given the distances between these options, further investigation may conclude no additional effects and therefore, mitigation may not be needed.

**Table 5.2: In-combination results of BVP Situation 1**

| Option combination | Description of risk | Result |
|---|---|---|
| Oxford Canal - Transfer from Duke's Cut to Farmoor and Beckton Desalination | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Options are connected through the River Thames as raw water will be discharged into the River Thames before being abstracted into Farmoor Reservoir and raw water from the Thames will be abstracted ~170km downstream as part of the Beckton Desalination option. The River Thames is connected to Oxford Canal through Duke's Cut and in Oxford City centre. Existing connections may mean that a similar INNS community already exists in the River Thames therefore the additional risk may actually be lower. | Medium additional risk.<br><br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. |

| Option combination | Description of risk | Result |
|---|---|---|
| Oxford Canal - Transfer from Duke's Cut to Farmoor and New Medmenham Surface Water Intake - 53 Ml/d | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Options are connected through the River Thames as raw water will be discharged into the River Thames before being abstracted into Farmoor Reservoir, and raw water from the Thames will be abstracted ~ 90km downstream as part of the Medmenham Intake option. The River Thames is connected to Oxford Canal through Duke's Cut and in Oxford City centre. Existing connections may mean that a similar INNS community already exists in the River Thames therefore the additional risk may actually be lower. | Medium additional risk.<br><br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. |
| Oxford Canal to Duke's Cut and Oxford Canal - Transfer from Duke's Cut to Farmoor | Option combination will create a hydrological link between surface waterbodies which are currently unconnected and will increase INNS risk at Farmoor reservoir. INNS risk will be increased as a result of increased flow down Oxford Canal and the Duke's Cut channel. | High additional risk.<br>Mitigation requirements will be reviewed as the option design progresses which may enable INNS risk to be reduced. |
| Oxford Canal - Transfer from Duke's Cut to Farmoor and Teddington DRA | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Options are connected through the River Thames as raw water will be discharged into the River Thames before being abstracted into Farmoor Reservoir, and raw water from the Thames will be abstracted ~150km downstream. The River Thames is connected to Oxford Canal through Duke's Cut and in Oxford City centre. Existing connections may mean that a similar INNS community already exists in the River Thames therefore the additional risk may actually be lower. | Medium additional risk.<br><br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. |
| Oxford Canal to Duke's Cut and Teddington DRA | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Options are connected through the River Thames. The River Thames is connected to Oxford Canal through Duke's Cut and in Oxford City centre. Existing connections may mean that a similar INNS community already exists in the River Thames therefore the additional risk may actually be lower. | Medium additional risk.<br><br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. |

| Option combination | Description of risk | Result |
|---|---|---|
| SESRO and Medmenham Surface Water Intake - 53 Ml/d | Both abstract from the same source (River Thames, 60km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| SESRO and Teddington DRA | Both abstract from the same source (River Thames, 100km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| SESRO and Beckton Desalination | Both abstract from the same source (River Thames, 160km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| Beckton Desalination and Medmenham Surface Water Intake - 53 Ml/d | Both abstract from the same source (River Thames, 80km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| Thames-Lee Tunnel extension from Lockwood PS to King George V Reservoir intake and Teddington DRA | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Water abstracted from the River Thames would be transferred to Lockwood PS which is the source of the Lockwood PS to KGV reservoir option. Therefore, INNS could be transferred from this abstraction point on the River Thames into KGV reservoir, although it is assumed these options are already connected, therefore the risk of new INNS introduction is may actually be lower. | Medium additional risk.<br><br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. |
| Beckton Desalination and Teddington DRA | Both abstract from the same source (River Thames, 40km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |

| Option combination | Description of risk | Result |
|---|---|---|
| Medmenham Surface Water Intake - 53 Ml/d and Teddington DRA | Both abstract from the same source (River Thames, 60km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| Oxford Canal to Duke's Cut, Oxford Canal - Transfer from Duke's Cut to Farmoor, Abingdon to Farmoor and SESRO | Option combination will create a hydrological link between surface waterbodies which are currently unconnected. Oxford Canal - Transfer from Duke's Cut to Farmoor and Oxford to Duke's Cut options are indirectly connected to SESRO reservoir through the Abingdon to Farmoor option. INNS risk will increase as a result of increased flow down Oxford Canal through Duke's Cut and potential recreation at SESRO may increase risk of INNS transmission to Farmoor. | High additional risk.<br>Potential to reduce risk through WTW at Abingdon as discussed in the Level 2 assessment. The SESRO SRO also sets out INNS mitigation to reduce effects at Abingdon, reported within the Gate 2 reports and summarised within this report. |

### Situation 4

The assessment results of Situation 4 options are presented below in Table 5.3. The In-combination assessment shows two option combinations are considered High additional risk, two combinations are considered Medium additional risk, and three option combinations are considered Very Low additional risk. For the High risk options, mitigation such as a WTW at Abingdon was discussed as part of the Level 2 assessments and would help reduce effects. The SESRO SRO also sets out INNS mitigation to reduce effects at Abingdon, reported within the Gate 2 reports and summarised within this report. It is likely that mitigation measures can be incorporated into the options design and through discussion with the Environment Agency to reduce risks.

The medium risk options are a significant distance away from each other; given the distances between these options, further investigation may conclude no additional effects and therefore mitigation may not be needed.

### Table 5.3: In-combination results of BVP Situation 4

| Option combination | Description of risk | Result |
|---|---|---|
| Oxford Canal - Transfer from Duke's Cut to Farmoor and Medmenham Surface Water Intake - 53 Ml/d | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Options are connected through the River Thames as raw water will be discharged into the River Thames before being abstracted into Farmoor Reservoir, and raw water from the Thames will be abstracted ~ 90km downstream as part of the Medmenham Intake option. The River Thames is connected to Oxford Canal through Duke's Cut and in Oxford City centre. Existing connections may mean that a similar INNS community already exists in the River Thames therefore the additional risk may actually be lower. | Medium additional risk.<br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed.<br>. |
| Oxford Canal to Duke's Cut and Oxford Canal - Transfer from Duke's Cut to Farmoor | Option combination will create a hydrological link between surface waterbodies which are currently unconnected and will increase INNS risk at Farmoor reservoir. INNS risk will be increased as a result of increased flow down Oxford Canal and the Duke's Cut channel. | High additional risk. Mitigation requirements will be reviewed as the option design progresses which may enable INNS risk to be reduced. |
| SESRO and Medmenham Surface Water Intake - 53 Ml/d | Both abstract from the same source (River Thames, 60km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| SESRO and Teddington DRA | Both abstract from the same source (River Thames, 100km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| Oxford Canal - Transfer from Duke's Cut to Farmoor and Teddington DRA | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Options are connected through the River Thames as raw water will be discharged into the River Thames before being abstracted into Farmoor Reservoir, and raw water from the Thames will be abstracted ~150km downstream. The River Thames is connected to Oxford Canal through Duke's Cut and in Oxford City centre. Existing connections may mean that a similar INNS community already exists in the River Thames therefore the additional risk may actually be lower. | Medium additional risk.<br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. |

| Option combination | Description of risk | Result |
|---|---|---|
| Oxford Canal to Duke's Cut and Teddington DRA | Option combination would create an additional hydrological link between surface waterbodies which are assumed to be already connected. Options are connected through the River Thames. The River Thames is connected to Oxford Canal through Duke's Cut and in Oxford City centre. Existing connections may mean that a similar INNS community already exists in the River Thames therefore the additional risk may actually be lower. | Medium additional risk.<br>Upon further investigation it may be concluded that a significant additional risk is unlikely and additional mitigation may not be needed. |
| Medmenham Surface Water Intake - 53 Ml/d and Teddington DRA | Both abstract from the same source (River Thames, 60km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |
| Oxford Canal to Duke's Cut, Oxford Canal - Transfer from Duke's Cut to Farmoor, Abingdon to Farmoor and SESRO | Option combination will create a hydrological link between surface waterbodies which are currently unconnected. Oxford Canal - Transfer from Duke's Cut to Farmoor and Oxford to Duke's Cut options are indirectly connected to SESRO reservoir through the Abingdon to Farmoor option. INNS risk will increase as a result of increased flow down Oxford Canal through Duke's Cut and potential recreation at SESRO may increase risk of INNS transmission to Farmoor. | High additional risk. Potential to reduce risk through WTW at Abingdon as discussed in the Level 2 assessment. The SESRO SRO also sets out INNS mitigation to reduce effects at Abingdon, reported within the Gate 2 reports and summarised within this report. |

### Situation 8

The assessment results of Situation 8 options are presented below in Table **5**.**4**. The In-combination assessment shows one option combination is considered Very Low additional risk. As this connection involves an abstraction from the same source and due to the distance between these options, no mitigation would be required as the INNS is considered very low.

**Table** 5.4**: In-combination results of BVP Situation 8.**

| Option combination | Description of risk | Result |
|---|---|---|
| SESRO and Teddington DRA | Both abstract from the same source (River Thames, 100km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options. | Very low additional risk |

#### 5.2.1.3 Further assessment results

Following Process B, any option combinations resulting in a final score of Low, Medium or High additional risk were recommended for further assessment using SAI-RAT. Individual option assessments were therefore combined to provide maximum component Risk Scores and Overall Risk Scores for each option combination.

These results may help to confirm the priority for mitigation measures, which can be incorporated into the options design and developed through discussion with the Environment Agency.

**Situation 1**

The final scores for the BVP Situation 1 options are presented below in Table 5.5. Table 4.6

**Table 5.5: Further assessment scores for BVP Situation 1 options**

| Option name | Process B outcome | SAI-RAT maximum score (%) | SAI-RAT average score (%) |
|---|---|---|---|
| Oxford Canal - Transfer from Duke's Cut to Farmoor and Beckton Desalination | Further assessment recommended, which may conclude that a significant additional risk is unlikely and additional mitigation may not be needed. | 62.25 (River Thames to RW Lagoons RWT) | 40.48 |
| Oxford Canal - Transfer from Duke's Cut to Farmoor and Medmenham Intake | Further assessment recommended, which may conclude that a significant additional risk is unlikely and additional mitigation may not be needed. | 56.50 (Oxford Canal - Transfer from Duke's Cut to Farmoor RWT) | 30.79 |
| Oxford Canal to Duke's Cut and Oxford Canal - Transfer from Duke's Cut to Farmoor | Further assessment recommended. The SAI-RAT recommends potential biosecurity mitigation measures to reduce effect which should be explored as the option design develops. | 56.50 (Oxford Canal - Transfer from Duke's Cut to Farmoor RWT) | 33.50 |
| Oxford Canal - Transfer from Duke's Cut to Farmoor and Teddington DRA | Further assessment recommended, which may conclude that a significant additional risk is unlikely and additional mitigation may not be needed. | 64.00 (Teddington DRA highest transfer volume) | 49.65 (maximum Teddington DRA score) |
| Oxford Canal to Duke's Cut and Teddington DRA | Further assessment recommended, which may conclude that a significant additional risk is unlikely and additional mitigation may not be needed. | 64.00 (Teddington DRA highest transfer volume) | 44.29 (maximum Teddington DRA score) |
| SESRO and Medmenham Intake | Further assessment not recommended | N/A | N/A |
| SESRO and Teddington DRA | Further assessment not recommended | N/A | N/A |
| SESRO and Beckton Desalination | Further assessment not recommended | N/A | N/A |

| Option name | Process B outcome | SAI-RAT maximum score (%) | SAI-RAT average score (%) |
|---|---|---|---|
| Beckton Desalination and Medmenham Intake | Further assessment not recommended | N/A | N/A |
| Thames-Lee Tunnel extension from Lockwood PS to King George V Reservoir intake and Teddington DRA | Further assessment recommended, which may conclude that a significant additional risk is unlikely and additional mitigation may not be needed. | 64.00 (Teddington DRA highest transfer volume) | 59.03 (maximum Teddington DRA score) |
| Beckton Desalination and Teddington DRA | Further assessment not recommended | N/A | N/A |
| Medmenham Intake and Teddington DRA | Further assessment not recommended | N/A | N/A |
| Oxford Canal to Duke's Cut, Oxford Canal - Transfer from Duke's Cut to Farmoor, Abingdon to Farmoor and SESRO | Further assessment recommended. The SAI-RAT recommends potential biosecurity mitigation measures to reduce effects. Potential to reduce risk through WTW at Abingdon as discussed in the Level 2 assessment. The SESRO SRO also sets out INNS mitigation to reduce effects at Abingdon, reported within the Gate 2 reports and summarised within this report. | 66.13 (Wyrley and Essington Canal to Duke's Cut) | 45.08 |

### Situation 4

The final scores for the BVP Situation 4 options are presented below in Table 5.6. Table 4.6

**Table 5.6: Further assessment scores for BVP Situation 4 options**

| Option name | Process B Outcome | SAI-RAT maximum score (%) | SAI-RAT average score (%) |
|---|---|---|---|
| Oxford Canal - Transfer from Duke's Cut to Farmoor and Medmenham Surface Water Intake - 53 Ml/d | Further assessment recommended, which may conclude that a significant additional risk is unlikely and additional mitigation may not be needed. | 56.50 (Oxford Canal - Transfer from Duke's Cut to Farmoor RWT) | 30.79 |
| Oxford Canal to Duke's Cut and Oxford Canal - Transfer from Duke's Cut to Farmoor | Further assessment recommended. The SAI-RAT recommends potential biosecurity mitigation measures to reduce effect which should be explored as the option design develops. | 56.50 (Oxford Canal - Transfer from Duke's Cut to Farmoor RWT) | 33.50 |
| SESRO and Medmenham Surface Water Intake - 53 Ml/d | Further assessment not recommended | N/A | N/A |
| SESRO and Teddington DRA | Further assessment not recommended | N/A | N/A |

| Option name | Process B Outcome | SAI-RAT maximum score (%) | SAI-RAT average score (%) |
|---|---|---|---|
| Oxford Canal - Transfer from Duke's Cut to Farmoor and Teddington DRA | Further assessment recommended, which may conclude that a significant additional risk is unlikely and additional mitigation may not be needed. | 64% (Teddington DRA highest transfer volume) | 49.65 (maximum Teddington DRA score) |
| Oxford Canal to Duke's Cut and Teddington DRA | Further assessment recommended, which may conclude that a significant additional risk is unlikely and additional mitigation may not be needed. | 64.00 (Teddington DRA highest transfer volume) | 44.29 (maximum Teddington DRA score) |
| Medmenham Surface Water Intake - 53 Ml/d and Teddington DRA | Further assessment not recommended | N/A | N/A |
| Oxford Canal to Duke's Cut, Oxford Canal - Transfer from Duke's Cut to Farmoor, Abingdon to Farmoor and SESRO | Further assessment recommended. The SAI-RAT recommends potential biosecurity mitigation measures to reduce effects. Potential to reduce risk through WTW at Abingdon as discussed in the Level 2 assessment. The SESRO SRO also sets out INNS mitigation to reduce effects at Abingdon, reported within the Gate 2 reports and summarised within this report. | 66.13 (Wyrley and Essington Canal to Duke's Cut) | 45.08 |

### Situation 8

No further assessments were required for BVP Situation 8.

# 6 Conclusions and Next Steps

## 6.1 Conclusions

### 6.1.1 Level 1 screening

The following key conclusions are taken from the Level 1 INNS screening:

- The Thames Water rdWRMP24 included a number of supply-side options not related to SROs, which were subject to Level 1 screenings for INNS risk.
  - 13 options presented No additional risk of INNS transfer.
  - 36 options were given a Very Low risk of INNS transfer as these involve the movement of groundwater or treated water which are considered unlikely to contain INNS.
  - The River Thames to Fobney transfer option scored a Risk Magnitude of Low and therefore was progressed to a Level 2 INNS risk assessment.
  - The Thames-Lee Tunnel extension from Thames-Lee Tunnel extension from Lockwood PS to King George V Reservoir intake option scored a Risk Magnitude of Moderate and therefore was progressed to a Level 2 INNS risk assessment.
  - The Abingdon Reservoir to Farmoor Reservoir pipeline option scored a Risk Magnitude of High and therefore was progressed to a Level 2 INNS risk assessment.
  - The Oxford Canal - Transfer from Duke's Cut to Farmoor transfer option scored a Risk Magnitude of High and therefore was progressed to a Level 2 INNS risk assessment.
  - The Oxford Canal to Duke's Cut option scored a Risk Magnitude of Moderate and therefore was progressed to a Level 2 INNS risk assessment.
  - The New Medmenham Surface Water Intake - 53 Ml/d scored a Risk Magnitude of Low and therefore was progressed to a Level 2 INNS risk assessment.
  - Beckton Desalination scored a Risk Magnitude of Low and therefore was progressed to a Level 2 INNS risk assessment.
- Feasible options not selected under the BVP, BESP or LCP were also subject to a Level 1 but not progressed to a Level 2 assessment screening. This included five options which were deemed Low risk, five assessed as Moderate risk rating and four which were given a High risk rating.
- A number of selected options related to SROs and were assessed for INNS risk through the Gate 2 process and reported in the Gate 2 submission documents, with the results included in this report.

### 6.1.2 Level 2 assessment

The following conclusions have been drawn from the results of the Level 2 assessment of the options not related to SROs:

- The Abingdon Reservoir to Farmoor Reservoir pipeline option was given a risk score of 32.02%. The principal risk associated with this option is the creation of a pathway between reservoir waterbodies, which could facilitate the movement of INNS between these waterbodies and potentially increase INNS spread through the wider environment. If a WTW is considered as part of the design for SESRO SRO as discussed in the workshop with the EA, the risk associated with this option would be substantially decreased.
- The Thames-Lee Tunnel extension from Lockwood PS to King George V Reservoir intake transfer option assessment resulted in a risk score of 54.06%. The principal risk associated with this transfer is the additional movement of raw water which could create a pathway and

facilitate the movement of INNS. However, this risk is slightly reduced due to all reservoirs in this complex having pre-existing connections. If water is passed directly into the KGV Reservoir rather than via the River Lee, as discussed in the EA workshop, then the risk may be reduced. However, current plans for how the transfer will operate are not well understood and mitigation will be considered as the option develops.

- Oxford Canal - Transfer from Duke's Cut to Farmoor transfer option assessment resulted in an INNS risk score of 35.31%. The principal risk associated with this option is the transfer of water between an online (river) source and receptor with potential high levels of recreational activity. It is considered that the risk level at this stage does not indicate a requirement for specific mitigation to be added to the option. However, mitigation requirements will be reviewed as the option design progresses.
- The Beckton Desalination option assessment resulted in an INNS risk score of 43.07%. The principal risk associated with this option is the transfer of raw water through the intake pipeline (from the intake in the tidal Thames to the new desalination plant) and raw water lagoons to the desalination plant in the event of a pipeline burst or leak between the source and receptor. As the option is developed, mitigation proportionate to the level of risk will be considered and the EA will be consulted to determine the appropriate level of mitigation measures in relation to the potential risk of INNS transfer.
- The Oxford Canal to Duke’s Cut transfer assessment resulted in an overall score of 31.69%. The principal risk associated with this option is the use of open waterbodies to transfer additional flows and the length of this transfer which may facilitate the spread of INNS. It is likely that the Canal and River Trust, the Environment Agency, and angling clubs would be well placed to advise on mitigation options which are proportional to the nature of the option.

The New Medmenham Surface Water Intake - 53 Ml/d option assessment resulted in an overall risk score of 26.26%. The principal risk associated with this scheme would be the spread of INNS through pipe bursts between source and receptor. However, the current proposed pipeline route does not cross any channels, with the closest being Hamble Brook which is approximately 150m away at its closest point.

The River Thames to Fobney option assessment resulted in a risk score of 28.64% using the SAI-RAT. The principal waterbody at risk from pipe bursts would be the Holy Brook, which flows into the River Kennet (which then joins the River Thames further downstream). The pipeline route for the option has been re-aligned and now largely mitigates the risk of pipe burst to Holy Brook. It is considered that the risk level at this stage does not indicate requirement for specific mitigation to be added to the option. However, mitigation requirements will be reviewed as the option design progresses.

The results of the options related to SROs have been subject to separate assessments (where appropriate), with the headline results provided within this report. The key points are as follows:

- Four options were related to the construction-phase of SROs and therefore a Level 2 assessment was not undertaken. Construction-phase risks will be appropriately evaluated and mitigated at the appropriate stage in planning and development.
- Two SRO-related options involve treated water or water re-use and so were not subject to a Level 2 assessment.
- For the London Reuse SRO, only the Direct River Abstraction option was considered necessary and appropriate for INNS assessment, and this assessment resulted in a risk score of 56.88%. The Teddington DRA scheme may cause changes in conditions that could theoretically affect INNS distribution; however, these changes would be minor, and are considered unlikely significantly affect INNS distribution in the river. As the option design progresses, consideration will be given to the development of mitigation to target specific risks and broader mitigation measures which are most likely to be feasible and effective for

the control of INNS. As the option develops, likely environmental impacts and potential mitigation will be outlined within the environmental statement.

- Two options relating to the Severn to Thames Transfer were subject to a Level 2 assessment:
  - The River Vyrnwy bypass, which under 180Ml/d and 205Ml/d options were assessed as 51.50% and 52.50% respectively.
  - The Deerhurst (Severn) to Culham (Thames) transfer, which was given a risk score of 49.73%.
- The SESRO SRO required the assessment of one option, which was given a risk score of 57.90% for the assets and 61.63% for the baseline transfer components. Mitigation will target the INNS risk associated with recreation. Option refinement would also result in fewer scenarios allowing focus on developing and embedding design mitigation and broader mitigation measures most likely to be feasible.
- The Culham to Speen transfer option was assessed as part of the T2ST SRO and resulted in risk scores of 35.73% for the transfer component, and 10.94% for the asset component (for both Option B and C). Potential biosecurity options identified within the SAIRAT tool should be evaluated as the option design is refined.

The greatest risks identified with the assessed options are spreading INNS through new pathways - due to the construction of new reservoirs and their associated water transfers, and the transfer of raw water. Options with a higher score represent a greater risk of transferring INNS and therefore will be a priority for mitigation – as in accordance with the EA position statement on raw water transfers, INNS should not be spread through new transfer pathways. Individual option components with the highest scores are likely to represent the greatest INNS transfer risk within an option.

### 6.1.3 LCP summary

Of the selected LCP options, 16 options were assessed as having a Very Low risk INNS risk and were not subject to a Level 2 INNS risk assessment. Four options were given a Level 2 assessment – New Medmenham Surface Water Intake - 53 Ml/d (which scored Low risk in the Level 1 assessment and 26.26% in the Level 2 assessment), Oxford Canal to Duke's Cut (SWOX) (which scored Moderate risk in the Level 1 assessment and 31.69% in the Level 2 assessment), Oxford Canal - Transfer from Duke's Cut to Farmoor (which scored High risk in the Level 1 assessment and 35.31% in the Level 2 assessment) and Abingdon to Farmoor (which scored High risk in the Level 1 assessment and 32.02% in the Level 2 assessment). Six options are components of SROs and were assessed through the Gate 2 process and the results summarised in this report.

### 6.1.4 BESP summary

Of the selected BESP options, 17 options were assessed as having a Very Low risk INNS risk and were not subject to a Level 2 INNS risk assessment. Five options were given a Level 2 assessment. These are the New Medmenham Surface Water Intake - 53 Ml/d (which scored Low risk in the Level 1 assessment and 26.26% in the Level 2 assessment), Beckton Desalination (which scored Low risk in the Level 1 assessment and 43.07% in the Level 2 assessment), Oxford Canal to Duke's Cut (SWOX), (which scored Moderate risk in the Level 1 assessment and 31.69% in the Level 2 assessment), Oxford Canal - Transfer from Duke's Cut to Farmoor (which scored High risk in the Level 1 assessment and 35.31% in the Level 2 assessment) and Abingdon Reservoir to Farmoor Reservoir pipeline (which scored High risk in the Level 1 assessment and 32.02% in the Level 2 assessment). Six options are components of SROs and were assessed through the Gate 2 process and the results summarised in this report.

### 6.1.5 BVP summary

For Situation 1 of the BVP, 19 options were assessed as having a Very Low risk INNS risk and were not subject to a Level 2 INNS risk assessment. Six options were given a Level 2 assessment. These are the New Medmenham Surface Water Intake - 53 Ml/d (which scored Low risk in the Level 1 assessment and 26.26% in the Level 2 assessment), Beckton Desalination (which scored Low risk in the Level 1 assessment and 43.07% in the Level 2 assessment), Oxford Canal to Duke's Cut (which scored Moderate risk in the Level 1 assessment and 31.69% in the Level 2 assessment), Lockwood PS to KGV Reservoir (which scored Moderate risk in the Level 1 assessment and 54.06% in the Level 2 assessment), Oxford Canal - Transfer from Duke's Cut to Farmoor (which scored High risk in the Level 1 assessment and 35.31% in the Level 2 assessment) and Abingdon Reservoir to Farmoor Reservoir pipeline (which scored High risk in the Level 1 assessment and 32.02% in the Level 2 assessment). Five options are components of SROs and were assessed through the Gate 2 process and the results summarised in this report.

For Situation 4 of the BVP, 12 options were assessed as having a Very Low risk INNS risk and were not subject to a Level 2 INNS risk assessment. Four options were given a Level 2 assessment. These are the Medmenham Intake (which scored Low risk in the Level 1 assessment and 26.26% in the Level 2 assessment), Oxford Canal to Duke's Cut (SWOX) (which scored Moderate risk in the Level 1 assessment and 31.69% in the Level 2 assessment), Oxford Canal - Transfer from Duke's Cut to Farmoor (which scored High risk in the Level 1 assessment and 35.31% in the Level 2 assessment) and Abingdon Reservoir to Farmoor Reservoir pipeline (which scored High risk in the Level 1 assessment and 32.02% in the Level 2 assessment). Five options are components of SROs and were assessed through the Gate 2 process and the results summarised in this report.

For Situation 8 of the BVP, six options were assessed as having a Very Low risk INNS risk and were not subject to a Level 2 INNS risk assessment. No options were subject to a Level 2 assessment. Four options are components of SROs and were assessed through the Gate 2 process and the results summarised in this report.

### 6.1.6 In-combination effects

#### 6.1.6.1 In-combination effects assessment results

The results of in-combination effects assessments within all plans are summarised as follows:

- LCP – Two option combinations may present a High additional risk, two option combinations may present a Medium risk and three options are likely to present a Very Low additional risk.
- BESP – Two option combinations may present a High additional risk, three may present a Medium additional risk and six are likely to present a Very Low additional risk.
- BVP Situation 1 – Two option combinations may present a High additional risk, four option combinations may present a Medium additional risk and six option combinations are likely to present Very Low additional risk.
- BVP Situation 4 – Two option combinations may present a High additional risk, two combinations may present a Medium additional risk, and three option combinations may present a Very Low additional risk.
- BVP Situation 8 – Only one option combination was progressed to Process B, and was assessed as presenting Very Low additional risk.
- Those options identified as presenting a Low, Medium or High additional risk were taken through to a further assessment stage where SAI-RAT assessments were combined, to generate a maximum component Risk Score and Overall Risk Score for each option combination.

#### 6.1.6.2 Mitigation of in-combination effects

- For the High additional risk option combinations, mitigation such as a WTW at Abingdon is being considered for the constituent individual options, and would help reduce INNS transfer risk. The SESRO SRO also sets out INNS mitigation to reduce effects at Abingdon.
- Upon further investigation it may be concluded that option combinations presenting a medium additional risk using this methodology are unlikely to significantly increase risk and therefore, additional mitigation may not be needed.
- SAI-RAT assessment of options combinations identified potential biosecurity measures to mitigate INNS transfer risk, and these will be considered in future option development and assessment work at the project level.
- Across all plans, the highest SAI-RAT Risk Scores were generated by option combinations involving the Oxford Canal, Duke's Cut, Teddington DRA, New Medmenham Surface Water Intake, Farmoor Reservoir and SESRO. The specific interaction of these options with others will be the focus of further consideration of appropriate mitigation, though in-combination risks may be sufficiently offset by mitigation of individual options.

## 6.2 Next steps

The following steps will be followed to progress the understanding of INNS risk through the option design and development process and to determine appropriate mitigation:

- INNS risk assessments will be revised as appropriate using the SAI-RAT for options which are taken forward, as more information becomes available through the design process.
- Appropriate mitigation will continue to be explored for all options which are progressed, including asset and water transfer elements. This will use the SAI-RAT biosecurity tab to identity potential biosecurity measures which may be most effective in reducing risk.
- In addition to standard mitigation practices, engagement with stakeholder and regulators such as the Canal and River Trust, the Environment Agency, and angling clubs will be considered to help to identify those measures which are most appropriate.
- Potential additional risks arising from the interaction of multiple options will continue to be considered through option design and development process, alongside appropriate mitigation. Potential interactions with other water company options should be considered as a part of regional planning.
- For options which are likely to be implemented, the INNS risk associated with the construction phase will be considered and mitigated through best practice.

# A. Assumed Values for SAI-RAT

With respect to staff visits and maintenance activities at assets, the SAI-RAT requires an estimate of frequency to be entered. The options are the same for each criterion, as follows:

- 0 – never
- 0.5 – rarely (once every 2 years)
- 1 – annually
- 1.5 – monthly
- 2 – weekly

It is likely that the frequency of such visits would vary according to asset type; therefore the 'assumed value' for each activity and asset type within the SAI-RAT is shown in Table A.1 below.

**Table A. 1: Assumed values for staff visit and maintenance activities at assets.**

| Asset type | Visit or maintenance activity | Assumed value (frequency) | Comment/rationale |
|---|---|---|---|
| Reservoir | Staff site visit (not entering water) | 2 (weekly) | Assumes visit frequency should be at least weekly |
| | Staff site visit entering or in contact with raw water | 2 (weekly) | Assumes visit frequency should be at least weekly |
| | Road vehicle site visit | 2 (weekly) | Aligned with staff visits, assuming arrival is most likely to be by road vehicle |
| | Maintenance not entering water | 1 (annually) | Assumes maintenance visits would be relatively infrequent |
| | Maintenance in water | 1 (annually) | Assumes maintenance visits within water would be relatively infrequent |
| | Transfer of waste sludge to land | 0 (never) | Sludge removal not associated with this asset type |
| | | | |
| Water treatment works | Staff site visit (not entering water) | 2 (weekly) | Assumes visit frequency should be at least weekly |
| | Staff site visit entering or in contact with raw water | 2 (weekly) | Assumes visit frequency should be at least weekly |
| | Road vehicle site visit | 2 (weekly) | Aligned with staff visits, assuming arrival is most likely to be by road vehicle |
| | Maintenance not entering water | 2 (weekly) | Assumes maintenance would need to be at least weekly |
| | Maintenance in water | 2 (weekly) | Assumes maintenance would need to be at least weekly |
| | Transfer of waste sludge to land | 1 (annually) | Sludge removal occasionally likely to be needed |
| | | | |
| Sealed water tank | Staff site visit (not entering water) | 1.5 (monthly) | Assumes visit frequency should be at least monthly |

| Asset type | Visit or maintenance activity | Assumed value (frequency) | Comment/rationale |
|---|---|---|---|
| | Staff site visit entering or in contact with raw water | 0 (never) | Sealed water tanks are likely to be used to store treated rather than raw water |
| | Road vehicle site visit | 1.5 (monthly) | Aligned with staff visits, assuming arrival is most likely to be by road vehicle |
| | Maintenance not entering water | 1.5 (monthly) | Assumes relatively frequent maintenance |
| | Maintenance in water | 0 (never) | Maintenance should not involve contact with treated water |
| | Transfer of waste sludge to land | 0 (never) | Asset type should not generate sludge |
| | | | |
| Wastewater treatment site | Staff site visit (not entering water) | 2 (weekly) | Assumes visit frequency should be at least weekly |
| | Staff site visit entering or in contact with raw water | 2 (weekly) | Assumes visit frequency should be at least weekly |
| | Road vehicle site visit | 2 (weekly) | Aligned with staff visits, assuming arrival is most likely to be by road vehicle |
| | Maintenance not entering water frequency | 2 (weekly) | Assumes maintenance would need to be at least weekly |
| | Maintenance in water frequency | 2 (weekly) | Assumes maintenance would need to be at least weekly |
| | Transfer of waste sludge to land frequency | 0.5 (rarely) | Sludge removal occasionally likely to be needed |
| | | | |
| Sewerage treatment works | Staff site visit (not entering water) frequency | 2 (weekly) | Assumes visit frequency should be at least weekly |
| | Staff site visit entering or in contact with raw water frequency | 2 (weekly) | Assumes visit frequency should be at least weekly |
| | Road vehicle site visit frequency | 2 (weekly) | Aligned with staff visits, assuming arrival is most likely to be by road vehicle |
| | Maintenance not entering water frequency | 2 (weekly) | Assumes maintenance would need to be at least weekly |
| | Maintenance in water frequency | 2 (weekly) | Assumes maintenance would need to be at least weekly |
| | Transfer of waste sludge to land frequency | 0.5 (rarely) | Sludge removal occasionally likely to be needed |

Assets also require assessment for recreational use within the SAI-RAT. In practice, four of the five asset types included (water treatment works, sealed water tank, wastewater treatment site, sewerage treatment works) are unlikely to be accessible for recreational use or by wildlife. Therefore, these asset types should be assigned a value of 0 (‘never’) for all recreational activities.

Reservoirs are frequently host to recreational activities and accessible by wildlife, though the extent of this is likely to be variable. In the potential absence of available information, the assumed values for activities relating to recreation or wildlife are shown in Table A.2 below.

**Table A. 2: Assumed values for recreational activities at assets.**

| Asset | Asset recreational or associated activity | Assumed value (frequency) | Comment/rationale |
|---|---|---|---|
| Reservoir | Angling equipment | 2 (weekly) | Angling is a relatively common activity at reservoirs. If permitted at a reservoir, likely to occur frequently |
| | Live bait | 0 (never) | Live bait is not typically allowed at reservoirs |
| | Fish stocking | 1 (annually) | Considered a typical stocking frequency |
| | Large vessels (over 28ft) | 0.5 (rarely) | Vessels of this large size are rarely likely to be brought onto a reservoir |
| | Small vessels (under 28ft) | 2 (weekly) | Boating is a relatively common activity at reservoirs. If permitted at a reservoir, likely to occur frequently |
| | Water sports equipment (Stand-up paddleboards, canoe, kayaks) | 2 (weekly) | Boating is a relatively common activity at reservoirs. If permitted at a reservoir, likely to occur frequently |
| | Water safety equipment (temporary moorings, jetties, inflatables, buoys) | 0.5 (rarely) | It is considered that such equipment is rarely brought to a reservoir |
| | Mammals/waterfowl on-site | 2 (weekly) | If a reservoir is accessible to mammals and waterfowl, they are likely to access the asset frequently |
| | Recreational walker/jogger/runner | 2 (weekly) | Relatively common activities at reservoirs. If reservoir is accessible for this purpose, likely to occur frequently |
| | | | |
| Water treatment works<br>Sealed water tank<br>Wastewater Treatment site<br>Sewerage Treatment works | Angling equipment | 0 (never) | Angling not expected at these asset types |
| | Live bait | 0 (never) | Angling not expected at these asset types |
| | Fish stocking | 0 (never) | Angling not expected at these asset types |
| | Large vessels (over 28ft) | 0 (never) | Boating not expected at these asset types |
| | Small vessels (under 28ft) | 0 (never) | Boating not expected at these asset types |
| | Water sports equipment (SUPs, Canoe, Kayaks) | 0 (never) | Water sports not expected at these asset types |
| | Water safety equipment (temporary moorings, jetties, inflatables, buoys) | 0 (never) | Associated activities not expected at these asset types |
| | Mammals/waterfowl on-site | 0 (never) | Mammals/waterfowl unlikely to access these asset types |
| | Recreational walker/jogger/runner | 0 (never) | Walking/jogging/running not expected at these asset types |

# B. SAI-RAT Input Data

## B.1 Abingdon Reservoir to Farmoor Reservoir pipeline SAI-RAT input data

The reservoir component of this option has been assessed separately in the associated SRO assessment, therefore the assessment for this option is limited to the raw water transfer component. The SAI-RAT inputs for the Abington to Farmoor raw water transfer and pumping station are presented below in Table B.1 and Table B.2. Where information was not yet available, it has been noted within the table.

**Table B.1: SAI-RAT RWT input data for Abingdon Reservoir to Farmoor Reservoir pipeline**

| Criterion | Abingdon to Farmoor pipeline | Assumptions/comments |
|---|---|---|
| Source Name | Abingdon reservoir | N/A |
| Source Management Catchment | Gloucestershire and the Vale Management Catchment | N/A |
| Source Operational Catchment | Ock | N/A |
| Source Waterbody ID | GB106039030334 | N/A |
| Source Type | Offline waterbody | Assumes receptor (Abingdon Reservoir) is offline when created |
| Number of RWT inputs into source | Unknown | Input value not known at the time of assessment |
| Pathway Type | Pipeline | N/A |
| Receptor Name | Farmoor reservoir | N/A |
| Receptor Management Catchment | Cotswold | N/A |
| Receptor Operational Catchment | Windrush | N/A |
| Receptor Waterbody ID | GB30641011 | N/A |
| Receptor Type | Offline waterbody | N/A |
| Isolated Receptor Catchment | No | N/A |
| Volume of Water | 6-50Ml/d | N/A |
| Frequency of Operation | Unknown | Input value not known at the time of assessment |
| Transfer Distance (km) | 10.1-15 | N/A |
| Washout/maintenance points outside of catchments | Unknown | Input value not known at the time of assessment |
| Details of washout/maintenance points | N/A | N/A |
| Source Navigable | Unknown | Level of public access/recreation is not yet known |
| Pathway Navigable | No | N/A |
| Angling at Source | Unknown | Level of public access/recreation is not yet known |
| Angling on Pathway | No | N/A |
| Water sports at Source | Unknown | Level of public access/recreation is not yet known |
| Water sports on Pathway | No | N/A |
| Presence of high priority INNS Source | Known to be present | INNS records up to date as of 01/08/2023 |

| Criterion | Abingdon to Farmoor pipeline | Assumptions/comments |
|---|---|---|
| Presence of high priority INNS Pathway | Known to be present | INNS records up to date as of 01/08/2023 |
| Details of INNS present | Signal crayfish (*Pacifastacus leniusculus*)<br>Himalayan balsam (*Impatiens glandulifera*)<br>Zander (*Sander lucioperca*) | WFD TAG high impact species, species on the Wildlife and Countryside act 1981<br>Schedule 9 and the European List of Concern |
| Highest order site designation Receptor | National | N/A |
| Presence of priority habitat pathway | Known to be present | Final pipeline route not yet known |
| Presence of priority habitat receptor | Not known to be present | N/A |
| Details of priority habitat present | Whytham Woods SSSI<br>Cotthill Fen SAC<br>Cotthill Fen SSSI<br>Frilford Heath, Ponds and Fens SSSI<br>Coastal and floodplain grazing marsh<br>No main habitat but additional habitats present<br>Deciduous woodland<br>Barrow Farm Fen SSSI<br>Lowland dry acid grassland<br>Good quality semi-improved grassland | N/A |
| Other existing connections between source and receptor | Unknown | Input value not known at the time of assessment |
| Details of other existing connections | N/A | N/A |

## Table B.2: SAI-RAT input data for Abingdon Reservoir to Farmoor Reservoir pipeline assets

| Criterion | Pumping station | Assumptions/ comments |
|---|---|---|
| Asset type | Pumping station | N/A |
| Asset size | Unknown | N/A |
| Existing high impact INNS records on site/area of proposed site | Known to be present | INNS records up to date as of 01/08/2023 |
| Details of high impact INNS | Zander (*Sander lucioperca*)<br>Common carp (*Cyprinus carpio*) | WFD TAG high impact species, species on the Wildlife and Countryside act 1981<br>Schedule 9 and the European List of Concern |
| Existing Priority Habitats on site | Known to be present | N/A |
| Details of priority habitats present | Coastal and floodplain grazing marsh<br>Deciduous woodland<br>No main habitat but additional habitats present<br>Traditional orchard | N/A |
| Highest order site designation of asset | None | N/A |
| Staff site visit (not entering water) frequency | 1.5 (monthly) | Assumed value |

| Criterion | Pumping station | Assumptions/ comments |
|---|---|---|
| Staff site visit entering or in contact with raw water frequency | 0 (never) | Assumed value |
| Road vehicle site visit frequency | 1.5 (monthly) | Assumed value |
| Maintenance not entering water frequency | 1.5 (monthly) | Assumed value |
| Maintenance in water frequency | 0 (never) | Assumed value |
| Angling equipment frequency | 0 (never) | Assumed value |
| Live bait frequency | 0 (never) | Assumed value |
| Fish stocking frequency | 0 (never) | Assumed value |
| Large vessels (over 28ft) frequency | 0 (never) | Assumed value |
| Small vessels (under 28ft) frequency | 0 (never) | Assumed value |
| Water sports equipment frequency | 0 (never) | Assumed value |
| Water safety equipment frequency | 0 (never) | Assumed value |
| Mammals/waterfowl on site frequency | 0 (never) | Assumed value |
| Transfer of waste sludge to land frequency | 0 (never) | Assumed value |
| Recreational walker/jogger/runner frequency | 0 (never) | Assumed value |

## B.2 Thames-Lee Tunnel extension from Lockwood PS to King George V Reservoir intake SAI-RAT input data

The PS and reservoir are existing structures and therefore have not been included within this assessment. The SAI-RAT inputs for the Thames-Lee Tunnel extension from Lockwood PS to King George V Reservoir intake are presented below in Table B.3. Where information was not yet available, it has been noted within the table.

**Table B.3: SAI-RAT input data for Thames-Lee Tunnel extension from Lockwood PS to King George V Reservoir intake tunnel**

| Criterion | Lockwood PS to River Lee Navigation | River Lee Navigation to KGV Reservoir | Assumptions/comments |
|---|---|---|---|
| Source Name | Lockwood PS | River Lee Navigation | N/A |
| Source Management Catchment | London | London | N/A |
| Source Operational Catchment | Lee Lower Rivers and Lakes | Lee Lower Rivers and Lakes | N/A |
| Source Waterbody ID | GB106038027950 | GB106038027950 | N/A |
| Source Type | Online waterbody | River | Assumed water from Lockwood PS originates from a variety of sources including treated effluent |
| Number of RWT inputs into source | Unknown | Unknown | Input value not known at the time of assessment |
| Pathway Type | Tunnel | Partial tunnel, partial pipeline | Assumed pathway through intake is pipeline |
| Receptor Name | River Lee Navigation | KGV Reservoir Intake | N/A |
| Receptor Management Catchment | London Management Catchment | London Management Catchment | N/A |
| Receptor Operational Catchment | Lee Lower Rivers and Lakes | Lee Lower Rivers and Lakes | N/A |
| Receptor Waterbody ID | GB106038027950 | GB30641523 | N/A |

| Criterion | Lockwood PS to River Lee Navigation | River Lee Navigation to KGV Reservoir | Assumptions/comments |
|---|---|---|---|
| Receptor Type | River | Online waterbody | N/A |
| Isolated Receptor Catchment | No | No | N/A |
| Volume of Water | 251Ml/d-300Ml/d | 251Ml/d-300Ml/d | N/A |
| Frequency of Operation | Unknown | Unknown | Input value not known at the time of assessment |
| Transfer Distance (km) | 5.1-10 | <1 | Input value had been measured from online conceptual maps |
| Washout/maintenance points outside of catchments | Unknown | Unknown | Input value not known at the time of assessment |
| Details of washout/maintenance points | Unknown | Unknown | N/A |
| Source Navigable | No | No | N/A |
| Pathway Navigable | No | No | N/A |
| Angling at Source | Unknown | Members and day ticket holders, no matches | Angling is present on the River Lee[11] |
| Angling on Pathway | No | No | N/A |
| Water sports at Source | No | Casual use by individuals/clubs | Water sports are present on the River Lee (source water) [12] |
| Water sports on Pathway | No | No | N/A |
| Presence of high priority INNS Source | Known to be present | Known to be present | INNS records up to date as of 01/08/2023 |
| Presence of high priority INNS Pathway | Known to be present | Known to be present | INNS records up to date as of 01/08/2023 |
| Details of INNS present | Demon shrimp (*Dikerogammarus haemobaphes*)<br>Zebra mussel (*Dreissena polymorpha*)<br>Common carp (*Cyprinus carpio*)<br>Floating pennywort (*Hydrocotyle ranunculoides*)<br>Japanese knotweed (*Fallopia japonica*)<br>Giant hogweed (*Heracleum mantegazzianum*)<br>Himalayan balsam (*Impatiens glandulifera*)<br>Canadian pondweed (*Elodea canadensis*)<br>Signal crayfish (*Pacifastacus leniusculus*) | Topmouth gudgeon (*Pseudorasbora parva*)<br>Goldfish (*Carassius auratus*)<br>Demon shrimp (*Dikerogammarus haemobaphes*)<br>Bloody red mysid (*Hemimysis anomala*)<br>Zebra mussel (*Dreissena polymorpha*)<br>Signal crayfish (*Pacifastacus leniusculus*)<br>Quagga mussel (*Dreissena bugensis*)<br>Nuttall's pondweed *(Elodea nuttallii*)<br>Himalayan balsam (*Impatiens glandulifera*) | WFD TAG high impact species, species on the Wildlife and Countryside act 1981<br>Schedule 9 and the European List of Concern |

[11] River Lea Anglers Club, 2014. About us. [online] Available at: <https://riverleaac.wixsite.com/river-lea-ac>. [Accessed 03/10/2022].

[12] LV Lee Valley, n.d. Lee Valley White Water Centre. Available at: <https://www.visitleevalley.org.uk/whitewater> [Accessed 03/10/2022]

| Criterion | Lockwood PS to River Lee Navigation | River Lee Navigation to KGV Reservoir | Assumptions/comments |
|---|---|---|---|
| | Nuttall's pondweed (*Elodea nuttallii*)<br>Topmouth gudgeon (*Pseudorasbora parva*) | | |
| Highest order site designation Receptor | International | National | N/A |
| Presence of priority habitat pathway | Known to be present | Known to be present | N/A |
| Presence of priority habitat receptor | Known to be present | Known to be present | N/A |
| Details of priority habitat present | Walthamstow Reservoirs SSSI<br>Lee Valley Ramsar<br>Deciduous woodland<br>No main habitat but additional habitats present<br>Coastal and floodplain grazing marsh<br>Chingford Reservoirs SSSI | Chingford Reservoirs SSSI<br>Deciduous woodland<br>Coastal and floodplain grazing marsh<br>No main habitat but additional habitats present | N/A |
| Other existing connections between source and receptor | Unknown | Unknown | Input value not known at the time of assessment |
| Details of other existing connections | N/A | N/A | N/A |

## B.3 Oxford Canal - Transfer from Duke's Cut to Farmoor SAI-RAT input data

The final section of this transfer, the River Thames to Farmoor Reservoir uses existing infrastructure and is therefore not included within the scope of this assessment. The SAI-RAT inputs for the Oxford Canal - Transfer from Duke's Cut to Farmoor are presented below in Table B.4 and Table B.5. Where information was not yet available, it has been noted within the table.

**Table B.4: SAI-RAT input data for Oxford Canal - Transfer from Duke's Cut to Farmoor**

| Criterion | Dukes Cut to Farmoor | Assumptions/comments |
|---|---|---|
| Source Name | Oxford Canal | N/A |
| Source Management Catchment | Thames AWB Management Catchment | N/A |
| Source Operational Catchment | Cherwell Canals and SWT Operational Catchment | N/A |
| Source Waterbody ID | GB70610542 | N/A |
| Source Type | Canal | N/A |
| Number of RWT inputs into source | Unknown | Input value not known at the time of assessment |
| Pathway Type | Pipeline | Assumed value |
| Receptor Name | River Thames | Final receptor is Farmoor Reservoir; however water is transferred from the River Thames via existing transfer therefore does not fall under the scope of this assessment |
| Receptor Management Catchment | Cotswolds Management Catchment | N/A |
| Receptor Operational Catchment | Windrush Operational Catchment | N/A |

| Criterion | Dukes Cut to Farmoor | Assumptions/comments |
|---|---|---|
| Receptor Waterbody ID | GB106039030333 | N/A |
| Receptor Type | River | N/A |
| Isolated Receptor Catchment | No | N/A |
| Volume of Water | 6-50Ml/d | N/A |
| Frequency of Operation | Unknown | Input value not known at the time of assessment |
| Transfer Distance (km) | 5.1-10 | Distance measured using web maps and is therefore an approximation |
| Washout/maintenance points outside of catchments | Unknown | Input value not known at the time of assessment |
| Details of washout/maintenance points | N/A | N/A |
| Source Navigable | Yes | Information taken from Canal and River Trust[13] |
| Pathway Navigable | No | N/A |
| Angling at Source | Members and day ticket holders, international events | Assumed most likely scenario[14] |
| Angling on Pathway | No | N/A |
| Water sports at Source | Casual use by individuals/clubs | Assumed most likely scenario [15] |
| Water sports on Pathway | No | N/A |
| Presence of high priority INNS Source | Known to be present | INNS records up to date as of 01/08/2023 |
| Presence of high priority INNS Pathway | Known to be present | INNS records up to date as of 01/08/2023 |
| Details of INNS present | Signal crayfish *(Pacifastacus leniusculus)*<br>Demon shrimp *(Dikerogammarus haemobaphes)*<br>Asian clam *(Corbicula fluminea)*<br>Zebra mussel *(Dreissena polymorpha)*<br>Quagga mussel( *Dreissena bugensis)* | WFD TAG high impact species, species on the Wildlife and Countryside act 1981<br>Schedule 9 and the European List of Concern |
| Highest order site designation Receptor | National | N/A |
| Presence of priority habitat pathway | Known to be present | Final pipeline route not yet known |
| Presence of priority habitat receptor | Known to be present | N/A |
| Details of priority habitat present | Wytham Woods SSSI<br>Oxford Meadows SAC<br>Coastal and floodplain grazing marsh<br>Lowland meadows<br>No main habitat but additional habitats present<br>Deciduous woodland<br>Good quality semi-improved grassland | N/A |

[13] Canal and Rivers Trust, n.d. Oxford Canal [online]. Available at: <https://canalrivertrust.org.uk/enjoy-the-waterways/canal-and-river-network/oxford-canal> [Accessed 21/10/22]

[14] Oxford City Council , n.d. Fishing [Online]. Available at: <https://www.oxford.gov.uk/info/20319/go_active_outdoors_-_waterways/1386/fishing#:~:text=You%20must%20hold%20a%20valid,See%20local%20signage.> [Accessed 21/10/22.]

[15] City of Oxford Rowing Club, n.d. City of Oxford Rowing Club- Homepage. Available at: <https://oxfordrowingclub.org.uk/> [Accessed 21/10/22]

| Criterion | Dukes Cut to Farmoor | Assumptions/comments |
|---|---|---|
| Other existing connections between source and receptor | Unknown | Input value not known at the time of assessment |
| Details of other existing connections | N/A | N/A |

**Table B.5: SAI-RAT input data for Oxford Canal - Transfer from Duke's Cut to Farmoor assets**

| Criterion | Intake Pumping Station | Assumptions/ comments |
|---|---|---|
| Asset type | Pumping station | N/A |
| Asset size | Unknown | Input value not known at the time of assessment |
| Existing high impact INNS records on site/area of proposed site | Not surveyed - unknown | N/A |
| Details of high impact INNS | N/A | N/A |
| Existing Priority Habitats on site | Known to be present | N/A |
| Highest order site designation of asset | International | N/A |
| Details of existing priority habitats present | Lowland meadows<br>Coastal and floodplain grazing marsh Deciduous woodland Good quality semi-improved grassland Traditional orchard Reedbeds<br>Pixey and Yarnton Meads SSSI<br>Oxford Meadows SAC | N/A |
| Staff site visit (not entering water) frequency | 1.5 (monthly) | Assumed value |
| Staff site visit entering or in contact with raw water frequency | 0 (never) | Assumed value |
| Road vehicle site visit frequency | 1.5 (monthly) | Assumed value |
| Maintenance not entering water frequency | 1.5 (monthly) | Assumed value |
| Maintenance in water frequency | 0 (never) | Assumed value |
| Angling equipment frequency | 0 (never) | Assumed value |
| Live bait frequency | 0 (never) | Assumed value |
| Fish stocking frequency | 0 (never) | Assumed value |
| Large vessels (over 28ft) frequency | 0 (never) | Assumed value |
| Small vessels (under 28ft) frequency | 0 (never) | Assumed value |
| Water sports equipment frequency | 0 (never) | Assumed value |
| Water safety equipment frequency | 0 (never) | Assumed value |
| Mammals/waterfowl on site frequency | 0 (never) | Assumed value |
| Transfer of waste sludge to land frequency | 0 (never) | Assumed value |
| Recreational walker/jogger/runner frequency | 0 (never) | Assumed value |

## B.4 Beckton Desalination SAI-RAT input data

This option consists of the construction of a new desalination plant which was assessed as an asset and a new intake pipe of saline water from the Thames Estuary. The SAI-RAT inputs for the Beckton Desalination plant are shown below in Table B.6. The intake pipeline inputs are shown in Table B.7. Where information was not yet available, it has been noted within the table.

### Table B.6: SAI-RAT input data for Beckton Desalination plant asset

| Criterion | Beckton Desalination | Assumptions/ comments |
|---|---|---|
| Asset type | Desalination plant | N/A |
| Asset size | Unknown | N/A |
| Existing high impact INNS records on site/area of proposed site | Known to be present | INNS records up to date as of 22/06/2023 |
| Details of high impact INNS | Japanese knotweed (*Fallopia japonica*)<br>Giant hogweed (*Heracleum mantegazzianum)* | WFD TAG high impact species, species on the Wildlife and Countryside act 1981<br>Schedule 9 and the European List of Concern |
| Existing Priority Habitats on site | Priority Habitat Inventory - Coastal Saltmarsh<br>Priority Habitat Inventory - Deciduous Woodland<br>Priority Habitat Inventory - Mudflats | N/A |
| Highest order site designation of asset | None | N/A |
| Staff site visit (not entering water) frequency | 2 (weekly) | Assumed value |
| Staff site visit entering or in contact with raw water frequency | 2 (weekly) | Assumed value |
| Road vehicle site visit frequency | 2 (weekly) | Assumed value |
| Maintenance not entering water frequency | 2 (weekly) | Assumed value |
| Maintenance in water frequency | 2 (weekly) | Assumed value |
| Angling equipment frequency | 0 (never) | Assumed value |
| Live bait frequency | 0 (never) | Assumed value |
| Fish stocking frequency | 0 (never) | Assumed value |
| Large vessels (over 28ft) frequency | 0 (never) | Assumed value |
| Small vessels (under 28ft) frequency | 0 (never) | Assumed value |
| Water sports equipment frequency | 0 (never) | Assumed value |
| Water safety equipment frequency | 0 (never) | Assumed value |
| Mammals/waterfowl on site frequency | 0 (never) | Assumed value |
| Transfer of waste sludge to land frequency | 1 (annually) | Assumed value |
| Recreational walker/jogger/runner frequency | 0 (never) | Assumed value |

### Table B.7: SAI-RAT input data for Beckton Desalination plant intake pipeline

| Criterion | Beckton Desalination intake | RW Lagoons to Desalinisation Plant | Assumptions/comments |
|---|---|---|---|
| Source Name | River Thames Estuary | Lagoons | N/A |
| Source Management Catchment | Thames TraC Management Catchment | Roding Beam and Ingrebourne Management Catchment | N/A |
| Source Operational Catchment | Tidal Thames Operational Catchment | Roding Beam and Ingrebourne Operational Catchment | N/A |

| Criterion | Beckton Desalination intake | RW Lagoons to Desalinisation Plant | Assumptions/comments |
|---|---|---|---|
| Source Waterbody ID | GB530603911402 | GB106037028171 | N/A |
| Source Type | River | Offline waterbody | N/A |
| Number of RWT inputs into source | Unknown | 1 | Input value not known at the time of assessment |
| Pathway Type | Pipeline | Pipeline | Assumed value |
| Receptor Name | Lagoons | Beckton Desalination | N/A |
| Receptor Management Catchment | Roding Beam and Ingrebourne Management Catchment | Thames Management Catchment | N/A |
| Receptor Operational Catchment | Roding Beam and Ingrebourne Operational Catchment | Roding Beam and Ingrebourne Management Catchment | N/A |
| Receptor Waterbody ID | GB106037028171 | No waterbodies associated with area | N/A |
| Receptor Type | Offline waterbody | Water treatment works | N/A |
| Isolated Receptor Catchment | No | No | N/A |
| Volume of Water | 151-200Ml/d | 151-200 Ml/d | N/A |
| Frequency of Operation | Year round - continuous, full flow | Year round - continuous, full flow | N/A |
| Transfer Distance (km) | 1.1-5 | <1 | Distance measured is an approximation |
| Washout/maintenance points outside of catchments | Unknown | Unknown | Input value not known at the time of assessment |
| Details of washout/maintenance points | N/A | N/A | N/A |
| Source Navigable | Yes | No | Information taken from Canal and River Trust[16] |
| Pathway Navigable | No | No | N/A |
| Angling at Source | Members and day ticket holders, no matches | No | Based on information available from local angling clubs |
| Angling on Pathway | No | No | N/A |
| Water sports at Source | Casual use by individuals/clubs | No | Based on most likely usage |
| Water sports on Pathway | No | No | N/A |
| Presence of high priority INNS Source | Known to be present | Known to be present | INNS records up to date as of 22/06/2023 |
| Presence of high priority INNS Pathway | Known to be present | Known to be present | INNS records up to date as of 22/06/2023 |
| Details of INNS present | Asian clam *(Corbicula fluminea)* | Asian clam *(Corbicula fluminea)*<br>Chinese mitten crab *(Eriocheir sinensis)* | WFD TAG high impact species, species on the Wildlife and Countryside act 1981 |

[16] Canal and Rivers Trust, n.d. Oxford Canal [online]. Available at: <https://canalrivertrust.org.uk/enjoy-the-waterways/canal-and-river-network/oxford-canal> [Accessed 21/10/22]

| Criterion | Beckton Desalination intake | RW Lagoons to Desalinisation Plant | Assumptions/comments |
|---|---|---|---|
| | Chinese mitten crab *(Eriocheir sinensis)*<br>Zebra mussel *(Dreissena polymorpha)*<br>Demon shrimp *(Dikerogammarus haemobaphes)*<br>Floating pennywort *(Hydrocotyle ranunculoides)*<br>Himalayan balsam *(Impatiens glandulifera)*<br>Common carp *(Cyprinus carpio)*<br>Canadian pondweed *(Elodea canadensis)*<br>Elodea nuttallii *(Elodea nuttallii)*<br>Japanese knotweed *(Fallopia japonica)*<br>Bloody red mysid *(Hemimysis anomala)*<br>Giant hogweed *(Heracleum mantegazzianum)*<br>Zander *(Sander lucioperca)* | Zebra mussel *(Dreissena polymorpha)*<br>Demon shrimp *(Dikerogammarus haemobaphes)*<br>Floating pennywort *(Hydrocotyle ranunculoides)*<br>Himalayan balsam *(Impatiens glandulifera)*<br>Common carp *(Cyprinus carpio)*<br>Canadian pondweed *(Elodea canadensis)*<br>Elodea nuttallii *(Elodea nuttallii)*<br>Japanese knotweed *(Fallopia japonica)*<br>Bloody red mysid *(Hemimysis anomala)*<br>Giant hogweed *(Heracleum mantegazzianum)*<br>Zander *(Sander lucioperca)* | Schedule 9 and the European List of Concern |
| Highest order site designation Receptor | None | None | N/A |
| Presence of priority habitat pathway | Known to be present | Known to be present | N/A |
| Presence of priority habitat receptor | Known to be present | Known to be present | N/A |
| Details of priority habitat present | Priority Habitat Inventory - Coastal Saltmarsh (England)<br>Priority Habitat Inventory - Deciduous Woodland (England) | Priority Habitat Inventory - Mudflats (England<br>Priority Habitat Inventory - Coastal Saltmarsh (England)<br>Priority Habitat Inventory - Reedbeds (England)<br>Priority Habitat Inventory - Deciduous Woodland (England)<br>Priority Habitat Inventory - No main habitat but additional habitat exists (England) | N/A |
| Other existing connections between source and receptor | None | None | Assumed none as desalination plant and lagoons are new |

| Criterion | Beckton Desalination intake | RW Lagoons to Desalinisation Plant | Assumptions/comments |
|---|---|---|---|
| Details of other existing connections | N/A | N/A | N/A |

## B.5 Oxford Canal - Duke's Cut (SWOX) SAI-RAT input data

This option consists of the transfer of 15Ml/d of excess water down the Oxford canal to Duke's Cut and where it supplies the Oxford Canal - Transfer from Duke's Cut to Farmoor pipeline option. The SAI-RAT inputs for the Oxford Canal to Duke's Cut option are shown below in Table B.8 and Table B.9. Where information was not yet available, it has been noted within the table. Due to the length of this transfer several inputs of this assessment have been performed at a high level.

**Table B.8: SAI-RAT input data for Oxford Canal to Duke's Cut**

| Criterion | Oxford Canal to Duke's Cut | Groundwater sources Daw End Branch | Chasewater Reservoir to Oxford Canal | Groundwater sources- Moss Farm | Groundwater sources- Batmans Hill | Groundwater sources – Perry | Assumptions/comments |
|---|---|---|---|---|---|---|---|
| Source Name | Wyrley and Essington Canal | Wolverhampton Levels | Chasewater Reservoir | Wolverhampton Levels | Wolverhampton Levels | Wolverhampton Levels | Part of Wolverhampton levels. One of several sources for this option. |
| Source Management Catchment | Humber AWB Management Catchment | Humber GW Management Catchment | Tame Anker and Mease Management Catchment | Humber GW Management Catchment | Humber GW Management Catchment | Humber GW Management Catchment | N/A |
| Source Operational Catchment | Tame Upper Canals Operational Catchment | Tame Anker Mease - Coal Measures Black Country Operational Catchment | Tame Upper Canals Operational Catchment | Staffordshire Trent Valley - Mercia Mudstone East and Coal Measures Operational Catchment | Tame Anker Mease - Coal Measures Black Country Operational Catchment | Tame Anker Mease - Coal Measures Black Country Operational Catchment | N/A |
| Source Waterbody ID | GB70410541 | GB40402G992400 | GB30436523 | GB40402G300300 | GB40402G992400 | GB40402G992400 | N/A |
| Source Type | Canal | Ground water | Online waterbody | Ground water | Ground water | Ground water | N/A |
| Number of RWT inputs into source | Unknown | None | None | None | None | None | Input value not known at the time of assessment |

| **Criterion** | **Oxford Canal to Duke's Cut** | **Groundwater sources Daw End Branch** | **Chasewater Reservoir to Oxford Canal** | **Groundwater sources-Moss Farm** | **Groundwater sources-Batmans Hill** | **Groundwater sources – Perry** | **Assumptions/comments** |
|---|---|---|---|---|---|---|---|
| Pathway Type | Canal | Canal | Canal | Canal | Canal | Canal | Assumed value |
| Receptor Name | Duke's Cut | Wyrley and Essington Canal | Oxford Canal | Oxford Canal | Oxford Canal | Oxford Canal | |
| Receptor Management Catchment | Thames AWB Management Catchment | Humber AWB Management Catchment | Tame Anker and Mease Management Catchment | Tame Anker and Mease Management Catchment | Tame Anker and Mease Management Catchment | Tame Anker and Mease Management Catchment | N/A |
| Receptor Operational Catchment | Cherwell Canals and SWT Operational Catchment | Tame Upper Canals Operational Catchment | Tame Upper Rivers Operational Catchment | Tame Upper Rivers Operational Catchment | Tame Upper Rivers Operational Catchment | Tame Lower Rivers and Lakes Operational Catchment | N/A |
| Receptor Waterbody ID | GB70610542 | GB70410541 | GB104028046990 | GB104028046990 | GB104028046930 | GB104028046842 | N/A |
| Receptor Type | Canal | Canal | Canal | Canal | Canal | Canal | N/A |
| Isolated Receptor Catchment | No | No | No | No | No | No | N/A |
| Volume of Water | 6-50Ml/d | 0-5 Ml/d | 0-5 Ml/d | 0-5 Ml/d | 0-5 Ml/d | 0-5 Ml/d | Assumed sources from Wolverhampton levels contribute equally to a total volume of 15Ml/d |
| Frequency of Operation | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Input value not known at the time of assessment |
| Transfer Distance (km) | >30 | 1.1-5 | 5.1-10 | 1.1-5 | 1.1-5 | 1.1-5 | N/A |
| Washout/maintenance points outside of catchments | Unknown | Unknown | Unknown | Unknown | Unknown | Unknown | Input value not known at the time of assessment |
| Details of washout/maintenance points | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

| Criterion | Oxford Canal to Duke's Cut | Groundwater sources Daw End Branch | Chasewater Reservoir to Oxford Canal | Groundwater sources-Moss Farm | Groundwater sources-Batmans Hill | Groundwater sources – Perry | Assumptions/comments |
|---|---|---|---|---|---|---|---|
| Source Navigable | Yes | No | No | No | No | No | Assumes source is ground water in is not in canal system before this point |
| Pathway Navigable | Yes | Yes | Yes | Yes | Yes | Yes | N/A |
| Angling at Source | Members and day ticket holders, local matches | No | Members and day ticket holders, no matches | No | No | No | N/A |
| Angling on Pathway | Members and day ticket holders, local matches | Members and day ticket holders, local matches | Members and day ticket holders, local matches | Members and day ticket holders, local matches | Members and day ticket holders, local matches | Members and day ticket holders, local matches | Assumed to be along length of Oxford Canal |
| Water sports at Source | Casual use by individuals/clubs | No | Casual use by individuals/clubs | No | No | No | Assumes source is ground water and is not in canal system before this point |
| Water sports on Pathway | Casual use by individuals/clubs | Casual use by individuals/clubs | Casual use by individuals/clubs | Casual use by individuals/clubs | Casual use by individuals/clubs | Casual use by individuals/clubs | Assumed to be along length of Oxford Canal |
| Presence of high priority INNS Source | Known to be present | Not surveyed unknown | Not surveyed unknown | Not surveyed unknown | Not surveyed unknown | Not surveyed unknown | INNS records up to date as of 22/06/2023<br>Ground water sources assumed to be free of INNS |
| Presence of high priority INNS Pathway | Not surveyed – unknown | Known to be present | Known to be present | Not recorded | Known to be present | Not recorded | INNS records up to date as of 22/06/2023<br>Main transfer not surveyed due to length. |
| Details of INNS present | Common carp *(Cyprinus carpio)*<br>Demon shrimp *(Dikerogammarus* | Demon shrimp (*Dikerogammarus haemobaphes*)<br>Zebra mussel | Zebra mussel (*Dreissena polymorpha*)<br>New Zealand pygmywe | N/A | Common carp (*Cyprinus carpio*) | N/A | WFD TAG high impact species, species on the Wildlife and Countryside act 1981<br>Schedule 9 and the |

| Criterion | Oxford Canal to Duke's Cut | Groundwater sources Daw End Branch | Chasewater Reservoir to Oxford Canal | Groundwater sources-Moss Farm | Groundwater sources-Batmans Hill | Groundwater sources – Perry | Assumptions/comments |
|---|---|---|---|---|---|---|---|
| | *haemobaphes)*<br>Zebra mussel *(Dreissena polymorpha)*<br>New Zealand pygmyweed *(Crassula helmsii)*<br>Nuttall's pondweed *(Elodea nuttallii)*<br>Japanese knotweed *(Fallopia japonica)* | (*Dreissena polymorpha*) | ed (*Crassula helmsii*)<br>Nuttall's pondweed (*Elodea nuttallii*) | | | | European List of Concern |
| Highest order site designation Receptor | International | Local | None | International | None | None | N/A |
| Presence of priority habitat pathway | Known to be present | Known to be present | Known to be present | Known to be present | Known to be present | Known to be present | N/A |
| Presence of priority habitat receptor | Known to be present | Known to be present | Known to be present | Known to be present | Known to be present | Known to be present | N/A |
| Details of priority habitat present | Pixey and Yarnton Meads SSSI<br>Oxford Meadows SAC<br>Rushy Meadows SSSI<br>Shipton-on-Cherwell & Whitehill Farm Quarries SSSI | Shire Oak Park LNR<br>Priority Habitat Inventory - Good quality semi-improved grassland (Non Priority) (England)<br>Priority Habitat Inventory - Deciduous Woodland (England) | Priority Habitat Inventory – Lowland Heathland (England)<br>Deciduous Woodland (England)<br>Priority Habitat Inventory – Lowland | Cannock Extension Cana SAC<br>Priority Habitat Inventory – Deciduous Woodland (England)<br>Priority Habitat Inventory – Good quality semi-improved grassland (Non Priority) | Priority Habitat Inventory – Deciduous Woodland (England) | Priority Habitat Inventory – Deciduous Woodland (England)<br>Priority Habitat Inventory – Coastal and Floodplain Grazing Marsh (England)<br>Priority Habitat Inventory – | N/A |

| Criterion | Oxford Canal to Duke's Cut | Groundwater sources Daw End Branch | Chasewater Reservoir to Oxford Canal | Groundwater sources-Moss Farm | Groundwater sources-Batmans Hill | Groundwater sources – Perry | Assumptions/comments |
|---|---|---|---|---|---|---|---|
| | Kirtlington Quarry SSSI<br>Bestmoor SSSI<br>Deciduous woodland<br>Reedbeds<br>Good quality semi-improved grassland<br>Coastal and floodplain grazing marsh<br>Lowland meadows<br>Traditional orchard<br>Lowland fens<br>Purple moor grass and rush pastures<br>No main habitat but additional habitats present<br>Lowland calcareous grassland | Priority Habitat Inventory - No main habitat but additional habitat exists (England)<br>Priority Habitat Inventory - Purple Moor Grass and Rush Pasture (England)<br>Priority Habitat Inventory - Lowland Fens (England)<br>Priority Habitat Inventory - Coastal and Floodplain Grazing Marsh (England) | Fens (England)<br>Priority Habitat Inventory – No main habitat but additional habitat exists (England)<br>Priority Habitat Inventory – Good quality semi-improved grassland (Non Priority) (England) | Priority Habitat Inventory – No main habitat but additional habitat exists (England)<br>Priority Habitat Inventory – Purple Moor Grass and Rush Pasture (England)<br>Priority Habitat Inventory – Lowland Fens (England)<br>Priority Habitat Inventory – Lowland Heathland (England) | | No main habitat but additional habitat exists (England) | |
| Other existing connections between source and receptor | 1 | 1 | 1 | 1 | 1 | 1 | Option infrastructure is existing |
| Details of other existing connections | Connected via Oxford Canal system | Connected via Oxford Canal system | Connected via Oxford Canal system | Connected via Oxford Canal system | Connected via Oxford Canal system | Connected via Oxford Canal system | N/A |

## Table B.9: SAI-RAT asset input data for Oxford Canal to Duke's Cut

| Criterion | Pumping station | Pumping station | Pumping station | Pumping station | Pumping station | Assumptions/ comments |
|---|---|---|---|---|---|---|
| Asset type | Pumping station | Pumping station | Pumping station | Pumping station | Pumping station | N/A |
| Asset size | Unknown | Unknown | Unknown | Unknown | Unknown | N/A |
| Existing high impact INNS records on site/area of proposed site | Not surveyed - unknown | Not surveyed - unknown | Not surveyed - unknown | Not surveyed - unknown | Not surveyed - unknown | Location of PS unknown |
| Details of high impact INNS | N/A | N/A | N/A | N/A | N/A | WFD TAG high impact species, species on the Wildlife and Countryside act 1981 Schedule 9 and the European List of Concern |
| Existing Priority Habitats on site | Not known to be present | Not known to be present | Not known to be present | Not known to be present | Not known to be present | Location of PS unknown assumed not present |
| Details of priority habitats present | N/A | N/A | N/A | N/A | N/A | N/A |
| Highest order site designation of asset | None | None | None | None | None | Location of PS unknown assumed not present |
| Staff site visit (not entering water) frequency | 1.5 (monthly) | 1.5 (monthly) | 1.5 (monthly) | 1.5 (monthly) | 1.5 (monthly) | Assumed value |
| Staff site visit entering or in contact with raw water frequency | 0 (never) | 0 (never) | 0 (never) | 0 (never) | 0 (never) | Assumed value |
| Road vehicle site visit frequency | 1.5 (monthly) | 1.5 (monthly) | 1.5 (monthly) | 1.5 (monthly) | 1.5 (monthly) | Assumed value |
| Maintenance not entering water frequency | 1.5 (monthly) | 1.5 (monthly) | 1.5 (monthly) | 1.5 (monthly) | 1.5 (monthly) | Assumed value |
| Maintenance in water frequency | 0 (never) | 0 (never) | 0 (never) | 0 (never) | 0 (never) | Assumed value |
| Angling equipment frequency | 0 (never) | 0 (never) | 0 (never) | 0 (never) | 0 (never) | Assumed value |
| Live bait frequency | 0 (never) | 0 (never) | 0 (never) | 0 (never) | 0 (never) | Assumed value |

| Criterion | Pumping station | Pumping station | Pumping station | Pumping station | Pumping station | Assumption s/ comments |
|---|---|---|---|---|---|---|
| Fish stocking frequency | 0 (never) | 0 (never) | 0 (never) | 0 (never) | 0 (never) | Assumed value |
| Large vessels (over 28ft) frequency | 0 (never) | 0 (never) | 0 (never) | 0 (never) | 0 (never) | Assumed value |
| Small vessels (under 28ft) frequency | 0 (never) | 0 (never) | 0 (never) | 0 (never) | 0 (never) | Assumed value |
| Water sports equipment frequency | 0 (never) | 0 (never) | 0 (never) | 0 (never) | 0 (never) | Assumed value |
| Water safety equipment frequency | 0 (never) | 0 (never) | 0 (never) | 0 (never) | 0 (never) | Assumed value |
| Mammals/waterfowl on site frequency | 0 (never) | 0 (never) | 0 (never) | 0 (never) | 0 (never) | Assumed value |
| Transfer of waste sludge to land frequency | 0 (never) | 0 (never) | 0 (never) | 0 (never) | 0 (never) | Assumed value |
| Recreational walker/jogger/runner frequency | 0 (never) | 0 (never) | 0 (never) | 0 (never) | 0 (never) | Assumed value |

## B.6 New Medmenham Surface Water Intake - 53 Ml/d

The SAI-RAT inputs for the New Medmenham Surface Water Intake - 53 Ml/d are presented below in Table B.10 and Table B.11. Where information was not yet available, it has been noted within the table.

**Table B.10: SAI-RAT input data for New Medmenham Surface Water Intake – 53 Ml/d**

| Criterion | Medmenham Intake | Assumptions/comments |
|---|---|---|
| Source Name | River Thames | N/A |
| Source Management Catchment | Thames and Chilterns South Management Catchment | N/A |
| Source Operational Catchment | Chilterns South Operational Catchment | N/A |
| Source Waterbody ID | GB106039023233 | N/A |
| Source Type | River | N/A |
| Number of RWT inputs into source | Unknown | Input value not known at the time of assessment |
| Pathway Type | Pipeline | N/A |
| Receptor Name | Medmenham WTW | N/A |
| Receptor Management Catchment | Thames and Chilterns South Management Catchment | N/A |
| Receptor Operational Catchment | Chilterns South Operational Catchment | N/A |
| Receptor Waterbody ID | GB106039023233 | N/A |
| Receptor Type | Water treatment works | N/A |
| Isolated Receptor Catchment | No | N/A |

| Criterion | Medmenham Intake | Assumptions/comments |
|---|---|---|
| Volume of Water | 51-100 Ml/d | N/A |
| Frequency of Operation | Unknown | Input value not known at the time of assessment |
| Transfer Distance (km) | 1.1-5.0 | N/A |
| Washout/maintenance points outside of catchments | Unknown | Input value not known at the time of assessment |
| Details of washout/maintenance points | N/A | N/A |
| Source Navigable | Yes | N/A |
| Pathway Navigable | No | N/A |
| Angling at Source | Members only, no matches | Level of public access/recreation is not known but assumed present |
| Angling on Pathway | No | N/A |
| Water sports at Source | Casual use by individuals/clubs | Level of public access/recreation is not known but assumed present |
| Water sports on Pathway | No | N/A |
| Presence of high priority INNS Source | Known to be present | N/A |
| Presence of high priority INNS Pathway | Not recorded | N/A |
| Details of INNS present | Common carp *(Cyprinus carpio)*<br>Demon shrimp *(Dikerogammarus haemobaphes)*<br>Bloody red mysid *(Hemimysis anomala)*<br>Zebra mussel *(Dreissena polymorpha)*<br>Signal crayfish *(Pacifastacus leniusculus)*<br>Nuttall's pondweed *(Elodea nuttallii)*<br>New Zealand pygmyweed *(Crassula helmsii)*<br>Floating pennywor*t (Hydrocotyle ranunculoides)*<br>Western skunk cabbage *(Lysichiton americanus)*<br>Parrots feather *(Myriophyllum aquaticum)*<br>Japanese knotweed *(Fallopia japonica)*<br>Giant knotweed *(Fallopia sachalinensis)*<br>Himalayan balsam *(Impatiens glandulifera)*<br>Chinese mitten crab *(Eriocheir sinensis)*<br>Canadian pondweed *(Elodea canadensis)* | N/A |
| Highest order site designation Receptor | None | N/A |
| Presence of priority habitat pathway | Known to be present | N/A |
| Presence of priority habitat receptor | Known to be present | N/A |
| Details of priority habitat present | Deciduous woodland | N/A |

| Criterion | Medmenham Intake | Assumptions/comments |
|---|---|---|
| | No main habitat but additional habitats present<br>Traditional orchard | |
| Other existing connections between source and receptor | None | N/A |
| Details of other existing connections | Assumed none as intake and WTW are new | N/A |

## Table B.11: SAI-RAT input data for New Medmenham Surface Water Intake – 53 Ml/d asset

| Criterion | Medmenham Intake | Assumptions/ comments |
|---|---|---|
| Asset type | Pumping station | N/A |
| Asset size | Unknown | Input value not known at the time of assessment |
| Existing high impact INNS records on site/area of proposed site | Known to be present | N/A |
| Details of high impact INNS | Demon shrimp *(Dikerogammarus haemobaphes)*<br>Zebra mussel *(Dreissena polymorpha)*<br>Nuttall's pondweed *(Elodea nuttallii)*<br>Japanese knotweed (*Fallopia japonica)*<br>Canadian pondweed *(Elodea canadensis)* | N/A |
| Existing Priority Habitats on site | Known to be present | N/A |
| Highest order site designation of asset | None | N/A |
| Staff site visit (not entering water) frequency | 1.5 (monthly) | Assumed value |
| Staff site visit entering or in contact with raw water frequency | 0 (never) | Assumed value |
| Road vehicle site visit frequency | 1.5 (monthly) | Assumed value |
| Maintenance not entering water frequency | 1.5 (monthly) | Assumed value |
| Maintenance in water frequency | 0 (never) | Assumed value |
| Angling equipment frequency | 0 (never) | Assumed value |
| Live bait frequency | 0 (never) | Assumed value |
| Fish stocking frequency | 0 (never) | Assumed value |
| Large vessels (over 28ft) frequency | 0 (never) | Assumed value |
| Small vessels (under 28ft) frequency | 0 (never) | Assumed value |
| Water sports equipment frequency | 0 (never) | Assumed value |
| Water safety equipment frequency | 0 (never) | Assumed value |
| Mammals/waterfowl on site frequency | 0 (never) | Assumed value |
| Transfer of waste sludge to land frequency | 0 (never) | Assumed value |
| Recreational walker/jogger/runner frequency | 0 (never) | Assumed value |

## B.7 River Thames to Fobney SAI-RAT input data (not selected)

This option has not been selected in the BVP or the two alternative plans, however, a Level 2 INNS assessment was undertaken as it was selected in previous versions of the plans. The WTW in this option is existing infrastructure and therefore only the new water transfer component of the option was assessed. The SAI-RAT inputs for the Thames to Fobney transfer are shown below in Table B.12 and Table B.13. Where information was not yet available, it has been noted within the table.

**Table B.12: SAI-RAT input data for River Thames to Fobney transfer**

| Criterion | River Thames to Fobney pipeline | Assumptions/comments |
|---|---|---|
| Source Name | River Thames | N/A |
| Source Management Catchment | Thames and Chilterns South Management Catchment | N/A |
| Source Operational Catchment | Chilterns South Operational Catchment | N/A |
| Source Waterbody ID | GB106039030331 | N/A |
| Source Type | River | N/A |
| Number of RWT inputs into source | Unknown | Input value not known at the time of assessment |
| Pathway Type | Pipeline | N/A |
| Receptor Name | Fobney WTW | N/A |
| Receptor Management Catchment | Kennet and Trib Management Catchment | N/A |
| Receptor Operational Catchment | Kennet Operational Catchment | N/A |
| Receptor Waterbody ID | N/A | N/A |
| Receptor Type | Water treatment facility | Assumption that water will be treated at Fobney WTW |
| Isolated Receptor Catchment | No | N/A |
| Volume of Water | 6-50Ml/d | N/A |
| Frequency of Operation | Unknown | Input value not known at the time of assessment |
| Transfer Distance (km) | 1.1-5km | N/A |
| Washout/maintenance points outside of catchments | Unknown | Input value not known at the time of assessment |
| Details of washout/maintenance points | N/A | N/A |
| Source Navigable | Yes | N/A |
| Pathway Navigable | No | N/A |
| Angling at Source | Members and day ticket holders, international matches | Information collected from Reading and District Angling Association[17] Assumed worst case scenario |
| Angling on Pathway | No | N/A |
| Water sports at Source | International events | Information collected from Reading Canoe Club[18] Assumed worst case scenario |
| Water sports on Pathway | No | N/A |

[17] Reading and District Angling Association, 2022. Match Fishing [online] Available at: <https://www.rdaa.co.uk/river-thames> [Accessed 16/09/2022]

[18] Reading Canoe Club, 2022. Reading Canoe Club [online] Available at: <http://reading-canoe.org.uk/> [Accessed 16/09/2022]

| Criterion | River Thames to Fobney pipeline | Assumptions/comments |
|---|---|---|
| Presence of high priority INNS Source | Not surveyed-unknown | High impact INNS records not found within 1km search area defined within SAI-RAT methodology, though are likely to be present within the River Thames |
| Presence of high priority INNS Pathway | Not surveyed – unknown | N/A |
| Details of INNS present | N/A | N/A |
| Highest order site designation Receptor | None | N/A |
| Presence of priority habitat pathway | Not known to be present | N/A |
| Presence of priority habitat receptor | Not known to be present | N/A |
| Details of priority habitat present | N/A | N/A |
| Other existing connections between source and receptor | Unknown | Existing connectivity between River Thames and Fobney WTW not known |
| Details of other existing connections | N/A | N/A |

### Table B.13: SAI-RAT input data for River Thames to Fobney assets

| Criterion | Pumping station | Pumping station | Assumptions/ comments |
|---|---|---|---|
| Asset type | Pumping station | Pumping station | N/A |
| Asset size | Unknown | Unknown | N/A |
| Existing high impact INNS records on site/area of proposed site | Not surveyed - unknown | Not surveyed - unknown | Location of PS unknown |
| Details of high impact INNS | N/A | N/A | WFD TAG high impact species, species on the Wildlife and Countryside act 1981<br>Schedule 9 and the European List of Concern |
| Existing Priority Habitats on site | Not known to be present | Not known to be present | Location of PS unknown assumed not present |
| Details of priority habitats present | N/A | N/A | N/A |
| Highest order site designation of asset | None | None | Location of PS unknown assumed not present |
| Staff site visit (not entering water) frequency | 1.5 (monthly) | 1.5 (monthly) | Assumed value |
| Staff site visit entering or in contact with raw water frequency | 0 (never) | 0 (never) | Assumed value |
| Road vehicle site visit frequency | 1.5 (monthly) | 1.5 (monthly) | Assumed value |
| Maintenance not entering water frequency | 1.5 (monthly) | 1.5 (monthly) | Assumed value |
| Maintenance in water frequency | 0 (never) | 0 (never) | Assumed value |
| Angling equipment frequency | 0 (never) | 0 (never) | Assumed value |
| Live bait frequency | 0 (never) | 0 (never) | Assumed value |
| Fish stocking frequency | 0 (never) | 0 (never) | Assumed value |

| Criterion | Pumping station | Pumping station | Assumptions/ comments |
|---|---|---|---|
| Large vessels (over 28ft) frequency | 0 (never) | 0 (never) | Assumed value |
| Small vessels (under 28ft) frequency | 0 (never) | 0 (never) | Assumed value |
| Water sports equipment frequency | 0 (never) | 0 (never) | Assumed value |
| Water safety equipment frequency | 0 (never) | 0 (never) | Assumed value |
| Mammals/waterfowl on site frequency | 0 (never) | 0 (never) | Assumed value |
| Transfer of waste sludge to land frequency | 0 (never) | 0 (never) | Assumed value |
| Recreational walker/jogger/runner frequency | 0 (never) | 0 (never) | Assumed value |

## B.8 London Water Recycling SRO

The Level 2 INNS assessment for Gate 2 is documented in the London Water Recycling SRO INNS Assessment Report[19]. This includes a record of the input data used in the SAI-RAT.

## B.9 Severn to Thames Transfer SRO (STT)

The Level 2 INNS assessment for Gate 2 is documented in the Severn Thames Transfer (STT) INNS Assessment Report[20]. This includes a record of the input data used in the SAI-RAT. Treated water transfers were excluded from this assessment.

## B.10 South East Strategic Reservoir Option (SESRO)

The Level 2 INNS assessment undertaken for Gate 2 is documented in the SESRO Environmental Assessment Report (Aquatic)[21]. This report describes the scenarios tested and includes the input data used in the SAI-RAT. This assessment involved testing of a large number of different scenarios of operational and recreational uses; within this report the most likely scenario risk has been reported.

## B.11 Thames to Southern Transfer SRO

The Level 2 INNS assessment for Gate 2 is documented in the Thames to Southern Transfer (T2ST) Environmental Appraisal Report[22]. This includes the input data used in the SAI-RAT. The Culham to Speen transfer input data was integrated within the main options associated with this SRO and wasn't included as an individual transfer within the assessment as this is a treated water transfer therefore poses negligible INNS risk.

[19] Thames Water, 2022. London Effluent Reuse SRO. INNS Assessment Report. Issue 0.2. Report for Thames Water Utilities Ltd.

[20] Ricardo, 2022. Severn Thames transfer (STT) Solution. INNS Assessment Report. Issue 001. Report for United Utilities on behalf of the STT Group.

[21] Thames Water and Affinity Water, n.d. South East Strategic Reservoir Option. Technical Supporting Document B1 Environmental Appraisal Report.

[22] Mott MacDonald, 2022. Thames to Southern Transfer (T2ST). Annex B1

## B.12 Thames to Affinity Transfer SRO

The Level 2 INNS assessment for Gate 2 is documented in the Thames to Affinity Transfer (T2AT) Environmental Appraisal Report – Lower Thames Reservoir option[23] and the T2AT Environmental Appraisal Report – Beckton Reuse Indirect Option[24]. This includes the input data used in the SAI-RAT.

[23] Thames Water and Affinity Water, n.d Thames to Affinity Transfer. Technical Supporting Document B1a. Environmental Appraisal Report. Lower Thames Reservoir Option

[24] Thames Water and Affinity Water, n.d. Thames to Affinity Transfer. Technical Supporting Document B1b. Environmental Appraisal Report. Beckton Reuse Indirect Option


Thames
Water