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Anglian Water Draft WRMP24 Environmental Report

Sub-Report D: Invasive Non-Native Species Risk
Assessment

November 2022

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Anglian Water Draft WRMP24 Environmental Report

**Sub-Report D: Invasive Non-Native Species Risk
Assessment**

November 2022

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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 Guidelines¹ 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, increasing security of supply in each of the water resource zones making up its supply area.

1.2 Scope of this report

As a precursor to the level 1 INNS screening assessments, high-level environmental screening assessments for the WRMP24 options were completed in October 2021. This was undertaken to highlight environmental risks and constraints at an early stage in the options development process, in accordance with UKWIR (2021) Environmental Assessment Guidance For Water Resources Management Plans And Drought Plans (ref. 21/WR/02/15). The environmental screening findings were used to inform rejection of options on the basis of avoiding potentially significant environmental effects, and to identify suitable mitigation measures to be incorporated into option development.

Once the high-level environmental screening had concluded, an INNS assessment was undertaken. The scope of the INNS assessment for the draft WRMP24 is to identify and evaluate the potential for the different options to spread invasive non-native species (INNS) – plants and animals which can spread, and cause harm to the environment and cost to the economy², such as zebra mussel (*Dreissena polymorpha*)³ and Himalayan balsam (*Impatiens glandulifera*)⁴. As described below, Strategic Resource Options (SROs) and non-SRO options are considered within this report.

The process undertaken for the INNS assessment is outlined below:

- Undertake a high-level 'Level 1 screening' of options in the WRMP constrained list (constrained list options provided in Appendix B)
- Use the results of the Level 1 screening to identify constrained options requiring a more detailed 'Level 2 assessment'
- For those options identified in the BVP and initially assessed as having a Low, Moderate, or High risk - undertake a more a detailed 'Level 2 assessment'
- Present the results of Level 2 assessments for SROs, which have been undertaken separately

¹ EA, NRW, Defra and Ofwat (2021) *Water Resources Planning Guideline*. Available at: <https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline> [Accessed 26 September 2022]

² GB Non-Native Species Secretariat (2022) *Non-native species*. [online] Available at: <[Non-native species](https://nonnativespecies.org) » NNSS (nonnativespecies.org)> [Accessed 29 September 2022].

³ GB Non-Native Species Secretariat (2016) *Zebra mussel*. [online] Available at: <[Zebra Mussel](https://nonnativespecies.org) » NNSS (nonnativespecies.org)> [Accessed 29 September 2022].

⁴ GB Non-Native Species Secretariat (2019) *Himalayan balsam*. [online] Available at: <[Himalayan Balsam](https://nonnativespecies.org) » NNSS (nonnativespecies.org)> [Accessed 29 September 2022].

Thirty BVP options are considered in this report, including 28 non-SRO options and two SROs. A Level 1 screening was undertaken in order to highlight INNS risk, and to identify options requiring a more detailed Level 2 assessment for all 28 non-SRO options. The two SROs are subject to a Level 2 assessment as part of Gate 2 of the Regulators' Alliance for Progressing Infrastructure Development (RAPID) gated assessment scheme. Level 2 INNS assessments for SROs have thus been assessed in separate studies, as documented in their respective Environmental Appraisal Reports (EARs); the headline results of which are included in this report.

2 Methodology

2.1 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. 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 Environment Agency's Position Statement on managing the risk of INNS through raw water transfers⁵. 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 risk magnitude assessment produced by this Level 1 screening relates to the nature of any pathways created by water resource options and the impacts these are likely to have. Thus, the severity of risk is greater if a transfer links previously unconnected waterbodies, or if it involves the transfer of raw fresh or saline water (rather than treated water or groundwater).

2.1.2 Frequency of Risk rating

Table 2.1 below shows the criteria for determining the Frequency of Impact rating.

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 scheme
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 Risk rating

⁵ Environment Agency (2022). Managing the Risk of Spread of Invasive Non-Native Species Through Raw Water Transfers.

Table 2.2 below shows the criteria for determining the Severity of Impact rating.

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
Low	Existing pathway between waterbodies or treated water/groundwater/effluent with no INNS risk being transferred
Medium	Change in volume of transfer between waterbodies which are already connected.
High	New pathway between waterbodies not current connected or potential to introduce new INNS not currently observed in the UK

2.1.4 Magnitude of Risk rating

Once Frequency of Impact and Severity of Impact have been determined for a WRMP option, the results are combined in the Magnitude of Risk matrix (shown in Table 2.3), in order to generate an overall Magnitude of Risk. 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			
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
High	0 = No additional risk	4 = Moderate	5 = High	6 = High

2.1.5 Progression to Level 2

All non-SRO options initially screened as having a Low, Moderate or High INNS transfer risk were progressed to a more detailed Level 2 assessment. Level 2 assessments have been undertaken for all SRO options as part of their RAPID Gate 2 submissions.

2.2 Level 2 Assessment

2.2.1 Assessment methodology

The Level 2 assessment methodology utilised the SRO Aquatic INNS Risk Assessment Tool (SAI-RAT) ("the tool") developed by APEM on behalf of the Environment Agency (EA) to

quantify the INNS risk associated with each option, 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 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.

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 INNS⁶.

The SAI-RAT requires a significant amount of information about options to be entered in order to assess the level of risk. As WRMP options are in an early stage of conceptualisation, the full range of information was not available for WRMP 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 non-SRO WRMP options. This method was adopted to find a consistent way to populate the tool for the non-SRO 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 described and detailed in Appendix A.

The proposed decision process for entering information into the tool is shown below:

1. For any given criterion, if information is available for the option, then 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, then an assumed value should be entered.

2.2.2 Increasing the utilisation of existing surface water licence at Covenham Reservoir (LNE12)

This option proposes increasing the utilisation of the existing surface water licence at Covenham Reservoir, with an expected increase in abstraction both over a long-term average and at times of dry weather. Water would be taken directly from the Louth Canal and low flows are supported by the Great Eau via the 'Covenham Reservoir Transfer Scheme'. This option would also include upgrades to assets at Covenham Water Treatment Works (WTW) and an additional storm water storage and pumping station at Louth, and both have the potential to extend the existing site.

⁶ APEM, 2021. SRO Aquatic INNS Risk Assessment Tool (SAI-RAT) – User Guide. Produced on behalf of the Environment Agency.

For the purpose of the Level 2 assessment, the option was considered to comprise the following assets: storm water storage, pumping station, and Covenham Reservoir. The SAI-RAT input data for these components are shown in Table 2.4 below.

Table 2.4: SAI-RAT input data for increasing the utilisation of existing surface water licence at Covenham Reservoir (LNE12) option asset components.

Criterion	LNE12 Storm water storage	LNE12 Pumping station	LNE12 Covenham Reservoir	Assumptions/ comments
Asset type	Storm water storage	Pumping station	Reservoir	N/A
Asset size	Unknown	Unknown	864842m ²	N/A
Existing high impact INNS records on site/area of proposed site	Known to be present	Known to be present	Known to be present	N/A
Existing Priority Habitats on site	Not known to be present	Not known to be present	Not known to be present	N/A
Highest order site designation of asset	None	None	None	N/A
Staff site visit (not entering water) frequency	1.5 (monthly)	2 (weekly)	2 (weekly)	Assumed value
Staff site visit entering or in contact with raw water frequency	0 (never)	1 (annually)	2 (weekly)	Assumed value
Road vehicle site visit frequency	1.5 (monthly)	2 (weekly)	2 (weekly)	Assumed value
Maintenance not entering water frequency	0 (never)	1.5 (monthly)	1 (annually)	Assumed value
Maintenance in water frequency	0 (never)	1 (annually)	1 (annually)	Assumed value
Angling equipment frequency	0 (never)	0 (never)	2 (weekly)	Assumed value
Live bait frequency	0 (never)	0 (never)	0 (never)	Assumed value
Fish stocking frequency	0 (never)	0 (never)	1 (annually)	Assumed value
Large vessels (over 28ft) frequency	0 (never)	0 (never)	0.5 (rarely)	Assumed value
Small vessels (under 28ft) frequency	0 (never)	0 (never)	2 (weekly)	Assumed value
Water sports equipment frequency	0 (never)	0 (never)	2 (weekly)	Assumed value
Water safety equipment frequency	0 (never)	0 (never)	0.5 (rarely)	Assumed value
Mammals/waterfowl on site frequency	0 (never)	0 (never)	2 (weekly)	Assumed value
Transfer of waste sludge to land frequency	0 (never)	0 (never)	0 (never)	Assumed value
Recreational walker/jogger/runner frequency	0 (never)	0 (never)	2 (weekly)	Assumed value

2.2.3 Extension/new reservoir at Hall – conjunctive with new treatment (LNC10)

This option proposes a replacement and expanded reservoir at Hall, conjunctive with new treatment. Following the proposed works, New Hall reservoir would increase in size and change in proposed location.

For the purpose of the Level 2 assessment, the option was considered to comprise the raw water transfer (RWT) from the River Trent to the new reservoir, as well as the reservoir and three pumping stations. Table 2.5 shows the data input for the water transfer component and Table 2.6 shows the asset input data.

Table 2.5: SAI-RAT input data for the LNC10 transfer component.

Criterion	LNC10 Trent to reservoir transfer	Assumptions/comments
Source Name	River Trent	N/A
Source Management Catchment	Trent Lower and Erewash	N/A
Source Operational Catchment	Trent and Tributaries	N/A
Source Waterbody ID	Trent from Carlton-on-Trent to Laughton Drain (GB104028058480)	N/A
Source Type	River	N/A
Number of RWT inputs into source	Unknown	Unknown value
Pathway Type	Pipeline	N/A
Receptor Name	New Hall Reservoir	N/A
Receptor Management Catchment	Witham	N/A
Receptor Operational Catchment	Witham Upper	N/A
Receptor Waterbody	New Hill Reservoir (not yet constructed)	N/A
Receptor Type	Offline waterbody	N/A
Isolated Receptor Catchment	No	N/A
Frequency of Operation	Year round - continuous, full flow	N/A
Transfer Distance (km)	1.1-5	N/A
Washout/maintenance points outside of catchments	Unknown	Unknown value
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, local matches	N/A
Angling on Pathway	No	N/A
Water sports at Source	Casual use by individuals/clubs	N/A
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	Known to be present	N/A
Details of INNS present	Water fern (<i>Azolla filiculoides</i>), Chinese mitten crab (<i>Eriocheir sinensis</i>), Himalayan balsam, Caspian mud	N/A

Criterion	LNC10 Trent to reservoir transfer	Assumptions/comments
	shrimp (<i>Chelicorophium curvispinum</i>), Asian clam (<i>Corbicula fluminea</i>), polychaete worm (<i>Hypania invalida</i>), Jenkin's spire shell (<i>Potamopyrgus antipodarum</i>), demon shrimp (<i>Dikerogammarus haemobaphes</i>), side swimmer (<i>Gammarus tigrinus</i>)	
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	<p>PATHWAY PRIORITY HABITAT</p> <p>1 area of coastal and floodplain grazing marsh 545m north.</p> <p>3 areas of lowland fen approximately 520 m east.</p> <p>8 areas of deciduous woodland, 270m south at the closest point.</p> <p>RECEPTOR PRIORITY HABITAT</p> <p>5 areas of deciduous woodland between 550m-800m south.</p> <p>0.18 hectares of traditional orchard 1km south.</p> <p>2 areas of wood pasture and parkland 750m south.</p>	N/A
Other existing connections between source and receptor	None	N/A
Details of other existing connections	None	N/A

Table 2.6: SAI-RAT input data for the LNC10 option asset components.

Criterion	LNC10 reservoir	LNC10 pumping station 1	LNC10 pumping station 2	Assumptions/ comments
Asset type	Reservoir	Pumping station	Pumping station	N/A
Asset size	Area unknown	Area unknown	Area unknown	Unknown value
Existing high impact INNS records on site/area of proposed site	Not recorded	Known to be present	Not recorded	N/A
Existing Priority Habitats on site	Known to be present	Known to be present	Known to be present	N/A
Highest order site designation of asset	None	None	None	N/A
Staff site visit (not entering water) frequency	2 (weekly)	2 (weekly)	2 (weekly)	Assumed value
Staff site visit entering or in contact with raw water frequency	2 (weekly)	1 (annually)	1 (annually)	Assumed value
Road vehicle site visit frequency	2 (weekly)	2 (weekly)	2 (weekly)	Assumed value
Maintenance not entering water frequency	1 (annually)	1.5 (monthly)	1.5 (monthly)	Assumed value
Maintenance in water frequency	1 (annually)	1 (annually)	1 (annually)	Assumed value
Angling equipment frequency	2 (weekly)	0 (never)	0 (never)	Assumed value
Live bait frequency	0 (never)	0 (never)	0 (never)	Assumed value
Fish stocking frequency	1 (annually)	0 (never)	0 (never)	Assumed value
Large vessels (over 28ft) frequency	0.5 (rarely)	0 (never)	0 (never)	Assumed value

Criterion	LNC10 reservoir	LNC10 pumping station 1	LNC10 pumping station 2	Assumptions/ comments
Small vessels (under 28ft) frequency	2 (weekly)	0 (never)	0 (never)	Assumed value
Water sports equipment frequency	2 (weekly)	0 (never)	0 (never)	Assumed value
Water safety equipment frequency	0.5	0 (never)	0 (never)	Assumed value
Mammals/waterfowl on site frequency	2 (weekly)	0 (never)	0 (never)	Assumed value
Transfer of waste sludge to land frequency	0 (never)	0 (never)	0 (never)	Assumed value
Recreational walker/jogger/runner frequency	2 (weekly)	0 (never)	0 (never)	Assumed value

2.2.4 Holland on Sea desalination (seawater) 25 MI/d (EXS10)

This option proposes to increase the supply of water through the creation of a desalination treatment plant. A pumping station would transfer raw seawater from the marine intake inland to the desalination treatment plant. Water would be treated through reverse osmosis and chlorination, then transferred to a service reservoir or a treated water pumping station to supply Great Horkesley WTW.

For the Level 2 assessment, the option was assumed to comprise a RWT from the North Sea to the treatment plant, and the treatment plant itself. Table 2.7 shows the data input for the water transfer component and Table 2.8 shows the asset input data.

Table 2.7: SAI-RAT input data for the EXS10 option transfer component.

Criterion	EXS10 North Sea to desalination plant transfer	Assumptions/comments
Source Name	Seawater (North Sea)	N/A
Source Management Catchment	N/A	N/A
Source Operational Catchment	N/A	N/A
Source Waterbody ID	N/A	N/A
Source Type	Online waterbody	N/A
Number of RWT inputs into source	Unknown	Unknown value
Pathway Type	Pipeline	N/A
Receptor Name	Great Horkesley WTW	N/A
Receptor Management Catchment	N/A	N/A
Receptor Operational Catchment	Essex Combined	N/A
Receptor Waterbody	Stour OC	N/A
Receptor Type	Water Treatment Works	N/A
Isolated Receptor Catchment	No	N/A
Volume of Water	6-50 MI/d	N/A
Frequency of Operation	Year round - continuous, variable flow	N/A
Transfer Distance (km)	25.1-30	N/A
Washout/maintenance points outside of catchments	Unknown	Unknown value
Details of washout/maintenance points	Unknown	Unknown value

Criterion	EXS10 North Sea to desalination plant transfer	Assumptions/comments
Source Navigable	Yes	N/A
Pathway Navigable	No	N/A
Angling at Source	Unknown	Unknown value
Angling on Pathway	No	N/A
Water sports at Source	Unknown	Unknown value
Water sports on Pathway	No	N/A
Presence of high priority INNS Source	Not surveyed - unknown	Data not commercially available
Presence of high priority INNS Pathway	Not surveyed - unknown	Data not commercially available
Details of INNS present	Unknown	Unknown value
Highest order site designation Receptor	National	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	Option intersects Holland Haven Marshes SSSI and Outer Thames Estuary Marine Protected Area (MPA) and Special Protection Area (SPA). Pipeline is within 500m of Ardleigh Gravel Pit Site of Special Scientific Interest (SSSI). Option intersects priority habitat including coastal and floodplain grazing marsh, deciduous woodland and good quality semi-improved grassland.	N/A
Other existing connections between source and receptor	None	No existing connections as the option is a new pipeline to Great Horkeley WTW.
Details of other existing connections	Unknown	N/A

Table 2.8: SAI-RAT input data for the EXS10 option asset component.

Criterion	Desalination plant	Assumptions/comments
Asset type	Pipeline	N/A
Asset size	Unknown	N/A
Existing high impact INNS records on site/area of proposed site	Not surveyed - unknown	Data not commercially available
Existing Priority Habitats on site	Known to be present	N/A
Highest order site designation of asset	National	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

Criterion	Desalination plant	Assumptions/comments
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

2.2.5 Mablethorpe desalination Seawater (63 MI/d) (LNE6)

This option proposes to increase the supply of water from Covenham WTW through the creation of a desalination treatment plant. A pumping station would transfer raw seawater from the marine intake inland to the desalination treatment plant. Water would be treated through reverse osmosis and chlorination, then transferred to a service reservoir or a treated water pumping station to supply Covenham WTW.

For the Level 2 assessment, the option was assumed to comprise a RWT from the North Sea to the treatment plant, and the treatment plant itself. Table 2.9Table 2.9 shows the data input for the water transfer component and Table 2.10Table 2.10 shows the asset input data.

Table 2.9: SAI-RAT input data for the LNE6 option transfer component.

Criterion	LNE6 North Sea to desalination plant transfer	Assumptions/comments
Source Name	Seawater (North Sea)	N/A
Source Management Catchment	N/A	N/A
Source Operational Catchment	N/A	N/A
Source Waterbody ID	N/A	N/A
Source Type	Online waterbody	N/A
Number of RWT inputs into source	Unknown	Unknown value
Pathway Type	Pipeline	N/A
Receptor Name	Covenham WTW	N/A
Receptor Management Catchment	Louth Grimsby and Ancholme	N/A
Receptor Operational Catchment	Becks Northern	N/A
Receptor Waterbody	GB30432209	N/A
Receptor Type	Water Treatment Works	N/A
Isolated Receptor Catchment	No	N/A
Volume of Water	51-100 MI/d	N/A
Frequency of Operation	Year round - continuous, variable flow	N/A
Transfer Distance (km)	25.1-30	N/A
Washout/maintenance points outside of catchments	Unknown	Unknown value
Details of washout/maintenance points	Unknown	Unknown value
Source Navigable	Yes	N/A

Criterion	LNE6 North Sea to desalination plant transfer	Assumptions/comments
Pathway Navigable	No	N/A
Angling at Source	Unknown	Unknown value
Angling on Pathway	No	N/A
Water sports at Source	Unknown	Unknown value
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	Known to be present	N/A
Details of INNS present	Water fern, goldfish (<i>Carassius auratus</i>), American slipper limpet (<i>Crepidula fornicata</i>), Common carp (<i>Cyprinus carpio</i>), Nuttall's pondweed (<i>Elodea nuttallii</i>), Himalayan balsam	N/A
Highest order site designation Receptor	International	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	The option intersects the Humber Estuary Ramsar Site, Greater Wash SPA, Humber Estuary SPA, Saltfleetby - Theddlethorpe Dunes Special Area of Conservation (SAC), Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC, Saltfleetby-Theddlethorpe Dunes NNR and Saltfleetby-Theddlethorpe Dunes SSSI. The proposed pipeline is within 500m of Deeping Gravel Pits SSSI and within 1km of Horbling Fen SSSI. It is also within SSSI impact risk zones. The option is also within 1km of Willoughby Branch Line LNR.	N/A
Other existing connections between source and receptor	None	No existing connections as the option is a new pipeline to Covenham WTW
Details of other existing connections	Unknown	N/A

Table 2.10: SAI-RAT input data for the LNE6 option asset component.

Criterion	LNE6 desalination plant	Assumptions/comments
Asset type	Desalination plant	N/A
Asset size	Unknown	Unknown value
Existing high impact INNS records on site/area of proposed site	Known to be present	N/A
Existing Priority Habitats on site	Known to be present	N/A
Highest order site designation of asset	International	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

Criterion	LNE6 desalination plant	Assumptions/comments
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

2.2.6 Desalination (seawater) plant in the Caister area (25 MI/d) (NTB20)

This option proposes to increase the supply of water from Mousehold WTW through the creation of a desalination treatment plant. A pumping station would transfer raw seawater from the marine intake inland to the desalination treatment plant. Water would be treated through reverse osmosis and chlorination, then transferred to a service reservoir or a treated water pumping station to supply Norwich, Norfolk and the Broads WTW.

For the Level 2 assessment, one transfer component was considered: a pipeline from the North Sea to the desalination plant, and one asset component – the desalination plant – was assessed. Table 2.11 Table 2.11 shows the data input for the water transfer component and Table 2.12 shows the asset input data.

Table 2.11: SAI-RAT input data for the NTB20 option transfer component.

Criterion	NTB20 North Sea to desalination plant transfer	Assumptions/comments
Source Name	Seawater (North Sea)	N/A
Source Management Catchment	N/A	N/A
Source Operational Catchment	N/A	N/A
Source Waterbody ID	N/A	N/A
Source Type	Seawater (North Sea)	N/A
Number of RWT inputs into source	Unknown	Unknown value
Pathway Type	Pipeline	N/A
Receptor Name	Mousehold WTW	N/A
Receptor Management Catchment	Wensum	N/A
Receptor Operational Catchment	Wensum DS Norwich	N/A
Receptor Waterbody	GB105034055882	N/A
Receptor Type	Water Treatment Works	N/A
Isolated Receptor Catchment	No	N/A
Volume of Water	6-50 MI/d	N/A

Criterion	NTB20 North Sea to desalination plant transfer	Assumptions/comments
Frequency of Operation	Year round - continuous, variable flow	N/A
Transfer Distance (km)	25.1-30	N/A
Washout/maintenance points outside of catchments	Unknown	Unknown value
Details of washout/maintenance points	Unknown	Unknown value
Source Navigable	Yes	N/A
Pathway Navigable	No	N/A
Angling at Source	Unknown	Unknown value
Angling on Pathway	No	N/A
Water sports at Source	Unknown	Unknown value
Water sports on Pathway	No	N/A
Presence of high priority INNS Source	Not surveyed - unknown	Data not commercially available
Presence of high priority INNS Pathway	Not surveyed - unknown	Data not commercially available
Details of INNS present	Not surveyed - unknown	Data not commercially available
Highest order site designation Receptor	International	N/A
Presence of priority habitat pathway	Yes	N/A
Presence of priority habitat receptor	Yes	N/A
Details of priority habitat present	The option intersects Lion Wood LNR, the Southern North Sea SAC and Greater Wash SPA. It is also within SSSI impact risk zones. Whitlingham, Whitlingham Marsh and Mousehold Heath LNRs are within 500m. Broadland Ramsar/SPA, The Broads SAC, Southern North Sea SAC, Outer Thames Estuary SPA, Great Yarmouth North Denes SPA, Greater Wash SPA, Greater Wash MPA and Southern North Sea MPA are within 2km of the site.	N/A
Other existing connections between source and receptor	None	N/A
Details of other existing connections	N/A	N/A

Table 2.12: SAI-RAT input data for the NTB20 option asset component.

Criterion	NTB20 desalination plant	Assumptions/comments
Asset type	Pipeline	N/A
Asset size	Unknown	Unknown value
Existing high impact INNS records on site/area of proposed site	Not surveyed - unknown	Data not commercially available
Existing Priority Habitats on site	Known to be present	N/A
Highest order site designation of asset	International	N/A
Staff site visit (not entering water) frequency	2 (weekly)	Assumed value

Criterion	NTB20 desalination plant	Assumptions/comments
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

2.2.7 Felixstowe desalination (seawater) 25 MI/d (SUE5)

This option proposes to increase the supply of water at Wherstead SR through the creation of a desalination treatment plant. A pumping station would transfer raw seawater from the marine intake inland to the desalination treatment plant. Water would be treated through reverse osmosis and chlorination, then transferred to a service reservoir or a treated water pumping station to supply Wherstead SR.

For the Level 2 assessment, the option was considered to comprise three transfer components: including two pipelines from the North Sea to the desalination plant and a pipeline from the desalination plant to a covered reservoir. One asset component, the desalination plant itself, was assessed. SAI-RAT input data for the RWT transfer and asset components are shown in Table 2.13 and Table 2.14 respectively.

Table 2.13: SAI-RAT input data for the SUE5 option transfer components.

Criterion	SUE5 Pipeline 1 (north from sea to desalination plant)	SUE5 Pipeline 2 (south from sea to desalination plant)	SUE5 Pipeline 3 (desalination plant to covered reservoir)	Assumptions/ comments
Source Name	Seawater (North Sea)	Seawater (North Sea)	Desalination plant	N/A
Source Management Catchment	Anglian TraC*	Anglian TraC	Suffolk East	N/A
Source Operational Catchment	Suffolk TraC	Suffolk TraC	Deben	N/A
Source Waterbody ID	Suffolk, GB650503520002	Suffolk, GB650503520002	N/A	N/A
Source Type	Online waterbody	Online waterbody	Water treatment works	N/A
Number of RWT inputs into source	Unknown	Unknown	Unknown	Unknown value

Criterion	SUE5 Pipeline 1 (north from sea to desalination plant)	SUE5 Pipeline 2 (south from sea to desalination plant)	SUE5 Pipeline 3 (desalination plant to covered reservoir)	Assumptions/ comments
Pathway Type	Pipeline	Pipeline	Pipeline	N/A
Receptor Name	Desalination plant	Desalination plant	Covered reservoir	N/A
Receptor Management Catchment	Suffolk East	Suffolk East	Suffolk East	N/A
Receptor Operational Catchment	Deben	Deben	Gipping	N/A
Receptor Waterbody	N/A	N/A	GB105035040440	N/A
Receptor Type	Water treatment works	Water treatment works	Sealed water tank	N/A
Isolated Receptor Catchment	Yes	Yes	Yes	N/A
Frequency of Operation	Year round - continuous, full flow	Year round - continuous, full flow	Year round - continuous, full flow	N/A
Transfer Distance (km)	5.1-10	1.1-5	20.1-25	N/A
Washout/maintenance points outside of catchments	Unknown	Unknown	Unknown	Unknown value
Details of washout/maintenance points	N/A	N/A	N/A	Unknown value
Source Navigable	Yes	Yes	No	N/A
Pathway Navigable	No	No	No	N/A
Angling at Source	Unknown	Unknown	No	Unknown value
Angling on Pathway	No	No	No	N/A
Water sports at Source	Local events	Local events	No	Unknown value
Water sports on Pathway	No	No	No	N/A
Presence of high priority INNS Source	Not recorded	Not recorded	Known to be present	Data not commercially available
Presence of high priority INNS Pathway	Known to be present	Known to be present	Known to be present	Data not commercially available
Details of INNS present	No INNS recorded within 1km of the intake. Most data for pathway not commercially available. Modest barnacle (<i>Austrominius modestus</i>) within 1km of pathway.	No INNS recorded within 1km of the intake. Most data for pathway not commercially available. Modest barnacle within 1km of pathway.	Data not commercially available.	Data not commercially available
Highest order site designation Receptor	International	International	International	N/A
Presence of priority habitat pathway	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	N/A

Criterion	SUE5 Pipeline 1 (north from sea to desalination plant)	SUE5 Pipeline 2 (south from sea to desalination plant)	SUE5 Pipeline 3 (desalination plant to covered reservoir)	Assumptions/ comments
Details of priority habitat present	Coastal saltmarsh, maritime cliffs and slopes, mudflats, coastal and floodplain grazing marsh, deciduous woodland, no main habitat but additional habitat exists present within 1km of the new desalination plant and pathway.	Coastal saltmarsh, maritime cliffs and slopes, mudflats, coastal and floodplain grazing marsh, deciduous woodland, no main habitat but additional habitat exists present within 1km of the new desalination plant and pathway.	Coastal saltmarsh, maritime cliffs and slopes, mudflats, coastal and floodplain grazing marsh, lowland dry acid grassland, reedbeds, ancient woodland, deciduous woodland, traditional orchards, wood pasture and parkland, no main habitat but additional habitat exists present within 1km of the pathway. Coastal and floodplain grazing marsh, reedbeds, ancient woodland, deciduous woodland and wood pasture and parkland present within 1km of the receptor.	N/A
Other existing connections between source and receptor	None	None	None	N/A
Details of other existing connections	N/A	N/A	N/A	N/A

* TraC = Transitional and Coastal

Table 2.14: SAI-RAT input data for SUE5 option asset.

Criterion	Desalination plant	Assumptions/comments
Asset type	Desalination plant	N/A
Asset size	Unknown	Unknown value
Existing high impact INNS records on site/area of proposed site	Known to be present	Data not commercially available
Existing Priority Habitats on site	Known to be present	N/A
Highest order site designation of asset	International	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

Criterion	Desalination plant	Assumptions/comments
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

2.2.8 Fens Reservoir Strategic Resource Option (FND21)

The Fens Reservoir (FR) SRO⁷ involves the transfer of raw water from the River Ouse and River Delph (Ouse Washes) to the proposed FR. The assessment is divided into two components and examines the risk associated with the transfer of water to and from the reservoir and the risk associated with the operation of assets which form part of this SRO.

The transfer sections assessed using the SAI-RAT were as follows:

- The transfer of raw water from the River Ouse
- The transfer of raw water from the River Delph (Ouse Washes)
- The transfer of raw water from the reservoir to the discharge pond
- The transfer of raw water from the reservoir to the local drain network via the spillway
- Emergency drawdown: a transfer of raw water to the Forty Foot Drain (used in emergency situations only)

The asset components were defined as:

- Inlet pumping station and water sampling building – for control of water supply to the proposed reservoir
- FR – the proposed reservoir
- Emergency drawdown pond – used to hold and slowly release water in testing of the emergency drawdown system
- Proposed FR WTW – for treatment of water abstracted from the SLR
- Potable pumping station – for pumping of water to supply network
- Outlet pumping station – for distribution of potable water to the established distribution network
- Buried service reservoir – for storage of treated water
- Discharge pond – for low level outlet

All components of this SRO were assessed using the SAI-RAT methodology, with methodology (including SAI-RAT input data) as detailed in the FR EAR⁷.

⁷ Mott MacDonald (2022). Environmental Appraisal Report (Master Plan for RAPID Gate Two). Fens Reservoir.

2.2.9 South Lincolnshire Reservoir Strategic Resource Option (RTN17)

The South Lincolnshire Reservoir (SLR) SRO⁸ involves the transfer of raw water from the River Trent to the proposed South Lincolnshire Reservoir (SLR) via the River Witham, and transfer to the WTW from the reservoir. The scheme was divided into the following transfer sections for the purposes of assessment using the raw water transfer assessment tab in the SAI-RAT:

- Transfer of raw water from the River Trent to outfall location on the River Witham
- Transfer of raw water from the River Witham to SLR
- Transfer of raw water from SLR to discharge pond
- Emergency drawdown of water from SLR to a tributary of the South Forty Foot Drain (SFFD) – intended to be used in emergency situations only
- Spillway transfer of water from overtopping of the reservoir to local drain network

The asset components were defined as:

- Inlet pumping station and water sampling building – for control of water supply to the proposed reservoir
- SLR – the proposed reservoir
- Emergency drawdown pond – used to hold and slowly release water in testing of the emergency drawdown system
- Proposed SLR WTW – for treatment of water abstracted from the SLR
- Potable pumping station – for pumping of water to supply network
- Outlet pumping station – for distribution of potable water to the established distribution network
- Buried service reservoir – for storage of treated water

All components of this SRO were assessed using the SAI-RAT methodology, with methodology (including SAI-RAT input data) as detailed in the SLR EAR⁸.

2.3 Limitations and Assumptions

2.3.1 Level 1 Screening

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 transfers⁵. 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. It is therefore assumed that construction-phase impacts will be assessed at the appropriate phase of option design, 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 transfers⁵, 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 will be subject to this more detailed risk assessment. By their nature, it is unlikely that those options initially screened as presenting No risk or Very Low risk would be affected by such local issues, as these will not involve the transfer of raw water likely to contain INNS.

⁸ Mott MacDonald (2022). Environmental Appraisal Report (Master Plan for RAPID Gate Two). South Lincolnshire Reservoir.

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

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

2.3.2 Level 2 Assessment

For the LNE12 option, the information available suggests that no significant new water transfer component was planned as part of the option and therefore this part of the assessment was not included; if more information becomes available then this component should be updated.

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

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 Appendix A) were used where 'Unknown' was not available as an option within the tool. For this purpose, it was assumed that staff visits to water treatment works, wastewater treatment sites and sewerage treatment works will be frequent. Whilst staff visits to reservoirs may still be frequent, maintenance activities are likely to be less so. Sealed water tanks are associated with the storage of treated water and therefore should not involve raw water, or human contact with water. Staff visits and maintenance activities of sealed water tanks are considered likely to be less frequent than for other assets.

The overall level of risk indicated may be subject to change as further information about options become available and more representative input data can be entered into the SAI-RAT.

These assessments are based on operational INNS transfer risk as the tool 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. It is therefore assumed that construction-phase impacts will be assessed at the appropriate phase of option design, that any construction-phase impacts will be appropriately mitigated, and that biosecurity best practice will be followed.

Cumulative effects from the combined risks of interacting options, such as from successive transfer pathways or additional asset maintenance schedules, have not been included in these assessments. It is noted however, that as options are taken forward and more information is available, that the potential for cumulative effects should be considered.

Mitigation is not being considered at this stage due to the limited information available for the non-SRO options. Mitigation for the SRO options is discussed within their respected reports.

3 Results

3.1 Level 1 screening results

Table 3.1 below summarises the results from the INNS risk screening assessment of the WRMP24 options. Of the 28 options subject to a Level 1 screening, two were classed as presenting 'No additional risk', as these involved only physical changes to infrastructure capacity. Twenty options were determined to be of Very Low risk as these involved the transfer of treated water. Three options were assessed as Low risk, as these options involved the transfer of raw water within a sealed pipeline and the residual risk was related to potential pipe bursts. One option was screened as being of Moderate risk, as it may involve an increase in the transfer of raw water. One option was screened as High risk, as this potentially involves the relocation and expansion of a reservoir.

Table 3.1: Summary of WRMP24 INNS Level 1 screening results.

Option ID	Description of Risk	Frequency	Severity	Risk Magnitude	Level 2 Assessment Required
CAM4	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
LNC25	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
EXC15	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
EXS18	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
NAY1	Transfer of potable water therefore the risk of transfer/movement of invasive non-native species is anticipated to be very low.	Regular	Very Low	1 = Very Low	No
NBR6	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 Required
NEH5	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
NHL4	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
NTB10	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
RTS21	Increase Water Treatment Works capacity (Additional Treatment and Conventional Use)	Regular	None	No additional risk	No
SUE23	Change in Water Treatment Works capacity (Treatment and Conventional Use)	Regular	None	No additional risk	No
SWC8	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
LNE12	Physical transfer of untreated water (between two locations assumed currently connected). (Assumes any transferred INNS would be treated/removed at water treatment facility).	Regular	Medium	4 = Moderate	Yes
EXS19	Very limited risk as the source water is likely to be entirely free of INNS	Regular	Very Low	1 = Very Low	No
NED2	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
NNC4	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
FND21	New potential pathway for invasive non-native species to spread	N/A	N/A	N/A	Yes - SRO

Option ID	Description of Risk	Frequency	Severity	Risk Magnitude	Level 2 Assessment Required
SUT5	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
RTC3	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
EXS10	Potential for pipe bursts cause water to be released to the environment (creating pathway for the transfer of INNS)	Regular	Low	3 = Low	Yes
LNB1	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
LNE6	Potential for pipe bursts cause water to be released to the environment (creating pathway for the transfer of INNS)	Regular	Low	3 = Low	Yes
NTB20	Potential for pipe bursts cause water to be released to the environment (creating pathway for the transfer of INNS)	Regular	Low	3 = Low	Yes
NWY2	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
RTN13	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
RTS11	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
FND16	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 Required
RTN17	New potential pathway for invasive non-native species to spread	N/A	N/A	N/A	Yes - SRO
SUE5	Potential for pipe bursts cause water to be released to the environment (creating pathway for the transfer of INNS)	Regular	Low	3 = Low	Yes
LNC10	New potential pathway for invasive non-native species to spread	Regular	High	6 = High	Yes

3.2 Level 2 assessment results

Six non-SROs required a more detailed Level 2 assessment. The results of the Level 2 assessments for the two SROs are also presented in this section.

3.2.1 Non-SRO options

The Level 2 INNS risk assessment results for the non-SRO options progressed to Level 2 are shown in Table 3.2. Displayed in the table are both the initial Level 1 screening outcomes and the Level 2 assessment results.

As detailed in Section 2, Level 1 screenings and Level 2 assessments differ in methodology and risk level scoring, and the Level 2 assessments are based on a more detailed understanding of each option. The additional details used in a Level 2 assessment may therefore mean that the more detailed assessment results in an apparent lower or higher risk than indicated by the initial screening. Furthermore, the Level 2 assessment produces a final score based on the average of its constituent RWT and asset components. Therefore, the risk score generated by individual components may be masked by this averaging; for example the relatively high risk score associated with a reservoir may be averaged with lower risk infrastructure (e.g. pipelines, sealed service reservoirs). In understanding the risk presented by an option, the risk scores of individual components should be examined alongside the overall risk score.

Table 3.2: Level 2 INNS risk assessment results for non-SROs.

Option ID	Option Name	Level 1 Risk Magnitude	Asset	Asset score	RWT component	RWT score	Overall Risk Level
LNE12	Increasing the utilisation of existing surface water licence at Covenham Reservoir	Moderate	Storm water storage	7.81%	N/A	N/A	30.49%
			Pumping station	18.57%			
			Covenham Reservoir	65.08%			
LNC10	Extension/new reservoir at Hall - conjunctive with new treatment	High	Reservoir	65.08%	Pipeline New Hall Reservoir	58.63%	42.12%
			Pumping station 1	20.97%	Pipeline Hall WTW	40.10%	
			Pumping station 2	18.57%	N/A	N/A	

Option ID	Option Name	Level 1 Risk Magnitude	Asset	Asset score	RWT component	RWT score	Overall Risk Level
EXS10	Holland on Sea desalination (seawater) 25 MI/d	Low	Desalination plant	29.81%	Pipeline	49.35%	39.58%
LNE6	Mablethorpe desalination Seawater (63 MI/d)	Low	Desalination plant	31.61%	Pipeline	54.35%	42.98%
NTB20	Desalination (seawater) plant in the Caister area (25 MI/d)	Low	Desalination plant	30.41%	Pipeline	51.35%	40.88%
SUE5	Felixstowe desalination (seawater) 25 MI/d	Low	Desalination plant	15.32%	Pipeline to desalination plant 1	58.85%	35.55%
					Pipeline to desalination plant 2	59.48%	
					Pipeline to covered reservoir	49.98%	

3.2.2 SROs

The FR SRO and SLR SRO assessment results are shown in

Table 3.3. It should be noted that these scores do not take into account any engineering interventions that may be required as mitigation to prevent the spread of INNS.

Table 3.3: Level 2 INNS risk assessment results for SROs.

Option ID	Option Name	Asset	Asset Risk Score (%)	RWT component	RWT Risk Score (%)	Overall Risk Score (%)
FR SRO	Fens Reservoir with emergency drawdown	Inlet pumping station	11.84	Ouse River to FR	50.25	34.54
		Reservoir	56.55	River Delph (Ouse Washes) to FR	44.75	
		Potable pumping station	14.24	Reservoir to discharge pond	36.00	
		Emergency drawdown pond	23.50	Emergency Drawdown (Forty Foot Drain)	49.75	
		Discharge pond to low level outlet	39.06	Spillway	47.00	
		Proposed FR WTW	15.81			
		Buried service reservoir	15.38			
		Outlet pumping station	11.84			
SLR SRO	South Lincolnshire Reservoir with emergency drawdown option 1	Buried service reservoir	7.87	River Trent to River Witham	44.63	30.11
		Emergency drawdown pond	18.21	River Witham to SLR	45.00	
		Inlet pumping station and water sampling building	14.24	SLR to discharge pond	30.50	
		Outlet pumping station	13.04	SLR to spillway	41.50	
		Potable pumping station	9.44	EDD to SFFD tributary	42.25	
		Proposed SLR WTW	16.17			
		SLR	57.09			

4 Conclusions and Recommendations

4.1 Conclusions

4.1.1 Level 1 screening

- Twenty-eight options within the WRMP24 were screened to assess the risk of spreading INNS
- Two options were classed as “No additional risk” and therefore did not require further assessment
- Twenty options were assigned a Very Low risk level and therefore did not require a Level 2 assessment
- Six options were progressed to a Level 2 assessment as they scored a risk level of Low, Moderate, or High:
 - The options SUE5, EXS10, LNE6, and NTB20 scored a risk magnitude of Low
 - LNE12 was assigned a Moderate risk level
 - LNC10 was assigned a High risk level
- The FND21 and RTN17 options were not given a Level 1 screening, however they were subject to the more detailed Level 2 Assessments as these are SROs.

4.1.2 Level 2 assessment

The following conclusions have been drawn from the results of the Level 2 detailed assessment:

- Overall risk score of the assessed options are as follows:
 - Increasing the utilisation of existing surface water licence at Covenham Reservoir (LNE12) option scored 30.49%
 - Extension/new reservoir at Hall - conjunctive with new treatment (LNC10) option scored 42.12%
 - Holland on Sea desalination (seawater) 25 MI/d (EXS10) option scored 39.58%
 - Mablethorpe desalination Seawater (63 MI/d) (LNE6) option scored 42.98%
 - Desalination (seawater) plant in the Caister area (25 MI/d) (NTB20) option scored 40.88%
 - Felixstowe desalination (seawater) 25 MI/d (SUE5) option scored 35.55%
- The FR (FND21) Overall Risk Score was 34.54%. The highest Risk Scores for transfer components were the River Great Ouse to FR transfer (50.25%), the EDD to Forty Foot Drain (49.75%), and the spillway (47.00%). The highest asset Risk Score was for the FR itself at 56.55%.
- The SLR (RTN17) Overall Risk Score was 30.11%. The highest Risk Scores for transfer components were the River Witham to SLR transfer (45.00%) and the River Trent to River Witham transfer (44.63%). The highest asset Risk Score was for the SLR itself at 57.09%.

The greatest risks identified with the assessed options are spreading INNS through new pathways - due to the creation of new reservoirs and their associated water transfers, and the transfer of raw water to desalination plants.

4.2 Recommendations

It is recommended that the INNS risk ratings are revised using the SAI-RAT for options which are taken forward as more information becomes available, including information on biosecurity measures.

Appropriate mitigation of INNS risk should be considered for all options which are progressed. Options for which a Level 2 assessment has resulted in higher percentage score risk will be of the highest priority for mitigation and therefore may not be considered appropriate if this level of risk cannot be mitigated.

For options which are likely to be implemented, the INNS risks associated with the construction phase should also be considered and mitigated through best practice measures.

It is acknowledged that cumulative effects arising from the interaction of options may arise – such as from successive water transfers or risks or increased use of assets. It is therefore advised that for options being implemented, further consideration is given on a case-by-case basis regarding the potential for cumulative effects through interaction with other options being taken forward. These updated assessments should account for both inter- and intra-regional effects.

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: Proposed 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 proposed assumed values for activities relating to recreation or wildlife are shown in Table A.2 below.

Table A. 2: Proposed 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 (Standup 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 Sealed water tank Wastewater Treatment site 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. Level 1 Assessments

Provided separately

