



Ecological Gap Analysis

The content of this document is draft and relates to material [or data] which is still in the course of completion in travel to Gate 2 and should not be relied upon at this early stage of development. We continue to develop our thinking and our approach to the issues raised in the document in preparation for Gate 2.

Tame Trent and Humber HEE

(Hydrology, Ecology and Environment)

Baseline Assessment: Data collation, literature review,
stakeholder engagement and gap analysis

Summary Report

Project reference: [REDACTED]
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Produced for Affinity Water in association with Anglian Water and Severn Trent Water

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Glossary of Terms

Abbreviation	Definition
ABP	Associated British Ports
Alevin	A newly hatched salmonid still attached to the yolk sac
Anadromous	A lifecycle where fish spawn, hatch and rear in freshwater and mature in salt water (e.g. salmon, sea trout)
AOD	Above Ordnance Datum
BAS	Biodiversity Alert Sites (Staffordshire) – equivalent of a Local Wildlife Site
BNG	Biodiversity Net Gain
CaBA	Catchment Based Approach
Catadromous	A lifecycle where fish, e.g. eels, spawn in salt water and mature in freshwater
CCI	Community Conservation Index for the assessment of nature conservation value of aquatic invertebrate species and assemblage
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
cLWS	Candidate LWS – considered the equivalent of fully designated LWS for this assessment.
CRT	Canal and Rivers Trust
Diadromous	A life history that involves migrating between marine and freshwater environments
Dissolved oxygen (DO)	The amount of oxygen dissolved in water
EA	Environment Agency
ENG	Environmental Net Gain - Improving all aspects of environmental quality through a scheme or project
Entrainment	The passage of fish through a physical screen or intake at a hydropower or pumping facility
Fecundity	The reproductive potential of an organism, measured by the number of gametes produced
Fish pass	A structure on or near an anthropogenic barrier (e.g. dam or weir) designed to facilitate fish passage upstream, often through a sequence of weirs, orifices or baffles conveying flow
Fry	Salmonid life stage when the yolk sac has almost depleted and the fish must emerge from the redd to start feeding on plankton
GIS	Geographic Information System
Glass eel	A translucent juvenile eel at the time it first enters brackish or fresh water
GUC	Grand Union Canal
Hab Regs / HDir	Habitats Regulations [The Conservation of Habitats & Species Regulations 2017 (as amended)]
Hab Regs	Habitats Regulations [The Conservation of Habitats & Species Regulations 2017 (as amended)]
HEP scheme	Hydro-Electric Power scheme
HMWB	Heavily modified water bodies
HRA	Habitats Regulations Assessment
INNS	Invasive Non-Native Species
IUCN [LC]	International Union for Conservation of Nature [Least Concern – the species classification of least conservation concern]
Kelt	A salmonid that has spawned, but before it returns to the sea
Lariniere super-active baffle fish pass	A technical fish pass design capable of passing multiple species
LBAP	Local Biodiversity Action Plan
Leptocephalus	A flat, long, small-headed transparent pelagic eel larva
LERC	Local Environmental Records Centre
LNR	Local Nature Reserve
LNRS	Local Nature Recovery Strategies
LPA	Local Planning Authority
LRC	Local (Environmental) Records Centre (or LERC)
LWS	Local Wildlife Site
MAGIC	Multi-Agency Geographic Information for the Countryside
Migration	To move from one location to another, e.g. for the purposes of spawning or feeding

MMO	Marine Management Organisation
NCA	National Character Area (as in the Trent Valley Washlands)
NERC	Natural Environment and Rural Communities (NERC) Act 2006
NFM	Natural Flood Management – Using natural processes to reduce the risk of flooding and coastal erosion
NNR	National Nature Reserve
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NRA	National Rivers Authority
NSWL	Normal Summer Water Level
NVC	National Vegetation Classification
OS	Ordnance Survey
OSPAR	Oslo/Paris convention (for the Protection of the Marine Environment of the North-East Atlantic)
Parr	A juvenile salmonid life stage that inhabits freshwater
PHABSIM	Physical Habitat Simulation System
pLWS	Potential LWS – considered the equivalent of fully designated LWS for this assessment
Potadromous	A fish that migrates and completes their life cycle entirely within freshwater
RAMSAR	Wetlands of international importance that have been designated under the criteria of the Ramsar Convention on Wetlands
Redd	A depression created in gravel habitat by the upstroke of the female salmonid's body and tail before depositing eggs during spawning
Rheophilic	Species that prefer to inhabit fast-flowing water, such as chub, dace, minnow, salmonids
RHS	River Habitat Survey
Riffle	A relatively shallow area of fast flowing, well oxygenated water typically characterised by gravels and coarse sediments
RNAG	Reason for not Achieving Good (WFD) status
RSPB	Royal Society for the Protection of Birds
S41	Section 41 (of the Natural Environment and Rural Communities (NERC) Act 2006)
SAC	Special Areas of Conservation
SAGIS	Source Apportionment GIS
Salmonid	A fish belonging to the family Salmonidae e.g. Atlantic salmon, brown trout, grayling
SBI	Sites of Biological Importance (Staffordshire) – equivalent of a Local Wildlife Site
Sch 9	Schedule 9 [of the Wildlife and Countryside Act 1981 (as amended)]
SCP	Systematic Conservation Planning
SEA	Strategic Environmental Assessment
Silver eel	An adult eel that has undergone physiological changes around the time of sexual maturity during which time the spawning migration is undertaken
SLINC	Sites of Local Importance for Nature Conservation (Birmingham) – equivalent of a Local Wildlife Site
SLR	South Lincolnshire Reservoir
Sluice	A manually operated gate used to control water levels and flow
Smolt	An anadromous salmonid life stage where juveniles adapt for the marine environment by undergoing a series of physiological and behavioural changes, including migration downstream to sea
SPA	Special Protection Areas
SPS	Sewage Pumping Station
SRO	Strategic Resource Option
SSSI	Site of Special Scientific Interest (SSSI)
STT	Severn to Thames Transfer
STW	Sewage Treatment Works (superseded by WwTW below)
SWT	Staffordshire Wildlife Trust (in the context of SWT Nature Reserve)
Tide limit	The limit of tidal influence at the mouth of a river
TraC	Transitional and Coastal (WFD water body type)
UKBAP	UK Biodiversity Action Plan
WACA	Wildlife and Countryside Act 1981 (as amended) [WACA1 – Schedule 1 of WACA; WACA5 – Schedule 5 of WACA]
Weir	A low-head dam constructed across a river to increase water levels upstream, or regulate flow

Weir pool	A pool immediately downstream of a weir created by bed scour from high velocity and turbulent flows over the weir crest
WFD	Water Framework Directive
WRMP	Water Resource Management Plan
WwTW	Wastewater Treatment Works
Yellow eel	Maturation life stage of eel in fresh or brackish water prior to sexual maturity

1 Executive Summary

- 1.1.1 AECOM has been instructed by Affinity Water (the Client), together with Severn Trent Water Ltd and Anglian Water Services Ltd, to undertake a Hydrology, Ecology and Environment (HEE) baseline assessment to improve understanding of baseline data relating to River Tame, River Trent and Humber Estuary processes, hydrology, ecology and wider river environment. This includes a gap analysis and recommendations for next steps to inform the first phase of work needed to achieve Gate 1 of RAPID's process, and subsequent impact assessment of two Strategic Resource Option (SRO) schemes: Minworth SRO; and South Lincolnshire Reservoir (SLR).
- 1.1.2 The area covered by this study is the catchment of the Rivers Tame, Trent and the Humber Estuary, from 2 km upstream of the current discharge point from Minworth Sewage Treatment Works, to 2 km downstream of the confluence of the River Trent with the Humber Estuary.
- 1.1.3 The baseline assessment has been sub-divided into 19 inter-related topics, presented as Discipline areas as follows: Regulatory, Hydrology / Geomorphology, Ecology, Aquatic Ecology, Socio-economic and Data Management Topic areas.
- 1.1.4 Notable limitations to the baseline assessment include:
- Limitations to the availability of data to support the assessment, related to the large extent of the study area, availability of data within the timescale of the study, and due in part to Covid-19 restrictions.
 - Limited opportunities for stakeholder engagement and workshops due to Covid-19 restrictions.
- 1.1.5 Key findings and recommendations of this assessment include:
- the identification of ecologically sensitive designated sites, Priority Habitats, protected/notable species, hydro-geomorphological features, WFD statuses, potentially impacted by the SRO schemes, which should form the focus of subsequent impact assessment once likely impacts are established.
 - Recommendations for further work in each topic to complete and maintain the baseline assessment, inform subsequent impact assessment, and data refresh after the validity of current data has expired.
- 1.1.6 Gate One requirements include 'Initial option-level environmental assessments that meet local requirements and comply with Strategic Environmental Assessment and Habitats Regulations Assessments requirements.' This assessment therefore contains an initial high-level consideration of potential for impacts on European sites, with a view to defining the scope of subsequent HRA as schemes are further developed.
- 1.1.7 In Section 4, Table 4, recommendations have been prioritised for completing and maintaining the baseline, and next steps for impact assessment after Gate 1, (e.g. fisheries assessments to inform impacts to fish passage, impacts to designated sites, WFD compliance assessment, etc.).
- 1.1.8 Key next steps and recommendations in Table 3 include:
- Maintain and update baseline information through the RAPID Gated process, to ensure any impact assessment is based on up to date evidence, as and when it is completed.
 - Undertake monitoring and ground-truthing surveys to inform current conditions where impacts are thought to be most likely (ecological, bathymetric, fluvial walkover and River Habitat Surveys, water quality monitoring).
 - Conduct impact assessment on features of moderate to high sensitivity (e.g. designated sites, Priority Habitats, species including fish) where they are identified as sensitive to flow changes.
 - Investigate the sensitivity of abstractions, discharges and other assets to potential flow and water quality changes.
 - Further hydraulic modelling in specific targeted areas, as informed by baseline assessment, could be considered to inform the potential impacts identified in other topics.
 - Look for opportunities to explore potential for socio-economic, environmental and biodiversity net gain benefits.

2 Introduction

2.1 Project Overview

- 2.1.1 The objective of this Hydrology, Ecology and Environment baseline assessment is to gather baseline information and undertake gap analysis on the understanding of the river ecology, environment and hydrology of the rivers Tame and Trent and the Humber Estuary.
- 2.1.2 The study relates to two Strategic Resource Option (SRO) programmes which form part of the water industry's support to the national ambition to improve the resilience of water resources against increased growth, demand and climate change¹. Both the Minworth SRO (Affinity Water and Severn Trent Water Limited (Severn Trent Water)) and the South Lincolnshire Reservoir (SLR) SRO (Affinity Water and Anglian Water Services Limited (Anglian Water) schemes are part of this study and have relationship with the Tame Trent Humber river system. These two schemes are being investigated and will be assessed via a gated process by the Regulators' Alliance for Progressing Infrastructure Development (RAPID).
- 2.1.3 The purpose of the study is to improve understanding of baseline data relating to River Tame and River Trent processes, hydrology, ecology and wider river environment.

2.2 Background

Requirements for Gate 1

- 2.2.1 The first phase of work needed to achieve Gate 1 of RAPID's process is to gather baseline information and undertake gap analysis on our understanding of the ecology, environment and hydrology of the Rivers Tame, Trent and Humber. This work will then feed further studies towards the later stages of Gate 1 and into Gate 2 should the schemes progress. The outputs of this study will be used to support the progression of these options with regards to potential changes to Severn Trent's Minworth treated effluent discharges, or additional abstraction from the River Trent to support a new Reservoir.
- 2.2.2 Gate one includes initial concept design and decision making, generating sufficient information for an initial assessment of identified strategic solutions:
- 'The solution should be developed to a standard suitable for submitting into draft regional plans or draft water resources management plans. This stage of the programme remains focused on eliminating solutions that are demonstrated to be unsuitable, no longer require further development funding or will not benefit from the structured gate process, and the identification of suitable alternative solutions'².*
- 2.2.3 Indicative Gate 1 activities from the PR19 final determinations¹ are summarised in Table 1 below. Those that are of relevance to this assessment are highlighted in bold:

Table 1: Indicative Gate 1 activities from the PR19 final determinations

Final Determination – gate one activities: Initial concept design and decision making

Preliminary solution feasibility and data collection presented in a conceptual design report, using comparable methodologies and consistent assumptions:

- Initial configuration/sub-option solution designs
- Initial costing and estimating report supported by benchmarking evidence
- Initial water resource benefit
- Initial data available and provided to regional groups to support high-level assessment of regional water resource benefit

¹ Meeting our Future Water Needs: a National Framework for Water Resources. Environment Agency 2020.

² PR19 final determinations: Strategic regional water resource solutions

Final Determination – gate one activities: Initial concept design and decision making

- Initial option-level Strategic Environmental Assessment [SEA] and Habitat Regulations Assessment [HRA] including consideration of in-combination effects and identification of environmental risks that need mitigating through the solution design and costing
- Initial environmental, social and economic valuations (or metric benefits) consistent with principles in the National Planning Statement and Water Resources Planning Guidelines

Initial outline of the solution procurement strategy

Initial considerations of planning application route (high level view of process and timelines)

Initial comparison of solutions' costs and benefits in early draft regional plans with consideration given to inter-regional supply options and systems impacts

External assurance of data and approaches supported by Board statement

Regional stakeholder engagement including customer preferences to identify any issues that need further investigation

Details of efficient spend to gate submission on gate one activities, including a breakdown of costs against activities, evidence of efficiency of spend (benchmarking or tenders) and assurance

Assessment of key risks to identify potential regulatory barriers, guidance or changes required for the solution to progress

Identify impacts of solution on current supply-demand balance delivery plan with simple comparison to current programme solutions

Identification of any changes in solution partner (other water company) or solution substitutions

Develop solution programme plan to determine the activities that need to be undertaken prior to each subsequent gate

Proposals for gate two activity and outcomes, and penalty scale, assessment criteria and contributions

Initial considerations of planning application route (high level view of process and timelines)

2.2.4 Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended) requires any competent authority (such as a statutory water company) to consider whether any project they are developing will have a likely significant effect on any internationally important wildlife sites: *Special Areas of Conservation (SAC), Special Protection Areas (SPA) and (as a matter of government policy) Ramsar sites. These are often also termed 'European sites'. This assessment is frequently termed a Habitats Regulations Assessment (HRA) and must not only consider the effects of the scheme in isolation but also any effects 'in combination' with other plans or projects.*

2.2.5 Both the Minworth and South Lincolnshire Reservoir schemes are at an early stage of development. However, the Gate One requirements include:

'Initial option-level environmental assessments that meet local requirements and comply with Strategic Environmental Assessment and Habitats Regulations Assessments requirements, including consideration of in-combination effects and identification of environmental risks that need mitigating through the solution design and costing'.

2.2.6 This report therefore contains an initial high-level consideration of potential for impacts on European sites, with a view to defining the scope of subsequent HRA as schemes are further developed.

Strategic Resource Options

South Lincolnshire Reservoir

- 2.2.7 The South Lincolnshire Reservoir Option (SLR) is a 50,000 Mm³ reservoir in South Lincolnshire being investigated jointly by Anglian Water and Affinity Water. The scheme yield will be confirmed during concept design and deployable output modelling but is thought to be up to 150 MI/d. The original concept of the South Lincolnshire Reservoir SRO was developed for WRMP19 and involved the construction of a new reservoir in South Lincolnshire which would allow Anglian Water to transfer water to Affinity Water's region via a bulk transfer. The transfer element of this original scheme has been subsequently de-coupled from the reservoir scheme and is currently being investigated as a separate SRO under the RAPID process (Anglian Water to Affinity Water Transfer).
- 2.2.8 The scheme is intended to provide a reliable water supply during a 1 in 500-year return period drought and under all climate conditions. The SLR will address future deficits identified in both companies' supply areas as well as supporting multi-sectoral aspirations in the South Lincolnshire region. To this end, Systematic Conservation Planning (SCP), an innovative approach to spatial prioritisation, is being used to assess many different elements of natural capital at the same time and develop a landscape level plan which will present a shared vision for the area in which the SLR will be built.
- 2.2.9 Optioneering studies are underway to identify a shortlist of suitable locations and sources of water that can feed the proposed reservoir. Preliminary results from the baseline hydrology study confirms that a new 300 MI/d transfer from the River Trent, in combination with the River Witham, would be the best additional source of water to maximise the yield of the SLR. Other local sources could potentially be used to support the SLR in conjunction with the Trent.
- 2.2.10 Ongoing work undertaken to support the Gate 1 submission is summarised below:
- Site selection;
 - Concept design, including multi-sector features and flood risk assessment;
 - Further hydrology, hydrogeology, ecology (including INNS) and water quality studies;
 - Planning, DCO and DPC considerations.
- 2.2.11 The indicative location of potential abstraction from the River Trent for the SLR is shown on Figure 1 in Appendix A.

Minworth SRO

- 2.2.12 Minworth Wastewater Treatment Works (WwTW) treats wastewater from the Birmingham area, with a Dry Weather Flow discharge of c.450 MI/d into the River Tame. The effluent is considered a resilient source of additional raw water to support an SRO transfer, or for both SROs simultaneously.
- 2.2.13 The original concept of the Minworth SRO was for either or both of:
- Provide 115 MI/d augmentation of the River Severn flows to allow a new abstraction at Deerpark as part of the Severn to Thames Transfer (STT) SRO - this scheme will investigate if additional treatment is required to allow discharge to the River Avon, a major tributary of the River Severn, via new pumped transfer main; or
 - Provide 50 to 100 MI/d augmentation of the Grand Union Canal flows to allow a new abstraction in Affinity Water's area as part of the Grand Union Canal (GUC) Transfer SRO - this scheme will consider if additional treatment is required to allow discharge to the canal system.
- 2.2.14 The points listed below describe ongoing works as part of the Gate 1 programme for Minworth SRO:
- Alternative discharge points to the canal, including via the Birmingham & Fazeley Canal and Grand Union Canal;
 - Additional treatment at Minworth if required;
 - Investigation if a combined pumped transfer main with separate discharge facilities to both the River Avon and the Grand Union Canal, if support to both SROs is considered feasible;
 - Optimising the design process for the separate receiving water bodies, both in terms of treatment and transfer route;

- The yield depends which scheme the water from Minworth would be utilised for, or indeed if it would be used for both schemes. The Grand Union Canal transfer is investigating input from 50 to 100 MI/d, while the Severn to Thames Transfer is investigating a 115MI/d discharge into the River Avon; and/or
 - The option of supplying both schemes is also being considered.
- 2.2.15 The exact transfer routes to the discharge points for both GUC / STT or a combined benefit option are currently being investigated and will be the subject of an agreed screening methodology. An initial six options for GUC were screened down to three discharge locations, and this will progress further post-Gate 1.

In-combination Effects

- 2.2.16 The maximum flow reduction that might be caused by the SROs is 515 MI/d (Minworth 215 MI/d [GUC 100 MI/d and STT 115 MI/d] plus SLR 300 MI/d).
- 2.2.17 The maximum flow that would be diverted from Minworth is 215MI/d, and the maximum amount abstracted for SLR would be 300MI/d. SLR would refill in high flow winter conditions for storage until summer peak demand, whereas the GUC and STT are more likely to be reactive. Therefore, it is extremely unlikely that the 215 MI/d and 300 MI/d would be used at the same time and the maximum stated above would be reached.

Drivers for Assessment

- 2.2.18 Drivers for this literature review and gap analysis are:
- Policies may need updating to drive efficiency and make best use of water resources. Changing climate and socio-economic demands are putting additional focus on current and future water supply options.
 - The need for the amount of water available in the River Trent to be managed effectively, to reduce the risk of serious environmental consequences.
 - The potential transfers will have environmental and socio-economic impacts and opportunities which must be understood. Decisions must be able to withstand reasonable scrutiny.
 - Understanding of potential in-combination impacts on protected sites and supporting habitats for migratory species need to be understood in more detail. Current monitoring programmes need to be assessed for evidence gaps and cross referenced with the proposed transfer schemes to ensure they are fit for all purposes.
 - Policy and legislation in England are pushing water companies to integrate regional plans but also to deliver net environmental gain. Understanding these opportunities and constraints will help shape potential transfers.
 - Insufficient evidence has resulted in regulators taking a precautionary approach when reviewing scheme-specific risk assessments. Improved evidence will enable regulators to form more definitive opinions and schemes to progress to delivery with greater confidence.
 - The argument to justify change must be equally as robust as the argument for no change. Either way, the best possible evidence and data must underpin the decision-making process.

2.3 Study Area

- 2.3.1 The area covered by this study is the catchment of the Rivers Tame, Trent and the Humber Estuary, from 2 km upstream of the current discharge point (SP 16[REDACTED] 91[REDACTED] from Minworth Wastewater Treatment Works (WwTW), to 2 km downstream of the of the confluence (SE 86[REDACTED] 23[REDACTED]) of the River Trent with the Humber Estuary. This study area therefore extends from approximate grid reference SP 14[REDACTED] 90[REDACTED] upstream of Minworth WwTW, to grid reference SE 88[REDACTED] 24[REDACTED] downstream on the Humber Estuary.
- 2.3.2 The study area is shown on Figure 1 in Appendix A.

2.4 Scope of the Study

- 2.4.1 The scope of this project is a desktop exercise to collate existing data, review literature and engage with key stakeholder organisations involved along this stretch of the River Tame, River Trent and the Humber Estuary.
- 2.4.2 The literature review, data review and gap analysis cover the study area described above, plus any associated upstream impacts. The objective is to provide answers to the questions below covering hydrology, ecology and environmental impacts which may arise as a result of changes to flow regime, water chemistry, abstractions and discharges to the system. The study also identifies where there are gaps in knowledge and makes clear recommendations for further desk study, field investigations or monitoring.
- 2.4.3 The study is broken down into 19 topics, summarised below and described in detail in each accompanying Topic report (refer to Table 2):
1. Topic 1: What are the flows and levels that are required for navigation on the fluvial and tidal Trent.
 2. Topic 2: Identification of the relationship between Protected Sites and supporting habitats for migratory species (may also be recorded as “features” of protected sites e.g. fish assemblage). Life cycle analysis and supportive food chains are key components.
 3. Topic 3: Identify if there any protected species / features / sites, priority habitats and SSSIs/ SACs and SPAs along the route potentially affected by changes to Minworth flows and new abstraction for the South Lincs Reservoir. Identify any existing Management Plans e.g. Water Level Management Plans for SSSIs.
 4. Topic 4: Update current understanding of site-specific ecological flow requirements.
 5. Topic 5: Provide a summary of existing understanding of river flows and levels on geomorphology and sedimentation. Identification of relationships between habitats and geomorphology features present.
 6. Topic 6: Investigate the current/baseline hydraulic geometry for habitat quantity.
 7. Topic 7: Document baseline available habitat and ecological sensitivities.
 8. Topic 8: Review of assets along the River Trent to confirm ownership and specification.
 9. Topic 9: Confirm existing licensed abstractions, (including licensed hydropower abstraction) and discharges along the river.
 10. Topic 10: Investigate the extent of saline intrusion along the tidal Trent.
 11. Topic 11: Confirm existing WFD status and reasons for not achieving good status for all relevant water bodies (and for each element within the waterbodies) along the River Tame, Trent and Humber Estuary.
 12. Topic 12: Investigate the importance of weir pool habitats for fish.
 13. Topic 13: Identify known barriers to fish migration and current proposals for providing fish passage at these barriers through the plans of the Trent Gateway project.
 14. Topic 14: Summarise the findings of existing INNS studies along the Trent and tributaries and mitigation techniques available in the UK and Europe.
 15. Topic 15: Benchmark studies which sought to define the socio-economic benefits from habitats and species associated with main river system of the Trent.
 16. Topic 16: Identify any literature which identifies habitat improvement/ creation to increase biodiversity gain in the Trent catchment as well as flood risk and catchment management issues and opportunities from the regional growth agenda.
 17. Topic 17: Identification of wetland habitats and avian species supported with hydrological connection to groundwater and main rivers.
 18. Topic 18: Identification of studies that reviewed humidity and soil moisture levels at SSSI and linkage to river flow or groundwater regimes.

19. Topic 19: Identification and collation of existing core datasets and recommendations for future data gathering where necessary.

2.4.4 Based on the interdependencies between topics and the requirement of some key topics as predecessors, topics have been broken down into disciplines as shown in Table 2 below, with predecessor topics shown in Figure 2. Topic numbers are retained from the initial project brief for ease of reference.

Table 2: Topic disciplines

Discipline	Topics
Regulatory	Topic 8: Assets along the Trent
	Topic 9: Abstractions and Discharges
	Topic 11: WFD Non-compliance
Hydrology / Geomorphology	Topic 1: Navigation
	Topic 5: Sedimentation
	Topic 6: Wetted Perimeters
	Topic 10: Saline Intrusion
	Topic 18: Soil Moisture
Ecology: Designated sites, habitats and protected / notable species	Topic 3: Ecological Desk Study
	Topic 7: Ecological Sensitivities
	Topic 14: Invasive Species
	Topic 17: Wetlands and Avian Species
Aquatic Ecology	Topic 2: Migratory Species
	Topic 4: Ecological Flow Requirements
	Topic 12: Weir Pool Habitats
	Topic 13: Barriers to Fish Passage
Socio-economic	Topic 15: Socio-economic benefits
	Topic 16: Environmental Net Gain
Data Management	Topic 19: Data Management

Topic Interdependencies

2.4.5 There is overlap between topics, with some topics acting as predecessors and providing data to subsequent chapters, and others reliant on the baseline assessments in other topics to establish interdependencies. These interdependencies are described in further detail in the individual topic chapters and are illustrated in the topic interdependencies and predecessors flow chart in Figure 2.

2.4.6 Notable predecessor topics include:

- Topic 3 *Ecological Desk Study*, which provides baseline ecological data which then informs the baseline assessment in Topics 2, 7, 12, 13, 14 and 17, and others.
- Topic 6 *Wetted Perimeters*, which provided hydrological modelling data to inform multiple other topics.

- Topic 8 *Assets Along the Trent*, which provides details of the location, specification and ownership of assets to inform several other topics – refer to Figure 2.
- Topic 19 *Data Management*, which collates data from all other topics, and presents key data on the web GIS system.

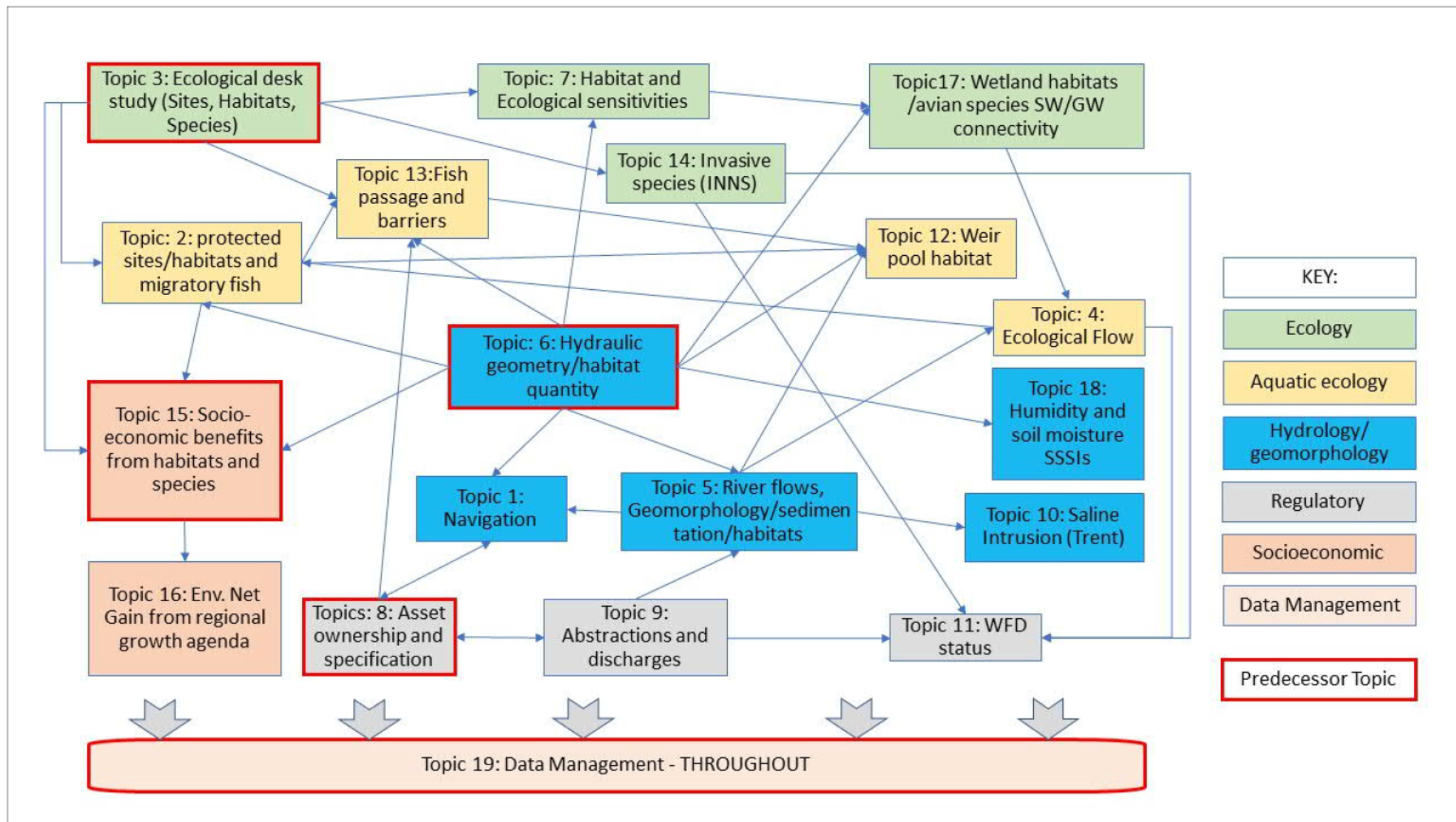


Figure 2: Topic interdependencies and predecessor topics

2.5 Approach

2.5.1 The approach followed by AECOM incorporates the following:

- A GIS layer data base for presentation of data and sites (e.g. SPAs etc);
- A repeatable analysis procedure for each Topic area (literature and data);
- Grouping of topics to be managed and delivered by area experts;
- A standard format of analysis – using reporting templates; and
- A clear and concise evidential presentation of the gap analysis.

Gap Analysis and Literature Review Methodology

2.5.2 The methodology used in this project consisted of a technical team led by a Topic Lead for each discipline area (refer to Table 2). This methodology was based on providing a model answer to the topic question by the expert lead, which was then answered from the collated information and data. An initial gap analysis was completed for each topic, which was then revisited with a further literature search. The literature search involved contacting statutory and local bodies, scientific literature databases, and using search engines such as Scopus and Science Direct. Data sources are listed in each individual topic report.

2.5.3 Finally, data analysis was conducted to review the quality, age and reliability of data that has been identified for inclusion. This information was recorded on a topic template that formed the foundation for each individual topic report.

2.5.4 To ensure a consistent and integrated approach, all completed gap analyses and topic reports were reviewed by an internal verification group to ensure that all aspects of topics have been addressed, and that interdependencies between different and related topics have been identified and recorded. This ensured that duplication in gap analysis and recommendations for further work has been avoided. The internal review steering group has involved personnel that have not been involved in the gap analysis.

2.5.5 Our approach has not just used the data provided by the client but also other available data. Given the wide range of topics this is a sizeable task and some data has been purchased, for example from Local Environmental or Ecological Records Centres.

Visual information data base (GIS layer data base)

2.5.6 Baseline information has been compiled both in a data collation database and in a spatial graphical format (GIS). This platform contains:

- Locations of ecological protected sites within the defined study area;
- Locations of investigations (referenced by primary objective e.g. ecology, water quality);
- Assets cross-referenced to the Topic 8 asset database, and other topics;
- Baseline information for each report or reason for the inclusion (e.g. Year, title, and key words for each report); and
- Any topic-specific spatial data that is possible to map according to data licence conditions (as presented in Topic 19).

2.5.7 Open source data has also been incorporated to show for instance: rivers, lakes, ponds, Ordnance Survey mapping, Priority Habitats, local Government and regulatory boundaries etc.

2.6 Baseline Information

2.6.1 Baseline information has been sought for each topic, as detailed in each Topic report. Each report also details data gaps, limitations and assumptions, and makes recommendations for further work where these are considered a limitation to the assessment.

2.6.2 Available baseline information includes previous environmental risk assessments, ecological records for designated sites, habitats and species, historic reports and water company water resource management

plans. Existing environmental data includes data from the Environment Agency (EA), Natural England (NE) and Water Companies, stakeholders and local interest groups, amongst other sources.

2.7 Deliverables

- 2.7.1 This summary report and the accompanying topic appendices set out how the literature review and baseline information for each topic, including any data gaps/ recommendations, links to the consistent methodology (including the SEA framework) currently being developed for the environmental assessment of SROs. This will help to demonstrate to regulators and stakeholders that the evidence gathering stage is effectively informing the strategic level assessments (SEA, HRA, Water Framework Directive (WFD) assessment, Natural Capital / socio-economic assessment and Biodiversity Net Gain (BNG) assessment).
- 2.7.2 These reports critically evaluate the information gathered and identify gaps in knowledge, reviewing areas of uncertainty or conflicting opinion, and form the basis for further environmental investigation and impact assessment, including recommendations for the next stages (Gate 2) of the assessment process.
- 2.7.3 Maps and datasets are collated and organised in a way, according to Topic 19, that can provide a common reference document for future use by the strategic resource option project teams, regional water resource planning groups and regulators.
- 2.7.4 A view has been taken with regards to SEA, HRA and WFD, as well as other statutory requirements as these options will ultimately be fed into company WRMPs. This information is provided in Section 3 of this report.

2.8 Significant Limitations

Overall Limitations

- 2.8.1 The following limitations to individual topics and the overall assessment are noted, and these have informed recommendations for next steps; see Section 4 and Table 4.
- 2.8.2 A 'data freeze' date of 14 December 2020 was agreed for the purpose of this assessment, after which the feasibility of including further data or information was assessed on a topic basis. Where information was received after this date it has been included in the relevant topic assessment where feasible in the timescale of the study; otherwise appropriate recommendations have been made.
- 2.8.3 Baseline data collection from a variety of organisations including regulators, companies and NGOs has been completed during the SARS-CoV-2 (Covid-19) pandemic. This is likely to have impacted on the availability of some data sources due to working restrictions and extended timescales. There will be a dominance on the reliability of electronically accessible data, but more limited access to and hence availability of non-digitised 'grey' literature and paper data held in local offices.
- 2.8.4 Due to Covid-19 restrictions and the timescale of the study, some available data remains outstanding. This has formed the basis of recommendations where it is considered that at a later date it can be incorporated into the Gate 1 or subsequent assessments. It is possible that relevant data and reports are available, which have not been discovered by this preliminary review of literature and data.
- 2.8.5 Stakeholder consultation meetings/workshops are beneficial to discuss evidence requirements, data gaps and identify additional data sources, to further inform the baseline assessment. Such workshops have not been feasible during the Covid-19 pandemic, although stakeholders have been consulted remotely.
- 2.8.6 Ecological information obtained from Local Records Centres contains records of habitats and species from a wide variety of sources, and a wide age range. The baseline assessment identifies the data that are relevant and current; however, it is reliant on the providers in terms of the accuracy of data.

Topic-specific Limitations

Topic 1

- 2.8.7 Some records for water depths at Canal and Rivers Trust (CRT) locks were not accessible by CRT during the consultation period due to COVID-19 restrictions. Similarly, CRT guidelines, conditions, or planning permission stipulations for sand and gravel extractions are generally summarised in hard copy at The Trust offices and were not accessible.

Topic 2, 12 and 13

- 2.8.8 This assessment is subject to the accuracy and completeness of information provided in response to information requests, and through consultation with stakeholders. Some data constitutes anecdotal evidence and therefore may not be supported by official records, i.e. anecdotal records of fish species or fish habitat from angling clubs and associations.
- 2.8.9 Due to the sensitive nature of information provided in this assessment, it is recommended that it remains confidential. In particular, some angling groups consulted have requested that anecdotal records of key fishing locations, spawning habitats etc. remain confidential due in part to the risk of poaching of important fish species such as Atlantic salmon and European eel.

Topic 4

- 2.8.10 The Topic 4 literature review has generally been undertaken qualitatively. No hydrological or hydraulic modelling of the reduction of flows associated with the schemes has been undertaken although some hydraulic modelling of existing conditions under high, median and low flows was undertaken as part of Topic 6 (wetted perimeters) and has a number of caveats associated with it, as described in the Topic 6 report.

Topic 6

- 2.8.11 The hydrological analysis assumed that the linear regression of catchment area against flow is an appropriate method for estimating low (Q95), median (Q50) and high (Q10) flows at ungauged locations along the study reaches. Given the length of river being modelled, the correlation was based on relatively few gauged locations (seven) and this method may not fully capture small scale variations in flow conditions, e.g. immediately downstream of major tributaries. The approach also assumed that the entire study area experiences the same flow condition at the same time. In reality, there would be more variation in local flow condition because of varying weather conditions across a very large catchment area.
- 2.8.12 All hydraulic models used in this study were designed for simulating, and calibrated to, flood flow events. This means there are limitations associated with the accuracy of the results obtained from using these models for routing low flow conditions.
- 2.8.13 Due to the strategic nature of the models used, the cross sections are spaced relatively far apart. The Trent models typically have a cross section spacing of approximately 200m, whilst the cross sections in the Lower Tame model are typically approximately 50m apart. This means that there is a limited representation of channel variability through the study area, and therefore the application of conclusions of this assessment to other topics may be limited, for example where relevance to isolated features such as weirs cannot easily be made.
- 2.8.14 The 1D modelling approach means that there is inconsistency in the proportion of the cross sections that represent the river channel. Some model nodes used extended cross sections to represent a significant part of the floodplain, whilst other cross sections were much shorter. These extended cross sections affect a small number of locations only; refer to Topic 6 for further details.
- 2.8.15 The models of the Trent used in this study are not georeferenced and some nodes of the Lower Tame model are missing georeferencing information. It was not possible to undertake full geo-referencing, but key structures were georeferenced within the hydraulic model only. However, this does not allow spatial representation of the outputs outside of the hydraulic model (e.g. within GIS). The lack of georeferencing limits the accuracy with which the model results can be located beyond key locations such as at structures (e.g. weirs) or confluences. The absence of georeferencing also means that all the outputs from the Trent models and outputs for some model nodes of the Lower Tame model could not be plotted in GIS software.

- 2.8.16 Whilst the existing ('sweetening') flows contained within the hydraulic models have been reduced as much as possible, these model flows are still in addition to the flows calculated from the linear regression. This is likely to have a greater influence on the Q95 flows where the 'sweetening' inflows are proportionately largest, relative to the total model inflows.

Topic 3, 7 and 17

- 2.8.17 The accuracy of RHS surveys from the online RHS portal³ is dependent upon the accreditation or certification of the surveyor submitting the data. The RHS portal is not an official EA website and RHS survey results on the portal may not have undergone quality assurance and verification checks. Where it is considered that RHS data sourced may not accurately represent habitat conditions at that location, this is described in Topic 7.
- 2.8.18 Descriptions of designated sites are based on the most recent available supporting documents obtained from Local Environmental Records Centres or other sources. Sites have often not been recently assessed, and habitat conditions may have changed since the date of the last assessment. Therefore, it has been assumed that habitats remain in the same condition as at the time of the most recent assessment.
- 2.8.19 Supporting documents for statutory designated sites, i.e. SSSIs, have been obtained through a Freedom of Information Request from the EA. Therefore, a further request for information from NE has not been considered necessary. Generally, information pertaining to statutory designated sites is freely available via the NE Designated Sites View⁴ online portal, or otherwise from other online sources.
- 2.8.20 The analysis of Priority Habitats is limited by the accuracy and temporal completeness of habitat mapping from Magic.gov⁵. This includes United Kingdom Biodiversity Action Plan (UK BAP) Priority Habitats rather than Habitats of Principal Importance under Section 41 of the NERC Act 2006. Therefore, there may be areas of more recently designated Habitats of Principal Importance that are excluded from the assessment and may only be identified by physical site surveys.

Topic 8

- 2.8.21 The response to the Freedom of Information Request to the EA provided no asset ownership data. The EA does not hold any land ownership responsibility in the majority of cases, and it is highly unlikely they would be able to provide third party land ownership details under Data Protection. The EA has recommended that further enquiries are made via local Land Registry searches, and this has been included in the recommendations and next steps at the end of this report. Ownership of in-river assets by the EA has been assumed in some cases, and this has been made clear in Table 3.
- 2.8.22 Local Authority records have not yet been requested, likewise Land Registry searches have not been completed due to delayed general data requests. If, following analysis of incoming data critical data gaps are identified, further searches, e.g. from the Local Planning Authorities (LPAs), may be required to inform the assessment beyond Gate 1 and into Gate 2.
- 2.8.23 Due to the sensitive nature of information provided in this assessment, it is recommended that it remains confidential. In particular, some angling groups consulted have requested that anecdotal records of key fishing locations, spawning habitats etc. remain confidential due in part to the risk of poaching of significant fish species such as Atlantic salmon and European eel.

Topic 9

- 2.8.24 The location of public water supply abstraction sources must not be published to a resolution more detailed than 1km² (refer also to Topic 19), in accordance with EA data licensing conditions. It is considered that presentation of these at a high level within this study conforms with this requirement. Mapping of discharges has been undertaken at the same scale to enable comparison between high level locations of abstractions with discharges. As such both datasets have not been added to the Web GIS (Topic 19).

Topic 16

- 2.8.25 The main limitation posed is the methodology is that not all relevant information may be in the public domain, and so accessible via internet-based search. However, the systematic literature review undertaken is considered suitable to mitigate any concerns regarding limited availability of studies (i.e.

³ River Habitat Survey: Map of RHS sites <http://www.riverhabitatsurvey.org/map-open-os/>

⁴ Natural England Designated Sites View <https://designatedsites.naturalengland.org.uk/SiteSearch.aspx>

⁵ Multi-Agency Geographic Information for the Countryside (MAGIC) <https://magic.defra.gov.uk/>

no studies were referred to in the sources identified that could not be investigated further via internet search).

Topic 19

- 2.8.26 Some datasets summarised in Topic 19 cannot be provided or mapped on the web GIS due to licence conditions or confidentiality. The ecology data sourced from various local record centres was purchased in AECOM's name and the licence does not permit us to pass the GIS data to third parties or clients. However, the data can be displayed in PDF figures and on the web GIS; the exception to this is confidential mammal data (badger records), which cannot be displayed. The EA water abstractions has a conditional licence: the location of public water supply abstraction sources must not be published to a resolution more detailed than 1km², so we have not included those points in the data.
- 2.8.27 We ask that screenshots of the web GIS (refer to Topic 19) site are not taken because the data has associated copyright which must be displayed on outputs and it's not possible to provide that via the site. Copyrights and licence details are provided in the data register.

2.9 Baseline Assessment

- 2.9.1 Please refer to the corresponding Topic reports for further detail of the baseline assessments.

3 Statutory Requirements: SEA and HRA

3.1 Approach

- 3.1.1 The strategic regional water resource solutions appendix in Ofwat's final determinations for PR19⁶ and recently published guidance for Gate 1 submissions⁷ set out the need for initial option-level environmental assessments for SROs, that meet local requirements and comply with Strategic Environmental Assessment (SEA) and Habitats Regulations Assessments (HRA) requirements. It is understood that the assessment should include the consideration of in-combination effects and identification of environmental risks that need mitigating through the solution design and costing.
- 3.1.2 While the option-level environmental assessments referred to above (SEA, HRA and including WFD) for the Minworth and SLR SROs as part of the Gate 1 submission are outside of the scope of this study, there is an opportunity for the findings of this baseline assessment study to inform them when they are carried out in due course. This section sets out and links the key findings of the baseline assessment to inform any future SEA, HRA and/ or WFD work carried out for the Minworth and SLR SROs.
- 3.1.3 It should be noted that a consistent environmental assessment methodology for the SROs is being developed by the All Company Working Group (ACWG); this has recently been published. Any future option-level environmental assessments carried out for the Minworth and SLR SROs will need to be consistent with the ACWG environmental assessment methodology.

3.2 SEA Considerations

- 3.2.1 Table 3 below sets out how the overarching themes and topics in this baseline assessment link to potential overarching SEA topics/themes. The key data gaps and recommendations arising through the baseline assessment are set out in Section 4 and are not repeated within the SEA considerations table below.

⁶ Ofwat (Dec 2019) PR19 final determinations – Strategic regional water resource solutions appendix. Available online: <https://www.ofwat.gov.uk/wp-content/uploads/2019/12/PR19-final-determinations-Strategic-regional-water-resource-solutions-appendix.pdf>

⁷ Ofwat (Feb 2021) Standard gate one submission template. Available online: <https://www.ofwat.gov.uk/wp-content/uploads/2021/02/Standard-gate-one-submission-template.pdf>

Table 3: SEA considerations

Overarching theme	Topics	Relevant SEA topics and key findings
Socio-economic	Topic 15: Socio-economic opportunity benefits for habitats and species	<ul style="list-style-type: none"> • Relevant for SEA topics relating to biodiversity, flora and fauna, health and wellbeing and the economy. • The findings demonstrate that: <ul style="list-style-type: none"> ○ the majority of the existing studies that were reviewed (88%, or 15 of 17 studies) covered freshwater, wetlands and floodplains. ○ the majority of the existing studies that were reviewed focused on natural hazard regulation (82%), biodiversity (82%), aesthetic value (76%) and recreation (65%). ○ relatively few existing studies covered economic impacts, compared to the coverage of ecosystem services. The economic impacts primarily considered job creation and tourism. ○ social impacts were significantly less considered in the literature, compared to ecosystem services and, to a lesser extent, economic impacts.
	Topic 16: Env Net Gain from regional growth area	<ul style="list-style-type: none"> • Relevant for SEA topics relating to biodiversity, flora and fauna. • Baseline habitats identified through the existing studies include highly modified riverine habitats, agricultural land, flat and open floodplains, wet grassland and woodland. In summary the area is characterised by a mosaic of high value habitats (see Topic 3 for further details). • There is significant pressure for new development within and surrounding the study area which will increase demand for new water and wastewater infrastructure in the future. This development/ infrastructure will require delivery of BNG, aligned with local plan policies and the draft Environment Bill. • There are a number of ongoing or planned initiatives to restore, improve or create habitats as well as any initiatives relating to natural flood or catchment management within the study area.
Hydrology/geomorphology	Topic 1: Navigation	<ul style="list-style-type: none"> • Relevant for SEA topics relating to health and wellbeing (in particular recreation) and the economy. • The baseline review identified that navigation within the study area is primarily regulated by permanent weirs and other structures that control flow levels. The Hands-off Flow is defined as a flow rate (of 2,640 Ml/d). • Flow rates could be influenced by any increase or decrease in water resources abstractions and discharges.
	Topic 5: River flows - Geomorphology/ sedimentation/ habitats	<ul style="list-style-type: none"> • Relevant for SEA topics relating to water levels and flows as well as biodiversity, flora and fauna. • The relationships between river flows and levels and geomorphology and sedimentation, and between habitats and geomorphology features, are presented visually in Section 2.10 of Topic 5. • The relationships are broad ranging and complex, but underpin holistic, sustainable management of water resources.
	Topic 6: Hydraulic geometry / habitat quantity	<ul style="list-style-type: none"> • Relevant for SEA topics relating to biodiversity, flora and fauna and water levels and flows. • The percentage change in wetted perimeter within the study area between moderate (Q50) and low (Q95) flow conditions is typically relatively small (<5%) but there is a relatively large degree of variability within the results. For example, the Tame wetted perimeter results (Figure 3-2) vary by up to 31%. This variability suggests a high degree of variability in channel geometry. • Changes in flow influence water level, velocity and wetter perimeter of the river channel affect the river ecosystem in a number of ways. For example, lower flows and decreased water depths result in reduced wetted widths and perimeters, impacting availability of, and connectivity with, essential habitats longitudinally (e.g. spawning and nursery habitats) and laterally (e.g. marginal, riparian and floodplain habitats). Reductions in velocity cause decreases in shear stresses in the water column, leading to higher sedimentation rates and decreased fine sediment flushing causing coarser bed materials, such as gravels, to become clogged.

Overarching theme	Topics	Relevant SEA topics and key findings
	Topic 10: Saline intrusion (Trent)	<ul style="list-style-type: none"> • Relevant for SEA topics relating to biodiversity, flora and fauna and water quality. • The tidal influence in the River Trent extends upstream as far as Torksey, but not as far as North Muskham; this is consistent with Cromwell Weir being reported as the limit of tidal influence i.e. it is located between Torksey and North Muskham. • Saline intrusion (water quality impacts) from the Humber can extend into the River Trent. The extent of saline intrusion will be influenced by the magnitude of freshwater flows within the Trent. • No evidence has been found to suggest that the saline / freshwater interface in the tidal Trent has changed over longer time scales. • There is limited interaction between groundwater and surface water in the tidal Trent. However, there may be localised interactions including with the sand and gravel superficial deposits. • At present there is no identified available dataset that demonstrates the relationship between changes in freshwater river flow and the extent of saline intrusion. However, there is anecdotal evidence to suggest that under lower flow conditions, the extent of saline intrusion could move further upstream of Owston Ferry. It is also possible that salinity might increase in the tidal Trent owing to reduced dilution from freshwater flows.
	Topic 18: Humidity and soil moisture SSSIs	<ul style="list-style-type: none"> • Relevant for SEA topics relating to biodiversity, flora and fauna. • The names of SSSIs that appear to have the most potential to be impacted by the proposed SROs with respect to soils and humidity are highlighted in Table 3-1 in Topic 18.
Ecology	Topic 2: Protected sites/ habitats and migratory fish	<ul style="list-style-type: none"> • Relevant for SEA topics relating to biodiversity, flora and fauna. • The study area and associated tributaries provide a range of essential supporting habitats for protected and notable migratory fish species, including those noted as qualifying features of the Humber Estuary SAC. • Little information available on specific habitat locations, although fluvial dynamics will influence this. Hydraulic modelling (Topic 6) and geomorphological assessment (Topic 5) provide further information on essential supporting habitats for migratory species in the study area and relevant available data. • Access for migratory fish species to essential supporting habitat in the study area and associated tributaries is critical. • The study identifies some high-level mitigation measures including: <ul style="list-style-type: none"> ◦ Limiting operational time of SROs to minimise impacts during critical periods, e.g. spawning seasons or low flows; ◦ Alterations to aquatic infrastructure; and ◦ Strategic creation of appropriate habitat.
	Topic 3: Ecological desk study (sites, habitats and species)	<ul style="list-style-type: none"> • Relevant for SEA topics relating to biodiversity, flora and fauna. • There are a significant number of statutory and non-statutory designated sites for biodiversity within the study area and likely to be within the influence of the SROs. The study also identifies a range of priority habitats, protected and notable species as well as INNS. • Site management plans, restoration plans or similar supporting documents were not available for five statutory designated sites (please refer to Section 3.4 of Topic 3). • Potential mitigation measures set out in Table 13 of Topic 3.
	Topic 7: Baseline habitat and ecology sensitivities	<ul style="list-style-type: none"> • Relevant for SEA topics relating to biodiversity, flora and fauna. • The ecological sensitivities of Statutory and Non-statutory designated sites are set out in Tables 4 and 5 respectively of Topic 7. • Potential mitigation measures set out in Table 11 of Topic 7.
	Topic 17: Wetland habitats/ avian species SW/GW connectivity	<ul style="list-style-type: none"> • Relevant for SEA topics relating to biodiversity, flora and fauna. • Protected and notable wetland avian species within 2km of the Rivers Tame, Trent and Humber set out in Table 4 of Topic 17.

Overarching theme	Topics	Relevant SEA topics and key findings
		<ul style="list-style-type: none"> Concludes that a change in flow has the potential to impact upon priority habitats and designated sites within the study area. This includes habitats used by important numbers of breeding, passage and wintering birds of conservation concern. Schedule-1 birds are also likely to be breeding in such habitats, most notably reedbed, including within sections protected by the Humber Estuary SPA. All of the designated sites, habitats and species described in Topic 17 should be considered 'at risk' from potential changes in flow in the Rivers Tame, Trent and Humber.
Aquatic Ecology	Topic 4: Ecological flow	<ul style="list-style-type: none"> Relevant for SEA topics relating to biodiversity, flora and fauna. The study area reaches (9 in total) and their sensitivities are set out in Section 4 of Topic 4.
	Topic 12: Weir poll habitat	<ul style="list-style-type: none"> Relevant for SEA topics relating to biodiversity, flora and fauna, the economy and health and wellbeing (in particular recreation). A number of weir pools are present in the Rivers Trent and Tame. High velocities and turbulent flows over weirs can cause scour, creating deep pools often comprising riffle habitat at the toe. As a result, weir pools can provide unique and diverse habitat that may not be prevalent elsewhere in the study area. Such habitat is suitable for a range of fish species, including socio-economically important coarse fish. The two SRO programmes, Minworth and the South Lincolnshire Reservoir, may alter abstractions and discharges within the study area, potentially impacting water depths, velocities and habitat quality in weir pools. Potential mitigation measures set out in Section 4.3 of Topic 12.
	Topic 13: Fish and passage barriers	<ul style="list-style-type: none"> Relevant for SEA topics relating to biodiversity, flora and fauna, the economy and health and wellbeing (in terms of recreation). A total of 15 and 8 barriers to fish passage were identified on the Rivers Trent and Tame, respectively. All barriers identified were weirs, with the exception of Holme Sluices. A summary of barriers to fish passage identified in the study area is presented in Table 4 (River Trent) and Table 5 (River Tame) of Topic 13. The two SRO programmes, Minworth SRO and the South Lincolnshire Reservoir, may alter abstractions and discharges within the study area, impacting water depths, velocities and passability of barriers by fish. Potential mitigation measures set out in Section 4.3.
	Topic 14: Invasive species (INNS)	<ul style="list-style-type: none"> Relevant for SEA topics relating to biodiversity, flora and fauna. Records of aquatic, semi-aquatic and riparian invasive species are set out in Topic 14. Potential mitigation measures are set out in Appendix B of Topic 14. This includes a review of treatment and intervention options for their applicability to water companies.
Regulatory	Topic 8: Asset ownership and specification	<ul style="list-style-type: none"> Relevant for SEA topics relating to the economy, health and wellbeing (in particular recreation), material assets and transport. A summary of the type and number of assets within the study area including the likelihood of impacts due to changes in flow is presented in Table 4 of Topic 8.
	Topic 9: Abstractions and discharges	<ul style="list-style-type: none"> Relevant for SEA topics relating to water levels and flows as well as the economy. The majority of significant abstractions (> 10MI/d) are for the production of energy. A summary of the significant abstractions (> 10MI/d) are provided in Table 2 of Topic 9.
	Topic 11: WFD status	<ul style="list-style-type: none"> Relevant for SEA topics relating to water flows, levels and quality. This topic confirms existing WFD status and reasons for not achieving good status for all relevant water bodies (and for each element within the water bodies) along the River Tame, Trent and Humber Estuary. Each of the water bodies through the study area are of less than Good overall WFD status. This indicates that at least one of their component statuses is less than Good.

Overarching theme	Topics	Relevant SEA topics and key findings
		<ul style="list-style-type: none">• Eleven water bodies cover the Rivers Tame, Trent and Humber downstream of Minworth WwTW. This includes 3 Tame water bodies, 6 Trent water bodies and 2 TraC water bodies. Status of these water bodies would be directly sensitive to the effects of the proposed water resource options.• A summary of the reasons for water bodies not achieving good status is presented in Table 2 and the responsible sectors in Table 3 of Topic 11.

3.3 HRA Considerations

Minworth SRO

- 3.3.1 Minworth WwTW is remote from European sites, the closest being Ensor's Pool, c. 18km to the east. Ensor's Pool is a former claypit that is not hydrologically connected to Minworth WwTW. Although Topic 3 (Ecological Desk Study) discusses all European sites within 5km of the River Trent and River Tame, the HRA discussion in this Summary Report considers the specific impact pathways based on expected locations of abstraction and discharge. As such, the River Mease SAC (discussed in Topic Paper 3) is not considered to be linked to either scheme; although it lies within 5km of the River Trent and drains into it like the River Tame, it does so 23km downstream of Minworth WwTW and there is therefore no mechanism for the final effluent transfer from Minworth to affect this SAC.
- 3.3.2 The Minworth SRO considers a maximum diversion of 215 MI/d (115 MI/d for STT and up to 100 MI/d for GUC) to support regional water transfers. The River Tame is a tributary of the River Trent. The River Trent joins the River Ouse at Trent Falls to form the Humber Estuary. The tidal part of the River Trent, and the Humber Estuary, are designated as part of the Humber Estuary SAC, while the estuary is also designated as a SPA and a Ramsar site. However, these designations lie 140km from Minworth. As such it may be reasonable to consider that the removal of 215 MI/d from the River Tame may have a minimal effect on total freshwater flows into these European sites (the Humber Estuary SAC, SPA and Ramsar site) even 'in combination' with other plans and projects.
- 3.3.3 For example, paragraph 48 of Advocate-General Sharpston's Opinion in European Court of Justice Case C-258/11 states that: 'the requirement for an effect to be 'significant' exists in order to lay down a de minimis threshold. Plans and projects that have no appreciable effect on the site can therefore be excluded. If all plans and projects capable of having any effect whatsoever on the site were to be caught by Article 6(3), activities on or near the site would risk being impossible by reason of legislative overkill'.
- 3.3.4 However, further investigation will be required to confirm the scale of the effect on the SAC, SPA and Ramsar site before a firm conclusion can be drawn. Further assessment should quantify the expected percentage reduction in flows due to the scheme, in combination with other plans and projects (including SLR, see below), consider the proportion of the Humber Estuary SAC, SPA and Ramsar site potentially impacted by changes in flow in the Trent, and confirm whether habitats relevant to the European site interest features (e.g. mudflats, reedbeds, bird species) are present in the affected area. Any potential barrier effects to migratory fish species for which the SAC is designated may also need consideration.
- 3.3.5 Other options are to discharge some of the diverted Minworth flow to Fazeley Canal, Coventry Canal and the Grand Union Canal. None of these canals have any international designation.

South Lincolnshire Reservoir

- 3.3.6 It is understood that the baseline hydrology study confirms that a new 300 MI/d transfer from the River Trent, in combination with the Witham, would be the best additional source of water to maximise the yield of the reservoir.
- 3.3.7 The River Witham abstraction will depend on a transfer from the River Trent, which is currently intended to occur at a point between Torksey and Winthorpe in Nottinghamshire. The River Trent joins the River Ouse at Trent Falls to form the Humber Estuary. The tidal part of the River Trent and the Humber Estuary are designated as the Humber Estuary SAC, while the estuary is also designated as a SPA and a Ramsar site. These designations lie 54km north of Winthorpe. As such, it may be reasonable to consider that the 300 MI/d abstraction from the River Trent will materially affect freshwater flows into the SAC, SPA and Ramsar site, even in combination with other plans and projects (including Minworth SRO), taking account of Advocate-General Sharpston's opinion above (namely, whether such a reduction in flows would be considered to constitute 'no appreciable effect' on overall flows into the SAC, SPA and Ramsar site). However, as with Minworth, this will require further consideration in a formal Habitats Regulations Assessment as the scheme is developed.
- 3.3.8 This scheme is a transfer of surplus raw water from Anglian Water from their Grafham Water reservoir in Cambridgeshire to Sundon. The nearest European site to Grafham Water is Portholme SAC located c.7km east. The SAC is a dry grassland site so there is no hydrological connection, and it is too far for

any other impact pathways (such as dust). As such the scheme poses no risk of a likely significant effect on that SAC.

- 3.3.9 The scheme is dependent on a new South Lincolnshire Reservoir being delivered by Anglian Water. The new South Lincolnshire Reservoir will include a river intake on the River Witham and a raw water delivery system to the downstream network. There are few European sites in Lincolnshire so the new reservoir can be located by Anglian Water without an adverse effect on European sites and the River Witham is not a European site. Since there are no relevant pathways of impact from the Affinity Water component (the pipeline from Grafham Water to Sundon) there is no scope for an effect in combination.

4 Overall Gap Analysis and Further Recommendations

4.1.1 A summary of the limitations, gap analysis and associated recommendations for further work to inform the assessment of impacts in relation to the SRO schemes is provided in Table 2 below. Recommendations have been sub-divided into:

- i. Recommendations to complete, maintain or update the baseline assessment; or
- ii. Recommendations to inform the impact assessment post-Gate 1.

4.1.2 Refer to the additional detail provided in each Topic report for more detailed recommendations and justification, including links between topics.

Table 4: Gap analysis, limitations and associated recommendations by topic

Topic	Baseline update /maintain	Impact assessment post-Gate1	Gap or Limitation	Recommendations for further work to inform impact assessment	Relevance to SRO Scheme (Minworth and/or SLR)	Priority (High, Medium, Low) and justification
All Topics		✓	Lack of detail regarding potential impacts of SRO schemes	Establish likely impacts of SRO schemes, once options have been finalised, e.g. locations of abstractions and discharges, and prioritise features for impact assessment.	Minworth SLR	High Establish likely impacts of SRO schemes to inform impact assessment
	✓	✓	Stakeholder consultation meetings/workshops	Hold focused stakeholder consultation meetings/workshops (once Covid-19 restrictions are lifted), to discuss impacts, and opportunities for mitigation with multiple benefits.	Minworth SLR	Medium Stakeholder consultation would be beneficial to inform scheme assessment and mitigation
	✓	✓	Lack of a comprehensive hydraulic model of the Tame, Trent and Humber river system	Further hydraulic modelling in specific targeted areas, as informed by baseline assessment, could be considered to inform the potential impacts identified in other topics.	Minworth SLR	High Further hydraulic modelling as required to inform impact assessment as per specific needs of other topics
Regulatory Topics						
Topic 8: Assets along the Trent	✓		Unconfirmed asset ownership and identification of previously unknown assets	Add asset ownership data to the database of assets, as required following identification of 'at-risk' assets. Add newly identified assets to the database as they are identified in field surveys, or through stakeholder consultation, for example. Add further information on the specification (e.g. height, width, etc.) of existing assets as it becomes available.	Minworth SLR	Medium Identification of asset specification and ownership required for impact assessment

Topic	Baseline update /maintain	Impact assessment post-Gate1	Gap or Limitation	Recommendations for further work to inform impact assessment	Relevance to SRO Scheme (Minworth and/or SLR)	Priority (High, Medium, Low) and justification
	✓		LPA Land Registry searches not completed	LPA Land Registry searches to confirm ownership of key assets considered critical to future assessment.	Minworth SLR	Medium Identification of all assets, their specification, and ownership required for effective impact assessment
Topic 9: Abstractions and Discharges		✓	Sensitivity of licensed abstractions unknown	Investigate the sensitivity of licensed abstractions to water level fluctuations and changes in water quality, once likely changes in water quality have been identified, to inform impact assessment. E.g. consultation with abstraction license holders.	Minworth SLR	Low Required to understand potential impacts of SRO on existing abstractions
Topic 11: WFD	✓		Time limit of current WFD statuses	Refresh WFD status and supporting information (classifications, RNAGs, etc) at next WFD Cycle (expected 2022).	Minworth SLR	Medium Dependent upon timescale of impact assessment
		✓	Water quality modelling incomplete	Use software such as SAGIS to predict potential changes in Physico-chemical status as a result of potential changes in water quantity.	Minworth SLR	Medium To be considered for impact assessment
		✓	Hydro-ecological modelling/ecological impact modelling	Use hydro-ecological tools and ecological indices to predict potential changes in Ecological status/potential as a result of potential changes in water quantity.	Minworth SLR	Medium To be considered for impact assessment
Hydrology / Geomorphology Topics						
Topic 5: Sedimentation	✓	✓	General lack of baseline data	Fluvial audits targeted to the SRO locations to define geomorphological baselines and assess effects	Minworth SLR	High Required to establish baselines and predict effects
Topic 1: Navigation	✓	✓	Few gaps, but the statutory Hands-off Flow defined in 1993 needs to be updated	Hydrological and hydraulic modelling to measure the relative importance of different flows inputs/outputs including the SROs	Minworth SLR	Medium Navigation authorities identified that structures control navigable flow depths, but the HoF is a statutory flow rate that should be updated
Topic 6: Wetted Perimeters	✓		Uncertainty of using models developed and calibrated for extreme high flows to model low and moderate flows	Further hydraulic modelling in specific targeted areas, as informed by baseline assessment, could be considered to inform the potential impacts identified in other topics. Ideally this would link with other modelling that is recommended (e.g. with regard to water quality or hydro ecology).	Minworth SLR	Low/Medium Quicker to build a new model rather than make improvements to the existing models. Informed by requirements of other topics.

Topic	Baseline update /maintain	Impact assessment post-Gate1	Gap or Limitation	Recommendations for further work to inform impact assessment	Relevance to SRO Scheme (Minworth and/or SLR)	Priority (High, Medium, Low) and justification
	✓	✓	Hydrological analysis assumes that linear regression fully represents change in flow between gauges	For areas identified as sensitive to changes in wetted perimeter, undertake further, more detailed assessment of hydrological analysis (refer to Topic 6: Section 3.4).	Minworth SLR	Medium If further detail is required for the outputs of other topics, or for impact assessment
	✓	✓	All models used were designed for high flow events. Limitations associated with the accuracy of results obtained from using these models for low flow conditions	Verify model flows at locations between gauges through use of spot flows taken around the Q10, Q50 and Q95 range, as above.	Minworth SLR	Medium If further detail is required for the outputs of other topics, or for impact assessment
	✓	✓	Only three flow percentiles; Q ₉₅ , Q ₅₀ and Q ₁₀ were assessed	Extend the range of flow percentiles assessed, as informed by the assessments in other Topics referred to in Topic 6: Section 3.4, if greater resolution is required.	Minworth SLR	Low As required for the outputs of other topics
	✓	✓	Lower Tame, Trent 2, Trent 3 and Trent 4 hydraulic models were completed between 2005 and 2009 and are all 1D	Undertake the following model checks: Confirm no changes in cross sections or alterations to structures, at key locations, through check survey; Check representation of channel cross sections and structures against original survey data; Check operations of sluices are still representative; Undertake model review to assess modelling approach and suitability for use for the intended purpose.	Minworth SLR	Medium If further detail is required for the outputs of other topics, or for impact assessment
	✓	✓	Limited representation of channel variability due to channel cross-section spacing	Undertake further survey in areas of key interest to understand how representative modelled cross sections area and if necessary, add more cross-sections to model.	Minworth SLR	High For sections of river adjacent to SRO assets only
		✓	Sweetening flows are in addition to flows calculated from the linear regression - likely to have greater influence on Q ₉₅ flows where the 'sweetening' inflows are proportionately largest, relative to total model inflows	Undertake further iterations within the model to reduce these sweetening flows.	Minworth SLR	High In order to reduce the influence of additional flows on the scheme assessment, the sweetening flows should be reduced to the lowest values possible or removed entirely if the model is rebuilt
	✓	✓	Models provided were 1D-only - limitations in the consistency of wetted perimeter extent	Either trim cross sections appropriately or adopt a 1D-2D modelling approach to decrease uncertainty associated with the wetted perimeter results. As informed by baseline assessment, could be considered to inform the potential impacts identified in other topics.	Minworth SLR	Medium Provide greater confidence in model outputs for impact assessment. Informed by requirements of other topics.

Topic	Baseline update /maintain	Impact assessment post-Gate1	Gap or Limitation	Recommendations for further work to inform impact assessment	Relevance to SRO Scheme (Minworth and/or SLR)	Priority (High, Medium, Low) and justification
		✓	Reach of River Tame in Upper Tame model not assessed due to delayed delivery of hydraulic models	Complete wetted perimeter assessment for reach between upstream study extent and Water Orton located within the Upper Tame model – combine Upper Tame model with Lower Tame model to provide a more comprehensive picture of the Tame, including upper section upstream of Minworth.	Minworth	High The Upper Tame model covers 400m at the upstream extent of the assessment
		✓	Tidal reach of River Trent (Humber model) not assessed due to delayed delivery of hydraulic models after data freeze	No significant impact on wetted perimeters considered likely in this estuarine reach. No further work required unless required for other topics.	SLR [Minworth]	Low Only if required for other topics' impact assessment
		✓	Lack of georeferencing of the Trent 2, 3 and 4 models	Geo-reference the Trent 2, Trent 3 and Trent 4 hydraulic models, and nodes of the Lower Tame model. This would allow the outputs of the wetted perimeter assessment to be displayed spatially.	Minworth SLR	Medium Useful to allow outputs of the assessment to be view and analysed spatially to inform impact assessment
		✓	Model results from Trent 2 model only applicable downstream of Trent/Tame confluence	Truncate Trent 2 model at confluence with River Tame to avoid deriving outputs that are not applicable. Calculate inflows for this reach to allow wetted perimeter values to be calculated.	Minworth SLR	Low Only if required for other topics' impact assessment
Topic 10: Saline Intrusion		✓	Limited salinity or proxy determinand data within River Trent	Targeted sampling to better understand the saline interface and the extent and duration of saline intrusion during and after periods of low flow, e.g. water quality data loggers at key locations	Minworth SLR	Medium Baseline data required for impact assessment
	✓		Only daily mean flow and river level data openly available and accessible	Data request to EA for 15-minute flow and river level data from relevant monitoring sites to further develop understanding of short-term flow fluctuations in relation to saline intrusion	Minworth SLR	Medium Key aspect for understanding baseline scenario
		✓	Modelling reduced freshwater flow into the tidal River Trent	Modelling how reduction of freshwater input into the tidal River Trent will affect saline intrusion and the location of the saline interface should be considered	Minworth SLR	Medium To be considered for impact assessment
		✓	Lack of understanding of potential impact and interactions with SROs resulting from climate change	The potential impact of climate change on sea levels and river flows with respect to saline intrusion within the tidal Trent could be explored, using relevant academic studies as a basis.	Minworth SLR	Low To be considered for impact assessment under long term scenarios
Topic 18: Soil Moisture		✓	Impact assessment for SRO schemes	Identify likely impacts through flow changes as a result of the SRO schemes, in order to prioritise SSSIs for impact assessment according to Table 3-1.	SLR [Minworth to a lesser extent due to the lack of	High

Topic	Baseline update /maintain	Impact assessment post-Gate1	Gap or Limitation	Recommendations for further work to inform impact assessment	Relevance to SRO Scheme (Minworth and/or SLR)	Priority (High, Medium, Low) and justification
					water dependent SSSIs in the area]	Identify likely impacts to prioritise SSSIs for impact assessment
	✓	✓	Lack of historical studies for SSSIs	Once SSSIs have been prioritised based on likely impacts from the SRO schemes, investigate further whether relevant literature exists in relation to those sites, i.e. refresh and widen data searches/requests.	SLR [Minworth to a lesser extent due to the lack of water dependent SSSIs in the area]	Medium Obtain further SSSI data to inform impact assessment
	✓	✓	Lack of SSSI-specific soil moisture data	Once SSSIs have been prioritised based on likely impacts from the SRO schemes, further investigation should be made to source soil moisture, groundwater level and surface water level monitoring data and documents to inform the impact assessment.	SLR [Minworth to a lesser extent due to the lack of water dependent SSSIs in the area]	High Obtain further SSSI data to inform impact assessment
		✓	Imminently available soil moisture gridded data	Once SSSIs have been prioritised based on likely impacts from the SRO schemes, source soil moisture information from JULES via the CHER platform, if available, to inform the impact assessment.	SLR [Minworth to a lesser extent due to the lack of water dependent SSSIs in the area]	Medium Obtain further SSSI data to inform impact assessment
Ecology Topics						
Topics 3, 7, 17 and interdependent topics [Also Topic 14]	✓		Time limit of data from Local Records Centres	Refresh LRC data searches after a period of two to three years from the date of this report	Minworth SLR	Medium Dependent upon timescale of impact assessment
Topic 3: Ecological Desk Study	✓		Time limit of data on INNS	Refresh data search for INNS records after a period of approximately two years from the date of this report	Minworth SLR	Medium Dependent upon timescale of impact assessment
	✓		Site management plans unavailable for several statutory designated sites	Consult with NE or LPA to obtain management/restoration plans if further information for these sites is required.	Minworth SLR	Low No or minimal potential impacts considered to result from flow changes due to SRO schemes
Topic 7: Ecological Sensitivities		✓	Limited accuracy and lifespan of online RHS data	River Habitat Surveys (RHS) recommended for 'at risk' locations identified in subsequent impact assessment.	Minworth SLR	Medium Sites to be prioritised for RHS as potential impacts are established
		✓	Focus of impact assessment of SRO schemes	It is recommended that future impact assessment in relation to the SRO schemes is concentrated on those	Minworth SLR	High

Topic	Baseline update /maintain	Impact assessment post-Gate1	Gap or Limitation	Recommendations for further work to inform impact assessment	Relevance to SRO Scheme (Minworth and/or SLR)	Priority (High, Medium, Low) and justification
				designated sites or areas of habitat of moderate to high ecological sensitivity.		Focus of impact assessment on ecological features of moderate to high sensitivity
Topic 7 and Topic17: Wetland Habitats		✓	Citations and assessments for designated sites are outdated	Ground-truthing Phase 1 Habitat or NVC surveys recommended to assess the current condition of designated sites.	Minworth SLR	High Sites to be prioritised for survey based on the likelihood of impacts
Topic17: Wetland Habitats		✓	Cross-reference Catchment Based Approach (CaBA) opportunity areas with likely scheme impacts	Identify areas where there are potential impacts on current CaBA opportunity areas, e.g. for wetland habitat creation. Identify opportunities where the schemes can contribute to CaBA objectives. Consultation with catchment partnerships to identify opportunities for mitigation with multiple benefits.	SLR [Minworth to a lesser extent as there are no specific CaBA objectives for the Tame]	Medium Cross-reference CaBA opportunities when impacts are identified
		✓	Further assessment of European designated sites for HRA	Determine the requirement for further HRA as the SRO schemes develop, and likely impacts are identified.	SLR [Minworth to a lesser extent due to the lack of European designated sites in that area]	Medium The requirement for HRA is described in Section 3 of this report
		✓	Habitat walkover surveys	Targeted ecological walkover surveys on wetland Priority Habitats, to identify the importance of these habitats for avian species in relation to designated sites.	Minworth SLR	Medium Targeted habitat walkover surveys to inform impact assessment
Aquatic Ecology Topics						
Topic 2: Migratory Species	✓	✓	2D hydraulic modelling and associated topographic and bathymetric surveys.	2D modelling, requiring recent topographic and bathymetric survey data, is recommended to identify the impacts of each SRO scheme on essential supporting habitats in the study area, as required to assess potential impacts identified in Topic 2 (see also Topic 6 above).	Minworth SLR	High Required to assess impacts different SRO scenarios
		✓	Habitat surveys.	Habitat surveys are recommended for corroborating aerial imagery assessments and anecdotal information on essential supporting habitats.	Minworth SLR	Medium Required for ground truthing modelling outputs
		✓	Status of abstraction, fish passes, and habitat creation schemes at the time of SRO impact assessment.	Progress of planned abstractions, fish passes, and habitat creation schemes should be considered in any modelling undertaken in relation to SROs and accessibility of migratory species to essential	Minworth SLR	High Important for incorporating into modelling and impact assessment under different SRO scenarios

Topic	Baseline update /maintain	Impact assessment post-Gate1	Gap or Limitation	Recommendations for further work to inform impact assessment	Relevance to SRO Scheme (Minworth and/or SLR)	Priority (High, Medium, Low) and justification
			[Also for Topic 13 – see below]	supporting habitats in the study area and associated tributaries.		
Topic 4: Ecological Flow Requirements	✓		Lack of complete understanding of the effects of reduction in discharge on the depleted reach.	Further investigation to establish if there is any precedent in the UK or abroad for the redirection of discharge from a WwTW, and any associated effects on the depleted reach of the receiving watercourse.	Minworth	High Prior to further design evolution of the Minworth SRO scheme
		✓	Lack of detail and resolution in existing hydraulic models to inform assessment of potential impacts.	Undertake detailed 2d hydraulic modelling at flows likely to result from SRO schemes, integrating water quality effects and notable abstractions and discharges – targeted modelling in specific areas where impacts as a result of the SRO schemes are likely.	Minworth SLR	High Needed to understand potential changes in the Physical Environment and appraise resulting ecological effects.
		✓	Unknown sensitivity of aquatic species in study area to potential environmental changes	Undertake a detailed appraisal of WFD biotic indices and aquatic species data to better understand the aquatic ecological sensitivity to changes potentially resulting from the SRO schemes	Minworth SLR	High Required for impact assessment.
		✓	Lack of a hydraulic estuarine model	Develop an estuarine model incorporating the hydrology and water quality of the tidal River Trent and Humber Estuary, as informed by other topics to inform the assessment of potential impacts.	SLR [Minworth – Low priority]	Medium Will improve understanding and model potential effects on ecology and hydrology in estuarine locations.
		✓	Lack of understanding of water quality parameters around Minworth in relation to RNAG.	Further investigation of water quality parameters upstream and downstream of the Minworth discharges would be beneficial in understanding the level to which Minworth is affecting water quality, compared to other reasons for not achieving good status.	Minworth	Medium Understand the effect of a reduction in discharge for the SRO.
		✓	Potential lack of monitoring data to support hydrology models	Identify available monitoring and undertake additional monitoring for hydrology models. Undertake additional monitoring for sensitivities not considered by modelling	Minworth SLR	Medium Required to develop and ground truth hydrology models
	✓	✓	Further work required to understand the distribution of riparian mammals in relation to the SRO schemes.	Further investigation of the distribution and abundance of riparian species, notably otter and water vole, would be beneficial in identifying sensitive riparian habitats, and informing future mitigation requirements.	Minworth SLR	Medium Improve understanding of sensitive designated site requirements.
Topic 12: Weir Pool Habitats	✓		Lack of fish surveys conducted in the vicinity of weir pools, and downstream of Minworth [Refer to Topic 4]	Undertake fish surveys and detailed, scientific angling logs from weir pools, and in targeted habitats downstream of Minworth. Compare results to other locations in study area.	Minworth SLR	Low EA data exists for some weir pools as well as numerous non-

Topic	Baseline update /maintain	Impact assessment post-Gate1	Gap or Limitation	Recommendations for further work to inform impact assessment	Relevance to SRO Scheme (Minworth and/or SLR)	Priority (High, Medium, Low) and justification
						weir pool locations in the study area.
		✓	Develop knowledge about weir pool characteristics in the study area	Undertake bathymetric and substrate surveys for each weir pool to model potential impacts of the SRO schemes	Minworth SLR	High Important for incorporating into modelling and impact assessment
	✓	✓	2D hydraulic modelling and associated topographic and bathymetric surveys.	2D modelling, requiring recent topographic and bathymetric survey data, is recommended to identify the impacts of each SRO scheme on weir pool characteristics.	Minworth SLR	High Required to assess impacts different SRO scenarios
	✓	✓	Status of abstraction, fish passes, and habitat creation schemes at the time of SRO impact assessment.	Progress of planned abstractions, fish passes, and habitat creation schemes should be considered in any modelling undertaken in relation to SROs and weir pools in the study area.	Minworth SLR	High Important for incorporating into modelling and impact assessment
Topic 13: Barriers to Fish Passage	✓	✓	Status of abstraction, fish passes, and habitat creation schemes at the time of SRO impact assessment.	Progress of planned abstractions, fish passes, and habitat creation schemes should be considered in any modelling undertaken in relation to SROs and fish passage at potential barriers in the study area.	Minworth SLR	High Important for incorporating into modelling and impact assessment
		✓	Assess obstructions to fish passage. [Also for Topic 2 – see above]	An assessment of obstructions to fish passage is recommended to identify those weirs that may pose a risk to fish passage between essential supporting habitats as a result of the SRO schemes, pending the identification of potential impacts (see also Topic 6 above). This assessment should not be undertaken in isolation (i.e. solely in relation to the SRO schemes) as these existing obstructions to fish passage are also the responsibility of the asset owners.	Minworth SLR	Medium Needed to assess relative passability of structures in relation to proposed SROs, pending identification of potential impacts.
Topic 14: Invasive Species	✓	✓	Insufficient INNS data to inform impact assessment and subsequent Biosecurity Management Plan (BMP)	Investigate additional INNS data sources; undertake targeted INNS surveys once SRO scheme specifics known and likely impacts are established; Gain full understanding of INNS present in and around assets. As recommended for other Topics, targeted flow modelling at and downstream of Minworth would inform the risk of riparian INNS spread as a result of reduced discharge.	Minworth SLR	Medium Completes baseline gap, informs impact assessment.
		✓	Undertake INNS Pathways Risk Assessment for Gate 2	As a requirement for Gate 2, an INNS Pathways Risk Assessment should be undertaken for both SRO	SLR	Medium

Topic	Baseline update /maintain	Impact assessment post-Gate1	Gap or Limitation	Recommendations for further work to inform impact assessment	Relevance to SRO Scheme (Minworth and/or SLR)	Priority (High, Medium, Low) and justification
				schemes to identify potential risks associated with INNS transfer, and to explore potential mitigation options. Potentially including 'horizon scanning' for INNS most likely to invade the UK in the near future.	Minworth to a lesser extent	Pathways Risk Assessment for Gate 2 is an EA requirement.
Socio-economic Topics						
Topic 15: Socio-economic benefits	✓		Lack of consistent framework for identifying and considering positive and adverse social, economic and environmental impacts in decision-making regarding interventions for the River Trent, River Tame and Humber Estuary	Adopt a consistent framework for monitoring and reporting the impacts of interventions using agreed metrics, following a natural capital approach, recognising the extent and condition of habitats, as well as the physical and monetary flow of the ecosystem services delivered by these habitats. This approach is consistent with the direction of travel for the water sector, particularly in the context of emerging guidance for the assessment of Water Resource Management Plans which considers natural capital.	Minworth SLR	High A consistent framework is required to compare different interventions, and to accord with emerging good practice guidance, such as the EA's WRMP guidelines.
		✓	Lack of context and evidence related to the baseline habitats and species present within the study area, against which the impacts of implementing the SROs can be compared. [See also Topic 16 below]	Maintain a comprehensive baseline of habitats and ecosystem services associated with the River Trent, River Tame and Humber Estuary, to inform future decision-making. The assessment should follow good practice including guidance within the Green Book (HM Treasury, 2020) and Defra's Enabling a Natural Capital Approach (ENCA) guidance (Defra, 2020). The baseline would also facilitate stakeholder engagement particularly in contexts where partnerships and collaboration are needed to deliver certain objectives.	Minworth SLR	Medium (aspirational) An understanding of the baseline is needed to understand positive or adverse socioeconomic impacts as a result of interventions including SROs, and delivery of Net Gain objectives (see below).
Topic 16: Environmental Net Gain	✓		Lack of comprehensive baseline of habitat extent and condition [See also Topic 15 above]	Capture habitat baseline data for the River Trent, River Tame and Humber Estuary, within a GIS system to enable it to be accessed and updated.	Minworth SLR	High Baseline scenario required to understand delivery of environmental or biodiversity gain
		✓	Inconsistent approaches to measuring and reporting net gain and in the extent to which net gain is measured	Use a consistent framework and approach such as the NE Biodiversity Metric 2.0 to track changes in biodiversity	Minworth SLR	High Consistent approach required to demonstrate measurable net gain.
		✓	Lack of a joined-up approach historically between organisations and stakeholders to share data in	Utilise digital platforms to engage with key stakeholders and local communities, to facilitate data sharing and	Minworth	Medium Stakeholder engagement a key for local knowledge, delivering unified

Topic	Baseline update /maintain	Impact assessment post-Gate1	Gap or Limitation	Recommendations for further work to inform impact assessment	Relevance to SRO Scheme (Minworth and/or SLR)	Priority (High, Medium, Low) and justification
			order to support and implement Net Gain objectives.	joined-up approaches to Net Gain objectives with multiple benefits.	SLR	catchment management and wider social value.
Data Management						
Topic 19: Data Management			The gap analysis for data has been completed for each individual topic (Topics 1 to 18), and as such is presented in each topic report, together with recommendations for further data requirements and refresh.			

5 Conclusions

5.1 Overall

- 5.1.1 The Tame, Trent and Humber HEE assessment has involved a comprehensive review of 18 topic areas, supported by the data collation, management and GIS presentation of Topic 19. Data has been sourced from a wide variety of sources, and limitations in relation to the availability or suitability of data have been identified where this is considered to have constrained the efficacy of the assessment.
- 5.1.2 The baseline assessment for each topic has identified any limitations to the study; refer to Section 2.8. Recommendations for next steps post-Gate 1 have been developed, including steps to fill knowledge gaps and maintain the baseline assessment and inform further assessment going forward into Gate 2. The hydrological, environmental and ecological baseline has been compiled to inform Gate 1, and post-Gate 1 as the SRO scheme designs progress and the exact nature of likely impacts is established, will provide the basis of further assessment.
- 5.1.3 Environmental features identified in the assessment have been categorised according to their significance, their sensitivity in relation to the two SRO schemes, and the likelihood of them being impacted by potential impacts from those schemes.

5.2 Topic Area Conclusions

- 5.2.1 The identification of notable features, which will form the basis of subsequent impact assessment, includes the following (key conclusions in relation to positive outcomes and impact assessment in relation to the SRO schemes are also highlighted below):
- 5.2.2 In this section, Topics are presented in the same order of topic disciplines as presented in Table 2.

Regulatory Topics

Topic 8 Assets Along the Trent

- 5.2.3 Identifying assets such as weirs, bridges and other in-channel features that may control or affect, or be affected by, changes in water level (Topic 8) - assets were assigned a red/amber/green rating according to their likelihood of impacts due to changes in flow as a result of the SRO schemes, with cross-references made to other topics where these effects are discussed in further detail:
- Potential impacts to existing assets due to reductions in flow, e.g. reduced flow over weirs during low flow conditions (refer to Topic 13); reduced capacity for abstraction at low flow conditions (refer also to Topic 9).

Topic 9 Abstractions and Discharges

- 5.2.4 Confirmation of existing licenced abstractions (including licenced hydropower abstraction) and discharges along the River Tame, Trent and Humber Estuary, which may potentially be affected by changes to Minworth discharges and/or new abstraction for the SLR, and quantifying these to allow an improved understanding of the hydrology of the system (Topic 9);
- Further work required to investigate the sensitivity of abstractions and discharges to water level fluctuations and changes in water quality, and how these abstractions might be affected by the change in flow resulting from the SRO schemes (Minworth and SLR).
 - Potential impacts on those abstractions within the tidal reach of the River Trent, in relation to abstraction for SLR [Minworth discharges would have a much lesser impact on water volume at this point].

Topic 11 WFD

- 5.2.5 Establishing existing WFD status and reasons for not achieving good status for all relevant water bodies (and for each element within the water bodies) along the Rivers Tame, Trent and Humber Estuary (Topic 11). This informed a preliminary assessment as to whether current WFD water body status is at risk of deterioration through potential flow changes as a result of the SRO schemes;

- Less than Good statuses in water bodies may indicate pressures associated with these (e.g. less than Good orthophosphate status may indicate pressures from discharges or wider catchment pressures), and further investigation would be required to identify these pressures and separate out potential impacts;
- WFD Water bodies of the Tame and Trent catchments are not achieving Good status, and therefore further investigation would be required to separate out the potential effects of the SRO schemes from wider catchment pressures.

Hydrology / Geomorphology Topics

Topic 5 Sedimentation

5.2.6 Summarising existing understanding of river flows and levels on geomorphology and sedimentation and identify relationships between habitats and geomorphological features present (Topic 5). Significant data gaps and limitations mean there remains work to do in this area to ensure that outputs will inform further appraisal of river processes for aquatic and riparian habitat creation and how these could be impacted by flow changes;

- Areas already prone to sedimentation may be sensitive to changes to Minworth discharges or the potential new abstraction for the SLR, for example by increased sedimentation in the locality of reduced flows. Further investigation would be required to establish this.

Topic 1 Navigation

5.2.7 Reviewing data on the flows and levels that are required for navigation on the fluvial and tidal River Trent (Topic 1). The Trust emphasised that the main control on water depths for navigation in the River Tame and River Trent are lock sill depths. A generally comprehensive baseline of navigation requirements and constraints was established for the Trent;

- The SROs would influence flow rates, but they should have less influence on low flow depths;
- There has been a steady decline in the number of vessels sailing to the Trent, and that this is in line with a steady decrease in the number of vessels visiting across the wider Humber region;
- While ABP and The Trust have statutory duties to maintain minimum navigation depth, and the EA has a statutory duty to protect the HoF, Severn Trent has no statutory duty to discharge Minworth into the Tame and Trent and in principle could stop doing so.

Topic 6 Wetted Perimeters

5.2.8 Modelling low flows and potential changes in wetted perimeter as a result of potential changes in flow through the SRO schemes (Topic 6). Existing hydraulic models of the River Tame and River Trent originally built for strategic flood risk mapping were adapted, however there are notable limitations with the data, which have fed into recommendations for further work in this area;

- The percentage change in wetted perimeter between Q50 and Q95 flow conditions is typically relatively small (<5%) but there is a relatively large degree of variability within the results;
- The Tame wetted perimeter results of changes between Q50 and Q95 vary by an average of 3.7% (and up to a maximum outlier of 31%). As expected, larger values tend to be associated with channel cross sections that have a wide, gently sloping base where the Q95 flows do not extend across the full width or where there is a part of the channel bed that contains the Q95 flows but not Q50 flows. This variability suggests a high degree of variability in channel geometry.

Topic 10 Saline Intrusion

5.2.9 Compiling a baseline dataset of the extent of saline intrusion along the tidal Trent, to inform further appraisal of potential impacts to upstream abstractions if the extent of saline intrusion changes because of changes in flow regime (Topic 10);

- Under low flow conditions the water quality may be influenced as far as 30 km upstream of Trent Falls (in the vicinity of Owston Ferry), although there appears to be a lack of data to confirm this;
- Further investigation may be required to establish potential effects on salinity as a result of reduced dilution from freshwater flows as a cumulative effect of SRO schemes and other factors, e.g. climate change.

Topic 18 Soil Moisture and Humidity

5.2.10 Reviewing hydrological regime (surface water and groundwater) in relation to humidity and soil moisture levels in SSSIs, and in conjunction with ecology topics, identifying potential risks in relation to changes in water supply to water dependent designated sites (Topic 18). SSSIs have been categorised in terms of their sensitivity and potential risk due to flow changes;

- Out of 22 SSSIs identified as at risk of potential impacts, six are at the greatest risk of impacts (within 100 m of the River Tame or Trent), five are at high risk (within Flood Zone 3), ten are at borderline risk according to the various indicators used, and one is at the lowest risk (refer also to Topics 7 and 17).

Ecology Topics

Ecology Topics 3, 7 and 17

5.2.11 A comprehensive review of ecological data in relation to designated sites (statutory and non-statutory), UKBAP Priority Habitats (equivalent of Habitats of Principal Importance), and protected, notable and invasive species (Topics 3, 7, 14 and 17). These ecological features have been assigned a level of ecological significance in order to inform future impact assessment and allow this to be appropriately targeted. Furthermore, water dependent habitats and species, most notably those listed within the citations of designated sites, have been identified and assigned an ecological sensitivity score, indicating how 'at risk' they are from potential changes in flow in the Tame, Trent or Humber. Potential mitigation options have been compiled in relation to INNS, and the risk of their spread as a result of the SRO schemes, both within the Trent catchment and between catchments due to strategic transfers. Ecological data has fed into numerous other topics as per the topic interdependencies described in Section 2.4 of this report;

- The following ecological features were identified as of High Significance in relation to potential changes in flow as a result of the SRO schemes:
 - a. One international statutory designated site – the Humber Estuary SAC/SPA/Ramsar site;
 - b. Eight national statutory designated sites – four SSSI and four LNR;
 - c. Nine non-statutory designated sites, LWS or equivalent, or RSPB Reserve;
 - d. Areas of Priority Habitats relevant to the SRO schemes and subsequent impact assessment thereof: 80.4 km length of Rivers; 178.4 ha Mudflats; 2,480.6 ha Coastal and Floodplain Grazing Marsh; 102.8 ha Lowland Fens (England); 369.8 ha Coastal Saltmarsh; 705.7 ha Reedbeds;
 - e. Thirty-six protected and notable species; and
 - f. Seven INNS.
- Any change in flow in the Rivers Tame, Trent or Humber Estuary as a result of the SRO schemes, has the potential to impact upon priority habitats and designated sites within the study area, both negatively and positively. This includes habitats used by important numbers of breeding, passage and wintering birds of conservation concern.

Aquatic Ecology Topics

Aquatic Ecology Topics 2, 12 and 13

5.2.12 Identifying key aquatic ecology receptors, notably fish, migratory fish such as river and sea lamprey which are named in the citation of the Humber Estuary SAC, habitats of critical importance for fish species, and barriers to fish passage and general longitudinal connectivity in the study area (Topics 2, 12 and 13). This study has described in detail the current limitations of weirs and other barriers to fish movement (a critical part of the lifecycle of certain fish species), and recommendations for further work required to fully assess the potential impacts of changes in flow on these ecological receptors;

- Limited fish passability at multiple barriers in the study area; primarily weirs and one set of sluices, are noted to be a key current impact (Topic 13);
- The importance of passability at barriers is greatest downstream, as fish will need to pass these prior to passing upstream infrastructure to access essential supporting habitats;

- A number of projects plan to improve access for migratory fish species at barriers in the River Trent (further details in Topic 13);
- Further investigation of the potential effects of the two SRO schemes on abstractions and discharges within the study area would be required;
- Changes to water depths, velocities, geomorphology and habitat distribution, quantity and quality, would require further assessment in terms of potential effects on fish species or fish passage;
- Weir pools can provide unique and diverse habitat that may not be prevalent elsewhere in the study area. Such habitat is suitable for a range of fish species, including socio-economically important coarse fish;
- River and sea lamprey, as features listed in the citation of the Humber Estuary SAC, rely upon spawning habitat in weir pools and elsewhere, and suitable fish passage at weirs and other barriers; existing weir and fish pass designs in the study area may not currently favour lamprey passage;
- Further HEP schemes are proposed, which may adjust weir heights, localised hydraulics and include the addition or upgrade of fish passes;

Topic 4 Ecological Flow Requirements

5.2.13 Topic 4 considers the ecological flow requirements of receptors likely to be sensitive to changes in hydraulics, including wetted depths and river velocities. These receptors include species, water quality, morphology and habitats. Potential reductions in flow as a result of the SRO schemes may result in a decrease in wetted perimeters; refer to Topic 6. The greatest changes are likely in the River Tame;

- Reduced flows generally manifest more as reductions in velocity rather than reductions in levels;
- Reductions in wetted perimeters would likely result in river habitat changes although these are not necessarily adverse, e.g. features may become exposed that could result in diverse/varied habitats becoming available.
- Potential reductions in flow, as a result of the proposed SRO schemes, would have the greatest effect in the River Tame since the flows from Minworth WwTW comprise a bigger proportion of flow in this river than in the Trent.

Socio-economic Topics

Socio-economic Topics 15 and 16

5.2.14 Exploring the socio-economic benefits and BNG initiatives and aspirations in the catchment (Topics 15 and 16), through the identification of benchmark studies and utilising the outputs of other topics to inform the review. With assessments of natural capital and environmental net gain being a relatively recent development, baseline information was somewhat lacking; however, several studies and initiatives were identified and reviewed accordingly to inform recommendations for further study. Further implementation of natural capital and BNG approaches would be aspirational on schemes of such a large scale and national significance, and form a key part of Water Companies strategic plans and the Catchment Based Approach;

- Relatively few studies covered economic impacts, compared to the coverage of ecosystem services;
- Social impacts were significantly less considered in the literature, compared to ecosystem services and, to a lesser extent, economic impacts;
- The absence of a quantified BNG baseline, combined with an absence of monitoring data (in the public domain) across all studies to understand the impacts of the works, makes it difficult to understand the extent to which historic and current initiatives result in measurable net gain.

Data Management

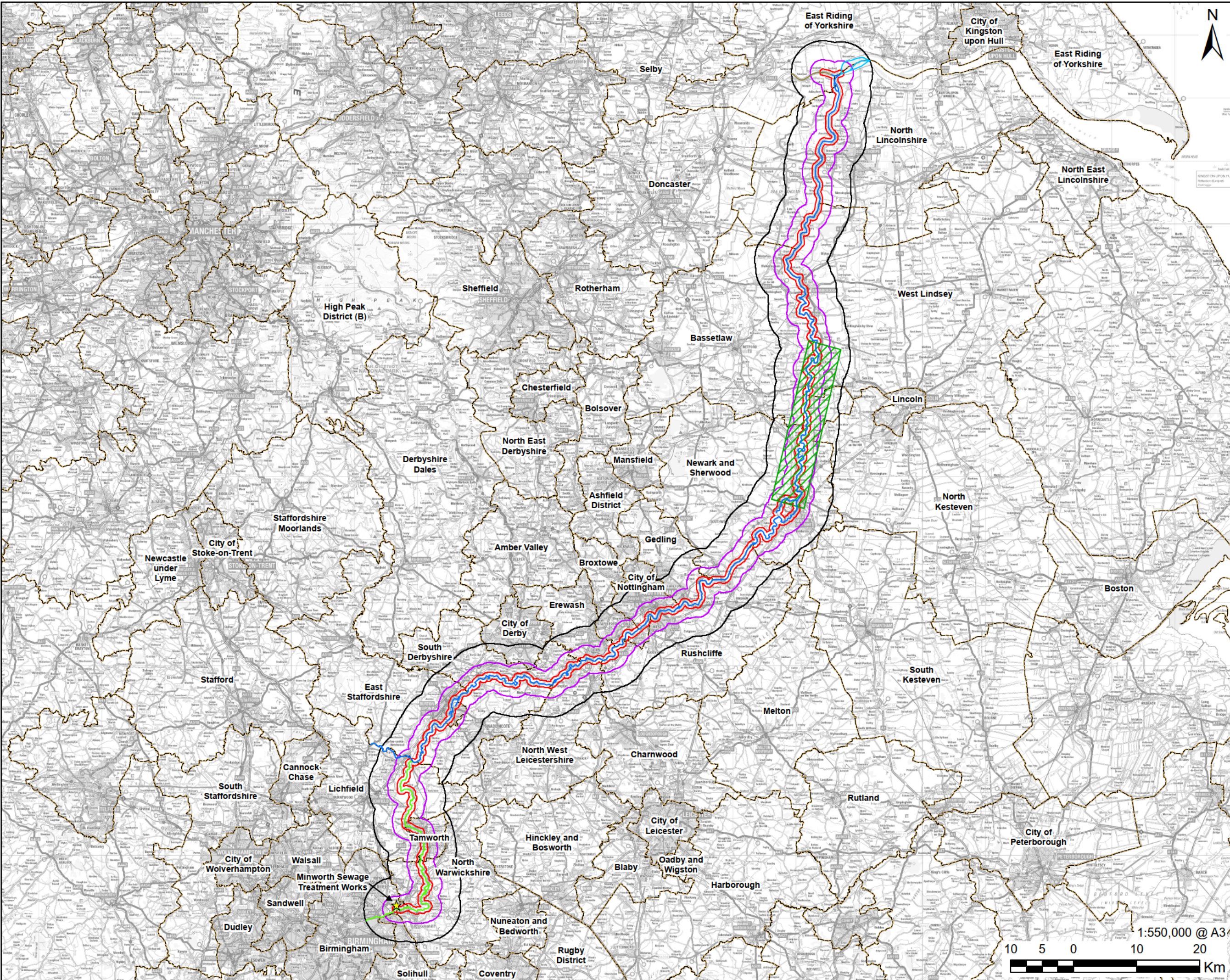
Topic 19 Data Management

5.2.15 Topic 19 effectively managed data across all topics to aid cross-referencing between topic areas, and to facilitate the visualisation of key components of the overall study. This topic provides an over-arching backbone of consistency across the baseline assessment and provides data for on-going assessment.

- Data pertaining to all topics is presented in databases and on the web GIS platform;

- Topic 19 details file names in the database, source organisation, data description, method of receipt or download URL, copyright, method of delivery to the client, licence restrictions and length of licence where appropriate.

Appendix A Figure 1: Study Area



PROJECT
Tame Trent and Humber
Hydrology, Ecology and
Environment

CLIENT
Affinity Water

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- LEGEND**
- ★ Minworth Sewage Treatment Works
 - River Humber
 - River Ouse
 - River Tame
 - River Trent *
 - 500m Study Area
 - 2km Study Area
 - 5km Study Area
 - Indicative Location of Proposed Abstraction from Trent for South Lincs Reservoir
 - District Boundary

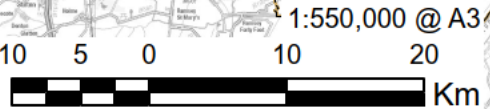
* The OS Open Rivers layer for the River Trent includes a spur extending upstream on the River Ouse, which overlaps part of the Ouse. Therefore, for completeness this has been included in the study area for the relevant Topics.

NOTES
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ISSUE PURPOSE
FINAL
PROJECT NUMBER

SHEET TITLE
Study Area

SHEET NUMBER
Figure 1b



Appendix B Legislation

The following environmental and wildlife legislation is relevant to the baseline assessment, and to any impact assessment undertaken in relation to the two schemes. Further detail of legislative drivers for each topic are presented in the individual topic appendices:

Water Industry and Water Resources

- Water Act 2014 [and Water Act 2003] – aims to reform the water industry to make it more innovative and responsive to customers and to increase the resilience of water supplies to natural hazards such as drought and floods;
- Water Resources Act 1991 – regulates water resources, water quality and pollution, and flood defence;
- Water Industry Act 1991 – sets out the main powers and duties of the water and sewerage companies, thus replacing those set out in the Water Act 1989;
- The Water Framework Directive (WFD; EC Directive 2000/60/EC) – aims to contribute to the progressive reduction of hazardous substances to water, promote sustainable water use, to contribute to the control of transboundary water problems, to protect aquatic ecosystems, and terrestrial ecosystems and wetlands directly depending on them, and to safeguard and develop the potential uses of Community waters;
- The Water Environment (Water Framework Directive [WFD]) (England and Wales) Regulations 2017 – establish a legislative framework for the protection of surface waters (including rivers, lakes, transitional waters and coastal waters) and groundwater throughout the EU. The Regulations transpose the WFD into law in England and Wales. This is currently being reviewed following Brexit;
- Groundwater Directive (2006/118/EC) and The Groundwater (England and Wales) Regulations 2009 – set groundwater quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater;
- Floods Directive 2007 – requires Member States to approach flood risk management in a three-stage process: undertake a preliminary flood risk assessment, develop flood hazard maps and flood risk maps and flood risk management plans must be drawn up for these zones;
- Floods and Water Management Act 2010 – provides for better, more comprehensive management of flood risk for people, homes and businesses, helps safeguard community groups from unaffordable rises in surface water drainage charges, and protects water supplies to the consumer;

Environmental Legislation

- Environment Protection Act 1990 – for example classifying waste containing INNS material as Controlled Waste;
- Environmental Permitting (England and Wales) Regulations 2016 – regulates offences related to regulated facilities, including waste operations, water discharge activities and flood risk activities;
- Environmental Damage (Preventions and Remediation) Regulations 2015 – implement the European Directive on Environmental Liability, based on the 'polluter pays principle' so those responsible prevent and remedy environmental damage, rather than the taxpayer paying;
- The Town and Country Planning (Environmental Impact Assessment) Regulations 2017, and the Town and Country Planning Act 1990 – provide local authorities with power to serve notices on owners or occupiers of land to control weeds that may be harming the amenity of the surrounding area;

Wildlife Legislation

- The Wildlife and Countryside Act (WCA) 1981 (as amended) – aims to prohibit certain methods of killing or taking wild animals, to restrict the introduction of certain animals and plants and to amend predecessor legislation;
- Natural Environment and Rural Communities (NERC) Act 2006 – Section 41 of the NERC Act (2006) provides a list of habitats and species of principal importance (formerly UK BAP Priority Habitats) for nature conservation in England which is to be used by decision-makers to guide the implementation of their duties under section 40 of the Act;

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (The 'Habitats Directive') and The Conservation of Habitats & Species Regulations 2017 (as amended) (the Habitats Regulations) – provide the protection of key habitats and species considered of European importance. ANNEX I of HD states the preservation, protection and improvement of the quality of the environment, including the conservation of natural habitats and of wild fauna and flora, are an essential objective of general interest pursued by the Community;
- The Invasive Alien Species (Enforcement and Permitting) Order 2019 (as amended) – The GB Invasive Non-native Species Strategy (Defra 2015) and the Invasive Alien Species (Enforcement and Permitting) Order 2019, direct landowners and managers to adopt a proactive biosecurity driven approach to INNS management, endorsed by EA, NE and Forestry Commission;
- The Invasive Non-native Species (Amendment etc.) (EU Exit) Regulations 2019 – ensure that the strict protections that are in place for INNS are maintained post-Brexit;
- The Bern Convention (1979), 'the Convention on the Conservation of European Wildlife and Natural habitats' – aims to ensure conservation and protection of all wild plant and animal species and their natural habitats (listed in Appendices I and II of the Convention), to increase cooperation between contracting parties, and to afford special protection to the most vulnerable or threatened species (including migratory species);
- The Salmon and Freshwater Fisheries Act (1975) – aims to protect all migratory and freshwater fish stocks, with a specific focus on salmon and trout, from activities that could result in direct mortality, barriers to migration and degradation of habitats;
- The Eels (England and Wales) Regulations 2009 – afford new powers to the EA to implement measures for the recovery of European eel stocks and have important implications for operators of abstractions and discharges;
- The 'UK Biodiversity Action Plan (UK BAP)', launched in 1994 – a framework and criteria for identifying species and habitat types of conservation concern. Action plans for priority habitats and species of conservation concern were published – UK BAP habitats/species. For the purpose of this assessment, the UK BAP is still used as one of the criteria to assist in assigning national value to an ecological receptor.

Regulatory Legislation

- National Parks and Access to the Countryside Act 1949 – provides Public Rights of Way and access to open land;
- Infrastructure Act 2015 – Environmental authorities may issue control orders under which landowners can be obligated to carry out species control operations for invasive non-native animal and plant species;
- Anti-social Behaviour, Crime and Policing Act 2014 and Community Protection Notices – may be utilised to issue Community Protection Notices in relation to INNS;
- Countryside and Rights of Way (CROW) Act 2000 – gives public right of access to land mapped as 'open country' (mountain, moor, heath and down) or registered common land - 'open access land';

Navigation Legislation

- Navigation Legislation – The historic functions of the British Waterways Board were transferred to The Canal and River Trust under the British Waterways Board (Transfer of Functions) Order 2012 and includes the relevant legislation of the Transport Act 1962 and Transport Act 1968 (both as amended by the 2012 transfer of functions).
- The Associated British Ports Act 1987 – Associated British Ports is the Statutory Harbour Authority for the River Trent upstream to the south side of the Stone Bridge at Gainsborough (i.e. from the downstream extent at the confluence with the Humber, to the road bridge at Gainsborough) as per The Associated British Ports Act 1987, section 12 (Humber Byelaws).

In addition to the legislative instruments listed above, the Draft Environment Bill and the National Planning Policy Framework each embed the concept of measurable net gains for biodiversity.

