

# NWT-G02-006-007

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United Utilities

# North West Transfer Strategic Resource Option

Gate 2: Initial Environmental Appraisal



## Report for

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4.	Final Report	11/11/2022

# Non-technical Summary

## Introduction

This non-technical Summary (NTS) provides an overview of the Initial Environmental Appraisal (IEA) of the North West Transfer (NWT) Strategic Resource Option (SRO). The IEA supports United Utilities' (UU) Gate 2 submission to the Regulators Alliance for Progressing Infrastructure Development (RAPID). It collates and integrates the results of the Gate 2 environmental assessments to present an overview of the potential environmental effects of the SRO. Where appropriate, measures to mitigate the negative effects of the SRO have been identified, together with opportunities to deliver additional benefits.

## What is the NWT SRO?

The NWT SRO is one of 17 schemes proposed by Ofwat in the PR19 final determination to help meet projected water supply deficits due to population growth and climate change. The scheme is a combination of the United Utilities Sources and Vyrnwy Aqueduct SROs, both having progressed through Gate 1 of RAPID's gated process.

The NWT SRO promotes best value source sub-options, selected to facilitate transfer volumes into the River Severn as part of the Severn Thames Transfer (STT) SRO. The NWT SRO provides additional water resources to be used if water were to be transferred out of the region, maintaining resilience for customers in the North West.

The NWT SRO comprises of two principal components:

- New sources, and increased use of existing sources, to offset water transferred out of region; and
- Enabling works on the Vyrnwy Aqueduct to allow treated water from regional UU sources to be transferred by pumping into the Vyrnwy Aqueduct.

A total of 14 sub-options are proposed for the NWT SRO and these are shown in **Figure 1.1**. The source sub-options are geographically spread across UU's supply area and include groundwater and river abstractions, as described in **Table NST.1**.

Table NTS.1 Sub-Options included in the NWT SRO

Option ID	Option name	Description	Capacity (MI/d)	Part of NWT Full Solution?
WR015	[REDACTED]	[REDACTED]	40	Yes
WR049d	[REDACTED]	[REDACTED]	40	Yes
WR076	[REDACTED]	[REDACTED]	25	Yes
WR102b	[REDACTED]	[REDACTED]	17	Yes



Option ID	Option name	Description	Capacity (MI/d)	Part of NWT Full Solution?
WR105a1	[REDACTED]	[REDACTED]	4.5	No
WR106b	[REDACTED]	[REDACTED]	8.5	No
WR107a2	[REDACTED]	[REDACTED]	10	Yes
WR107b	[REDACTED]	[REDACTED]	12	Yes
WR111	[REDACTED]	[REDACTED]	9	Yes
WR113	[REDACTED]	[REDACTED]	3	Yes
WR144	[REDACTED]	[REDACTED]	5	No
WR149	[REDACTED]	[REDACTED]	13	Yes
STT041b	[REDACTED]	[REDACTED]	58	No
STTA4	[REDACTED]	[REDACTED]	n/a	Yes

\*MI/d = mega litres per day.

Of the 13 source sub-options, nine are included in the NWT SRO Full Solution (alongside the Vyrnwy Enabling Works), with the remaining four held in reserve. The Full Solution has a capacity of 167MI/d required to support trading of up to 205MI/d.

## What is the Gate 2 Environmental Assessment Process?

UU's Gate 2 submission is supported by a range of assessments to understand the potential environmental effects of the NWT SRO. The assessments initially comprised individual sub-option assessments. For the five groundwater sub-options, the assessment work focussed on improving the conceptualisation of the key environmental impacts regarding water quantity and water quality. For the eight surface water sub-options, the assessment focussed on understanding the potential influence of the abstractions on river flow, and the resulting impacts on water quality and ecology. This assessment work is presented in two reports; Assessment of Sub-Options Involving Groundwater Abstractions<sup>1</sup> and Assessment of Sub-Options Involving Surface Water Abstractions<sup>2</sup> (referred to as the Sub-Option Assessment Reports).

These sub-option assessments have been used to inform an update of the Water Framework Directive (WFD) Compliance Assessment, Informal Habitats Regulations Assessment (HRA), Invasive Non-native Species Assessment and Natural Capital (NC) and Biodiversity Net Gain (BNG) Assessment completed for Gate 1 as well as this IEA. These 'overarching assessments' have considered both the effects of the individual sub-options and, additionally, the cumulative effects of the NWT SRO Full Solution.

<sup>1</sup> Wood (2022) North West Transfer Strategic Resource Option Gate 2: Assessment of Options Involving Surface Water Abstractions.

<sup>2</sup> Wood (2022) North West Transfer Strategic Resource Option Gate 2: Assessment of Options Involving Groundwater Abstractions.



## What is Integrated Environmental Appraisal?

RAPID's Gate 2 guidance<sup>3</sup> requires the submission of an IEA. The IEA of the NWT SRO draws together and summarises the results of the sub-option assessments and other overarching assessments but also considers a wider range of environmental effects.

Specifically, the IEA considers the effects of the NWT SRO in respect of the following topics:

- Population (socio-economics);
- Health;
- Biodiversity, flora and fauna;
- Land use, geology, geomorphology and soils;
- Water:
  - Hydrology;
  - Groundwater;
  - Water quality.
- Flood risk;
- Noise and vibration;
- Air quality;
- Climate change (including greenhouse gas emissions and resilience);
- Traffic and transport;
- Resource use and waste management;
- Historic environment;
- Landscape and visual.

## How have the Environmental Effects of the NWT SRO been Assessed in the IEA?

The IEA of the NWT SRO has been undertaken in three stages, as follows:

- **Stage 1:** Appraisal of NWT SRO sub-options;
- **Stage 2:** Appraisal of the NWT SRO Full Solution in terms of the cumulative effects of the component sub-options;
- **Stage 3:** Appraisal of the effects of the NWT SRO Full Solution in-combination with other plans, programmes and projects.

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<sup>3</sup> RAPID (2022) *Strategic regional water resource solutions guidance for gate two*, April 2022. Available online: [https://www.ofwat.gov.uk/wp-content/uploads/2022/02/Strategic-regional-water-resource-solutions-guidance-for-gate-two\\_RAPID.pdf](https://www.ofwat.gov.uk/wp-content/uploads/2022/02/Strategic-regional-water-resource-solutions-guidance-for-gate-two_RAPID.pdf).



Both the construction and operational effects of each sub-option and of the NWT SRO Full Solution have been assessed on a topic-by-topic basis. The sub-options and NWT SRO Full Solution have been assessed based on the nature of the effect, its timing and geographic scale, the sensitivity of the human or environmental receptor that could be affected, and how long any effect might last. Appraisal matrices have been used to capture the assessment of each sub-option in a consistent manner. The appraisal matrices are presented at **Appendix B**; and a summary is provided in **Section 3**.

The significance of effects for each topic has been categorised based on the following:

- Major effect (likely significant);
- Moderate effect (not significant);
- Minor effect (not significant);
- Negligible effect (not significant).

Specific thresholds have been developed for what constitutes a major, moderate, minor and negligible effect for each topic. These significance thresholds are shown in **Appendix A** of the IEA report.

Measures embedded into the design of the sub-options have been taken into account in the appraisal; opportunities for further mitigation and enhancement have also been identified in considering the effects of the NWT SRO Full Solution.

The assessment of environmental effects has been informed by an analysis of baseline environmental information for each topic, the Sub-Option Assessment Reports, the other overarching assessments and the Strategic Environmental Assessment (SEA) undertaken of the SRO sub-options in support of the Water Resources West (WRW) Regional Plan and UU's draft Water Resources Management Plan 24 (WRMP24).

**Section 2** of the IEA report provides further information in relation to the approach to the assessment of the NWT SRO.

## What are the Likely Significant Environmental Effects of the NWT SRO Full Solution?

The appraisal of the NWT SRO Full Solution is presented on a topic-by-topic basis in **Section 4**. For each topic, information is provided relating to:

- Aspects of water resources infrastructure relevant to the topic being considered;
- The environmental baseline;
- Embedded mitigation and enhancement measures;
- Appraisal of effects of the NWT SRO Full Solution sub-options (with a focus on where potentially major (likely significant) and moderate effects have been identified);
- Appraisal of the cumulative effects of the NWT SRO Full Solution (again, with a focus on where potentially major (likely significant) and moderate effects have been identified);



- Additional mitigation and enhancement measures; and
- Residual effects and uncertainties.

## Significant Construction Effects

Construction of the NWT SRO Full Solution would represent a substantial capital investment which is likely to generate considerable employment opportunities and supply chain benefits, as well as increased spend in the local economy by contractors and construction workers, over a sustained period. This socio-economic benefit has been assessed as a **major (likely significant) positive effect**.

Emissions to air (principally associated with vehicle movements) would be generated during the construction phase and could affect local air quality, including within the Liverpool City and Greater Manchester Combined Authority Air Quality Management Areas (AQMAs). Whilst any effects would be temporary, this has been assessed as a **major (likely significant) negative effect**. However, it is anticipated that there will be a transition to low emission/electric vehicles over the implementation period of the NWT SRO Full Solution. Therefore, it is predicted that the air quality effects of the SRO would be reduced to **minor negative**, with appropriate mitigation including the implementation of Construction Environmental Management Plans (CEMPs).

The embodied carbon associated with the NWT SRO Full Solution would be 211,290 tCO<sub>2</sub>e and, therefore, the NWT SRO Full Solution has been assessed as having potentially **major (likely significant) negative** carbon effects. However, with the progression of sub-option design from concept to detailed and implementation of additional mitigation measures such as a Carbon Management Plan, the adverse construction effects on climate change could be reduced to at least a **minor negative effect**.

Construction of the NWT SRO Full Solution would generate a substantial volume of vehicle movements, potentially causing congestion and driver delay on the local and strategic road network. This has been assessed as a **major (likely significant) negative effect**. However, with implementation of additional mitigation measures (such as Construction Traffic Management Plans), construction traffic and transport effects of the NWT SRO Full Solution are predicted to be reduced from major to **moderate negative**.

Construction of the NWT SRO Full Solution sub-options would require a substantial volume of materials and energy which has been assessed as a **major (likely significant) negative effect**. Construction waste would also be generated during the construction of the NWT SRO Full Solution which could affect the capacity of receiving waste management facilities. At this stage, a **major (likely significant) negative effect** has been identified.

No further major (likely significant) construction effects have been identified.

There is the potential for construction associated with the NWT SRO Full Solution to result in negative effects in respect of the other IEA topics including, for example, health, biodiversity and landscape. However, it is not predicted that these effects would be significant and, further, it is likely that mitigation measures could be employed to avoid/mitigate effects at the project stage.



## Significant Operational Effects

The NWT SRO Full Solution provides new sources to be brought online if water were to be transferred out of region, maintaining resilience for customers in the North West and indirectly helping to ensure a continual supply of drinking water in the South East region. This will, in-turn, support population and economic growth. In total, the NWT SRO will provide an additional capacity of up to 169.8 MI/d which has been assessed as a **major (likely significant) positive effect** in respect of the population, health and climate change IEA topics.

The operation of the NWT SRO Full Solution sub-options would generate operational emissions of 36,608 tCO<sub>2</sub>e/year; there would also be carbon emissions associated with operational vehicle movements. The NWT SRO Full Solution has therefore been assessed as having potentially **major (likely significant) negative** carbon effects as well as in respect of resource use. However, as for construction, the implementation of Carbon Management Plans would reduce the magnitude of these effects.

No further major (likely significant) operational effects have been identified.

Operation of the NWT SRO Full Solution would involve the abstraction of circa 105 MI/d from rivers and 64.8 MI/d from groundwater sources which has the potential to affect (i) deterioration of WFD status and/or (ii) the ability of a waterbody to attain its target status. The abstraction of water may also result in negative ecological effects, both alone and at the solution level.

There remains some uncertainty regarding the likelihood of these effects occurring and their magnitude and further evidence and assessment is required before Gate 3 in order to determine the potential effects of abstraction on waterbodies and associated ecological receptors. At this stage, **moderate negative effects** have been identified in respect of the biodiversity and water IEA topics, on a precautionary basis and recognising that residual uncertainties remain.

## What are the In-combination Effects Associated with the NWT SRO Full Solution?

The cumulative effects of the NWT SRO Full Solution in-combination with other plans, programmes and projects are assessed in **Section 5**. The other plans, programmes and projects considered for their in-combination effects with the NWT SRO Full Solution include:

- Other UU plans (the draft WRMP24, Drought Plan and Drainage and Wastewater Management Plan (DWMP));
- The WRW Regional Plan, adjacent water company plans (WRMPs) and projects (SROs);
- Local plans and strategies and National Policy Statements (NPSs);
- Nationally Significant Infrastructure Projects (NSIPs);
- High Speed 2 (HS2); and
- Major planning applications.

The cumulative effects of the NWT SRO Full Solution in-combination with other plans and projects are difficult to accurately assess at this stage given the inherent uncertainties concerning (*inter alia*): future changes to baseline environmental conditions; future population and economic



growth; the deliverability of some NSIPs (and the potential for new NSIPs to be brought forward); future major planning applications; and the proposals of emerging water company plans and projects. These factors will be kept under review in subsequent gates.

At this stage, **no significant in-combination effects** have been identified.

## What are the Next Steps?

The aim of the Gate 2 environmental assessments has been to establish the feasibility of the NWT SRO by understanding key environmental risks and how they may be mitigated. The assessments completed for Gate 2 including the IEA have not indicated that any sub-options are unfeasible, but key risks and uncertainties remain (as set out in **Table 6.1**), and further evidence is needed to demonstrate that sub-options will be compliant with environmental regulations.

It is anticipated that all the NWT sub-options would be consented individually under the Town and Country Planning Act 1990, either under permitted development rights and/or express planning permissions. The five new river sub-options and one of the groundwater sub-options would require new abstraction licences, and one groundwater sub-option would require a variation to an existing abstraction licence. The remaining six groundwater sub-options would operate within current conditions/limits on existing abstraction licences.

UU is proposing that Gate 3 will coincide with the submission of planning applications and abstraction licence applications. Gate 3 is likely to be phased, depending on the programme for delivering each sub-option, with the earliest Gate 3 and planning applications to be made in December 2024. A Gate 3 Checkpoint will occur in December 2023, following the adoption of UUs WRMP24, and progression of Gate 3 investigations and assessments, at which the Full Solution and implementation programme will be confirmed.

During Gate 3, UU will undertake surveys, modelling and assessment to support the regulatory requirements for planning applications (including Environmental Impact Assessments where required) and abstraction licence applications. **Section 6.4** provides a summary of the activities that will be undertaken during Gate 3 (the Forward Plan), with more detail presented in the Environment Monitoring & Assessment Plan included as **Appendix C**.

In the closing stages of Gate 2 and early stages of Gate 3 method statements will be prepared for each of the activities identified in the Forward Plan, which will enable methods, locations, timings and frequency/durations of the surveys, and the scope and methods for modelling and other desk-based assessments be agreed with the NAU.



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# 1. Introduction

## 1.1 Purpose of this Report

1.1.1 This report presents an Initial Environmental Appraisal (IEA) of the North West Transfer Strategic Resource Option (NWT SRO). It supports United Utilities' (UU) Gate 2 submission to the Regulators Alliance for Progressing Infrastructure Development (RAPID), and collates and integrates the results of the Gate 2 environmental assessments<sup>4</sup> to present an overview of the potential environmental impacts from the SRO, as well as potential benefits and opportunities.

## 1.2 RAPID Gate 2 Requirements

1.2.1 The purpose of RAPID Gate 2 is to enable detailed feasibility, concept design and multi-solution decision making, building on the work undertaken during Gate 1 to further develop the NWT SRO programme and sub-option design. The NWT SRO is following the standard Gate 2 requirements and timelines<sup>5</sup>. For Gate 2, RAPID requires an updated (from Gate 1) environmental feasibility statement, which is informed by a Water Framework Directive (WFD) Compliance Assessment, an informal Habitats Regulation Assessment (HRA) and consideration of biodiversity net gain (BNG) and natural capital (NC). The feasibility statement should be supported by an Initial Environmental Appraisal (this report), and include an assessment of the whole life carbon cost of the SRO and how opportunities for carbon reductions have been considered, and where appropriate, incorporated with the SRO.

## 1.3 The North West Transfer SRO

1.3.1 The NWT SRO is one of 17 schemes promoted by Ofwat in the PR19 Final Determination to identify new strategic water resources to meet projected supply deficits as a consequence of population growth and climate change. The NWT SRO is a combination of the United Utilities Sources (UUS) and Vyrnwy Aqueduct (UUVA) SROs, both of which progressed through Gate 1 RAPID gated process.

1.3.2 The NWT SRO promotes best value source sub-options, selected to facilitate transfer volumes<sup>6</sup> into the River Severn as part of the Severn Thames Transfer (STT) SRO. The NWT SRO provides additional water resources to be used if water were to be transferred out of region, maintaining resilience for customers in the North West. The NWT SRO comprises two principal components:

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<sup>4</sup> Water Framework Directive (WFD) Compliance Assessment, informal Habitats Regulation Assessment (HRA), Invasive non-Native Species (INNS) Assessment, Natural Capital Assessment (NCA) and Biodiversity Net Gain (BNG) Assessment

<sup>5</sup> RAPID (2022) *Strategic regional water resource solutions guidance for gate two*, April 2022. Available online:

[https://www.ofwat.gov.uk/wp-content/uploads/2022/02/Strategic-regional-water-resource-solutions-guidance-for-gate-two\\_RAPID.pdf](https://www.ofwat.gov.uk/wp-content/uploads/2022/02/Strategic-regional-water-resource-solutions-guidance-for-gate-two_RAPID.pdf)

<sup>6</sup> Could be either by the release of raw water directly from Lake Vyrnwy into River Vyrnwy or transferred through a new River Vyrnwy bypass pipeline



- New sources, and increased use of existing sources to offset water transferred out of region from Lake Vyrnwy as part of the STT SRO; and
- Enabling works on the Vyrnwy Aqueduct to allow treated water from regional UU sources to be transferred by pumping into the Vyrnwy Aqueduct to maintain customer supplies (for transfer volumes greater than 50MI/d).

1.3.3 A total of 14 sub-options are proposed for the NWT SRO (13 supply sub-options and one enabling works sub-option). The source sub-options are geographically spread across UU's supply area, and include groundwater and river abstractions. Of the 13 source sub-options, nine are included in the NWT Full Solution, with the remaining four held in reserve. The Full Solution has a capacity of 167MI/d which is the capacity required to support trading of up to 205MI/d. The sub-options are summarised in **Table 1.1** and shown on **Figure 1.1**.

Table 1.1 Sub-Options included in the NWT SRO

Option ID	Option name	Description	Capacity (MI/d)	Part of NWT Full Solution?
WR015	[REDACTED]	[REDACTED]	40	Yes
WR049d	[REDACTED]	[REDACTED]	40	Yes
WR076	[REDACTED]	[REDACTED]	25	Yes
WR102b	[REDACTED]	[REDACTED]	17	Yes
WR105a1	[REDACTED]	[REDACTED]	4.5	No
WR106b	[REDACTED]	[REDACTED]	8.5	No
WR107a2	[REDACTED]	[REDACTED]	10	Yes
WR107b	[REDACTED]	[REDACTED]	12	Yes
WR111	[REDACTED]	[REDACTED]	9	Yes
WR113	[REDACTED]	[REDACTED]	3	Yes
WR144	[REDACTED]	[REDACTED]	5	No
WR149	[REDACTED]	[REDACTED]	13	Yes
STT041b	[REDACTED]	[REDACTED]	58	No
STTA4	[REDACTED]	[REDACTED]	n/a	Yes

## 1.4 Selection of the Gate 2 Sub-Options and Full Solution

1.4.1 At Gate 1 UU selected 27 sub-options to potentially support the STT SRO. During the early stages of Gate 2, this long list of sub-options was reduced to the 14 sub-options



which make up the NWT SRO, and nine sub-options were selected for the NWT SRO Full Solution. The selection of the Gate 2 sub-options and the Full Solution is aligned to the WRMP24 and Regional Plan best value assessment and includes factors such as cost, carbon cost, drought resilience, flood risk, human and social wellbeing, ecosystem resilience, customer supply resilience and multi-abstractor benefits (water quality and quantity). More information on the sub-option selection process is provided in **Sections 3.2 and 4.2 of UU's Detailed Feasibility and Concept Design Report.**

- 1.4.2 During Gate 2 UU has used the results of environmental assessments to inform the selection of sub-options and influence the design process. Examples include:
- Removal of a proposed increased reservoir abstraction as the yield would not have been environmentally sustainable;
  - Changed a sub-option from transfer of raw river water to a reservoir to transfer direct to a water treatment works to reduce the risk of transfer of INNS (invasive non-native species) between source and receiving waters;
  - Inclusion of "hands off flow" assumptions for new river abstractions;
  - Revised routes and locations of infrastructure to avoid designated sites such as Sites of Special Scientific Interest, ancient woodlands etc.
- 1.4.3 A number of sub-options were also removed from Gate 2 as a result of completion of UU's AMP7 Water Industry National Environment Programme (WINEP) WFD no deterioration investigations in March 2022.

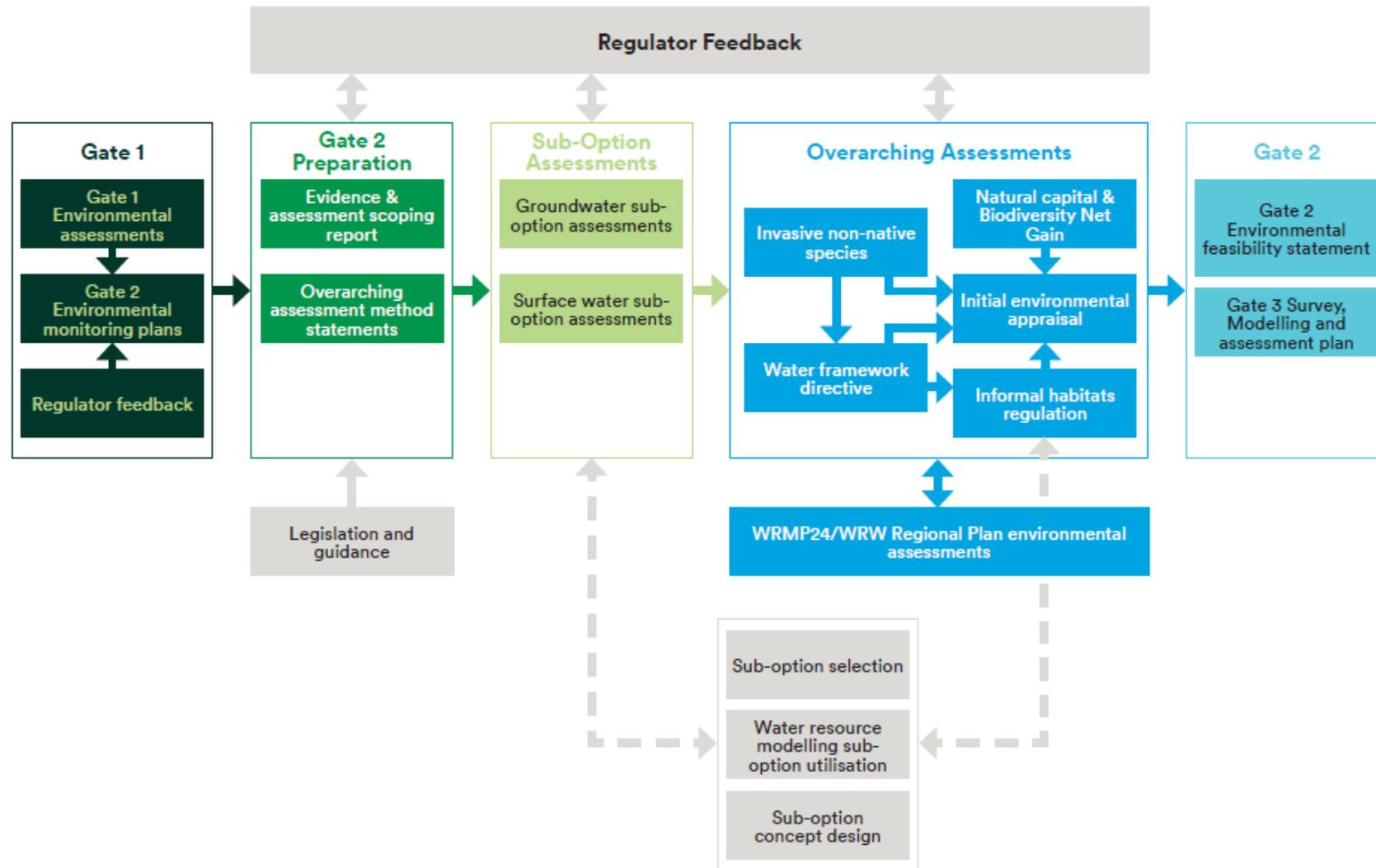
## 1.5 Environmental Assessment in Gate 2

- 1.5.1 For RAPID Gate 1, UU prepared a preliminary environment feasibility statement for the UUS and UUVA SROs. For Gate 2, the two SROs have been combined into a single SRO, the NWT SRO. The Gate 1 environment feasibility statements were aligned with the principles of Strategic Environmental Assessment (SEA), HRA and WFD assessment, and included high-level NC, BNG, and INNS assessment. Reflecting when the Gate 1 work was completed, the assessment methodologies used were consistent with Water Resource Management Plan 2019 (WRMP19) approaches.
- 1.5.2 During Gate 2, the Gate 1 environmental assessments have been updated to meet the requirements of RAPID's Gate 2 Guidance, and to align with the draft Water Resources management Plan 2024 (dWRMP24) and the Water Resources West (WRW) emerging Regional Plan. The methodologies used are consistent with legislation<sup>7</sup> and follow relevant guidance including that provided by the All Company Working Group (ACWG). The structure of the Gate 2 environmental assessments is presented in **Figure 1.2** and described below.

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<sup>7</sup> Legislation as relates to England. The NWT SRO includes no source options in Wales. A 7 km section of the Vyrnwy Aqueduct to the northeast of Oswestry passes through Wales, but at the time of writing no construction activities are confirmed in this section, so the Environment (Wales) Act and the Wellbeing of Future Generations (Wales) Act do not apply. The detailed design of the enabling works will continue to be progressed following Gate 2. Should further design work identify that works are required within Wales, this will be assessed in Gate 3 and beyond, including in the context of relevant Welsh legislation.

Figure 1.2 Gate 2 Environmental Assessments





- 1.5.3 The Gate 2 assessment work began with an evidence and assessment scoping exercise which identified the key potential environmental risks associated with the SRO that have the potential to influence the selection of the sub-options ultimately taken forward as part of the NWT SRO and/or affect the overall feasibility of the SRO. The most significant environmental risks are those associated with the operation of new or increased river and groundwater abstractions.
- 1.5.4 The scoping exercise selected environment topics that would be the focus of the Gate 2 sub-option environment assessments. The selection of topics was informed by the evidence review undertaken as part of the scoping study, the findings of the Gate 1 environmental assessments and engagement with regulators. Operational impacts on the following topics are considered in the sub-option environmental assessments:
- Aquatic (including wetland) ecology;
  - INNS;
  - Water quantity; and
  - Water quality.
- 1.5.5 Other environmental impacts and topics (e.g. impacts arising from construction activities) are not considered in the sub-option environment assessments at Gate 2 but are considered at a higher level as part of the overarching environmental assessments (WFD, HRA, BNG, NC, INNS, and this IEA).
- 1.5.6 The evidence and assessment scoping exercise also set out the data gathering and assessment work required during Gates 2 and 3 to better understand and address the most significant environmental risks and set out the methodology for doing so. This was followed by the sub-option environmental assessments of the 13 source sub-options which considered the four key topics listed above.
- 1.5.7 For the five groundwater sub-options, the assessment work focussed on improving the conceptualisation of the key environmental impacts regarding water quantity and water quality. For each sub-option, a hydrogeological conceptual model was developed based on existing data, to identify the potential linkages between increased abstraction and likely impact on groundwater, dependent surface water bodies, GWDTes and saline intrusion.
- 1.5.8 For the eight surface water sub-options, the assessment focussed on understanding the potential influence of the abstractions on river flow, and the resulting impacts on water quality and ecology. The assessments predominantly relied on existing environmental data, to undertake assessments of:
- The baseline environment (including geomorphology, physical habitat availability, water quality, and ecology);
  - The impact of the proposed abstractions on river flows;



- The potential for the baseline geomorphology, physical habitat availability, and water quality to be altered by the predicted changes in river flows;
- The potential for ecological receptors to be impacted by the predicted changes in river flows, water quality, geomorphology and habitat, and
- A review of potentially relevant designated sites.

1.5.9 The sub-option assessments were used to inform an update of the Gate 1 WFD, HRA, INNS, NC and BNG assessments. These “overarching” assessments consider the individual sub-options, and present a cumulative assessment of the NWT SRO Full Solution, and an in-combination assessment of the NWT SRO with other plans and projects. Prior to the preparation of the overarching assessments a method statement was produced which set out how the Gate 2 assessments would be undertaken and how they aligned with the WRMP24 and WRW Regional Plan environmental assessments. This was agreed with the National Assessment Unit (NAU).

1.5.10 The final stage of the Gate 2 environmental assessment was the production of this IEA report which pulls together and summarises the results of the sub-option and overarching assessments. It also considers a wider range of environmental topics as set out in **Section 2.3**. This report forms a standalone document, and further details of the environmental assessments can be found in the Technical Appendices which support the Gate 2 submission and are listed in **Table 1.2**.

**Table 1.2 Gate 2 Environment Technical Appendices**

ID	Title
NWT-G02-006-001	Assessment of Sub-Options Involving Groundwater Abstractions*
NWT-G02-006-002	Assessment of Sub-Options Involving Surface Water Abstractions*
NWT-G02-006-003	Water Framework Directive (WFD) Compliance Assessment
NWT-G02-006-004	Informal Habitats Regulation Assessment (HRA)
NWT-G02-006-005	Invasive non-Native Species (INNS) Assessment
NWT-G02-006-006	Biodiversity Net Gain (BNG) and Natural Capital (NC) Assessment
NWT-G02-006-007	Initial Environmental Appraisal Report (IEAR): <b>this document</b>

\*Referred to as Sub-Option Assessment Reports.

## 1.6 Relationship with WRMP24 and Regional Plans,

1.6.1 The NWT SRO is being developed in the context of the WRW Regional Plan and UU’s WRMP24.



- 1.6.2 The WRW Regional Plan covers the management of water resources in the North West of England, the West Midlands and the cross-border catchments with Wales. It includes all or part of the operational areas of Dŵr Cymru Welsh Water (DCWW), Hafren Dyfrdwy, Severn Trent Water (STW), South Staffordshire Water (SSW) and UU. WRW is taking an integrated approach to preparing the Regional Plan and the WRMPs and aims to provide a Regional Plan that is multi-sector and takes account of the water supply needs of non-public water supply (non-PWS) abstractors as well as public water supplies. WRW member water companies have used a regionally consistent set of methodologies to reflect local, regional and national needs into the development of the plans.
- 1.6.3 The WRW Regional Plan covers the period 2025 to 2085 and addresses long-term regional and inter-regional, multi-sectoral water resources management pressures and draws on water resource options from the member water companies' WRMP24s, as well as the SROs being taken forward by the companies. In this context, several of the SRO sub-options are included within the Regional Plan and preferred plan for UU's WRMP24 as to facilitate a trade from the Vyrnwy system to support wider regional needs. These comprise sub-options WR015, WR049d, WR076, WR107a2, WR111, WR113, WR149, and the Vyrnwy Aqueduct enabling works. One reasonable alternative plan has also been considered in the draft WRMP24 which includes in addition sub-options WR102b and WR107b, ensuring full alignment with the NWT SRO Full Solution.

## 1.7 Consultation and Engagement

- 1.7.1 Throughout Gate 2 UU has actively engaged with the NAU (including the Environment Agency (EA) and Natural England (NE), and supported by Natural Resources Wales (NRW)). A summary of meetings held with the NAU is presented in **Table 1.3**.
- 1.7.2 Engagement with the NAU and NRW has comprised a series of approximately monthly Environment Workstream Progress Meetings. The purpose of these meetings was to keep the NAU and NRW up to date with progress and plans and to resolve any issues arising.
- 1.7.3 In addition to the monthly Progress Meetings, a series of additional workshops were held with the NAU to discuss specific issues or discuss regulator feedback on the draft technical appendices. All the environment technical appendices, plus the evidence and scoping report and the overarching assessment method statement have been issued to the NAU for review and comment. All comments have been actioned as appropriate and responses provided in a comments log for each technical appendix.

**Table 1.3 Summary of NWT Specific Regulator Engagement**

Month	Meeting/Workshop	Attendees
September 2021	Gate 2 Introduction Meeting	NAU, NRW
November 2021	Monthly Engagement Meeting	NAU, NRW, RAPID



Month	Meeting/Workshop	Attendees
December 2021	Monthly Engagement Meeting	NAU
January 2022	Monthly Engagement Meeting	NAU, RAPID
February 2022	Monthly Engagement Meeting Part 1 Monthly Engagement Meeting Part 2	NAU, NRW, RAPID NAU
March 2022	Monthly Engagement Meeting Introduction to the Evidence and Assessment Scoping Report	NAU, RAPID NAU, EA
April 2022	Monthly Engagement Meeting Evidence and Assessment Scoping Feedback Meeting Groundwater Model Meeting	NAU NAU EA
May 2022	Groundwater Model Meeting	EA
June 2022	Method Statement Feedback Meeting Groundwater Model Meeting	NAU, EA EA
July 2022	Monthly Engagement Meeting Sub-option Utilisation Meeting	RAPID RAPID, NE, EA
August 2022	Feedback Meeting for Groundwater and Surface Water Sub-Option Assessment Reports Groundwater Model Meeting Monthly Engagement Meeting	NAU, EA, NE, RAPID EA NAU, RAPID
September 2022	Groundwater Model Meeting Monthly Engagement Meeting Sub-option Utilisation Meeting & Representation in WRMP (x2)	EA NAU, RAPID EA, NE, RAPID
October 2022	Sub-option Utilisation Meeting & Representation in WRMP (x2) Monthly Engagement Meeting IEA Report Review Meeting	EA EA, NE, RAPID NAU

1.7.4 In addition to the NWT environment workstream specific consultation described above, UU has also engaged more widely with stakeholders via the medium of the regional planning process. These initial consultations indicate stakeholders are favourable towards water trading in principle, but also the importance of protecting the environment and realising opportunities for environmental net gain to customers in the North West. More information on these consultations is presented in **Section 9** of UU's **Detailed Feasibility and Concept Design Report**.

## 1.8 Structure of this Report

1.8.1 Following this introductory section, the methodology for the IEA is explained in **Section 2**. **Section 3** presents the appraisal of the individual sub-options which make up the NWT SRO, and **Section 4** presents the appraisal of the NWT SRO Full Solution. **Section 5**



considers in-combination effects of the NWT SRO with other plans and projects, and **Section 6** presents a summary and looks ahead to Gate 3.

1.8.2 Figures 1.1, 4.1 to 4.7 and 4.9 to 4.12 are presented after page 154 of the report. The following appendices are also included in the report:

- **Appendix A:** Thresholds of Significance;
- **Appendix B:** Sub-Option Environmental Appraisal Tables;
- **Appendix C:** Gate 3 Environment Monitoring & Assessment Plan.

1.8.3 The IEA meets the requirements for environment appraisal as set out in RAPID's Gate 2 Guidance. However, some requirements are presented elsewhere in UU's Gate 2 submission and have not been repeated here for brevity. **Table 1.4** sets out where in this IEAR or in UU's **Detailed Feasibility and Concept Design Report** (the Gate 2 submission document) the environmental appraisal requirements have been addressed.

**Table 1.4 Gate 2 Environmental Appraisal RAPID Requirements**

No.	Requirement	Where Met
1	An update of the Gate 1 work where relevant	Updated WFD, HRA, INNS, NC and BNG assessments are presented in the Gate 2 Submission Environment Technical Appendices: <ul style="list-style-type: none"> <li>• <b>NWT-G02-006-003: Water Framework Directive (WFD) Compliance Assessment</b></li> <li>• <b>NWT-G02-006-004: Informal Habitats Regulation Assessment (HRA)</b></li> <li>• <b>NWT-G02-006-005: Invasive Non-Native Species (INNS) Assessment</b></li> <li>• <b>NWT-G02-006-006: Biodiversity Net Gain (BNG) and Natural Capital (NC) Assessment</b></li> </ul>
2	The environmental appraisal work undertaken to date – likely to be at a strategic scale.	An overview is presented in <b>Section 1</b> of this IEAR, with details in the <b>Technical Appendices</b> and <b>Sections 2 – 5</b> of this IEAR.
3	Baseline and analysis – this might include results of monitoring, modelling, environmental surveys, etc.	Sub-option specific baseline descriptions and environmental assessment/analysis are presented in <b>NWT-G02-006-001: Assessment of Sub-Options Involving Groundwater Abstractions</b> and <b>NWT-G02-006-002: Assessment of Sub-Options Involving Surface Water Abstractions</b> .
4	Options assessment, with sufficient detail to allow comparison of options within the solution and identify potential effects (positive and negative) and opportunities.	<b>Section 3</b> and <b>Appendix B</b> of this IEAR.
5	Assessment of the effects of the solution, an evaluation of their	<b>Section 4</b> of this IEAR.



No.	Requirement	Where Met
	significance and any cumulative or in-combination effects.	
6	Clear justification as to options within the solution discounted, those taken forward, and the preferred option selected. Where the preferred option is identified, potential environmental effects and opportunities should be discussed.	Full description is provided in <b>Section 3.2 and 4.2</b> of <b>UU's Detailed Feasibility and Concept Design Report</b> . Examples of how environmental factors have been considered in sub-option selection is included in <b>Section 1.4</b> of this IEAR. Potential environmental effects and opportunities of the NWT Full Solution are identified in <b>Section 4</b> of this IEAR.
7	The appraisal work should include consideration of resilience (e.g. climate change,)	See <b>Section 4.10</b> of this IEAR. Also refer to <b>Section 4</b> of <b>UU's Detailed Feasibility and Concept Design Report</b> for information on how climate change has been considered in the Water Resource Modelling of the NWT SRO.
8	A description of the connection to other assessments (e.g. biodiversity net gain, WFD, natural capital, carbon) and demonstrate how they have been considered within this initial appraisal work.	<b>Sections 1, 3 and 4</b> of this IEAR.
9	Development of mitigation and enhancement opportunities.	<b>Section 4</b> of this IEAR.
10	Any future monitoring requirements of the identified environmental effects and efficacy of any included mitigation measures.	<b>Section 6</b> of this IEAR.
11	A plan to address uncertainties and data gaps.	<b>Section 6</b> of this IEAR.



## 2. Methodology

### 2.1 Introduction

- 2.1.1 This section describes the methodology employed for the IEA of the NWT SRO. It sets out the scope of the IEA including the appraisal topics considered (**Section 2.2**), the appraisal approach including the assessment of cumulative and in-combination effects (**Section 2.3**) and the evidence and data sources used to inform the appraisal (**Section 2.4**). **Section 2.5** summarises the technical difficulties and uncertainties encountered in undertaking the appraisal.
- 2.1.2 The IEA methodology has been developed taking into account RAPID's Gate 2 guidance (Section 6.3) as well as feedback from regulators on the environmental assessment work completed for Gate 1 and RAPID's recommendations contained in its Gate 1 final decision on the NWT SRO. A Method Statement, setting out the proposed IEA scope and approach, was issued to regulators for comment in May 2022 followed by a proposed IEA Report template in July 2022. No substantive issues regarding the proposed methodology or report template were raised by the regulators.
- 2.1.3 The IEA for Gate 2 represents an initial, high-level appraisal of the NWT SRO, drawing together existing data sources and other assessment streams to determine the potential environmental effects and opportunities associated with the solution. In addition, the IEA methodology has been developed with possible Gate 3 Environmental Impact Assessment (EIA) requirements in mind; specifically, it anticipates the topics that may be included in any Environmental Statement (ES), and characterises effects of the NWT SRO Full Solution at the project level as opposed to plan or programme level.

### 2.2 IEA Scope

#### Appraisal Topics

- 2.2.1 The effects of the NWT SRO have been assessed on a topic basis. The appraisal topics have regard to the environmental topics of SEA<sup>8</sup> and those included in Schedule 4 of The Town and Country Planning (Environmental Impact Assessment) Regulations 2017<sup>9</sup> (the EIA Regulations) and Schedule 4 of The Infrastructure Planning (Environmental Impact

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<sup>8</sup> Schedule 2 of the SEA Regulations require that the assessment includes information on the "likely significant effects on the environment, including on issues such as: biodiversity; population; human health; fauna; flora; soil; water; air; climatic factors; material assets; cultural heritage, including architectural and archaeological heritage; landscape; and the inter-relationship between the issues referred to.

<sup>9</sup> Statutory Instrument No. 571 - The Town and Country Planning (Environmental Impact Assessment) Regulations 2017. Schedule 4 identifies the factors "likely to be significantly affected by the development: population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape".



Assessment) Regulations 2017<sup>10</sup>. Selection of the topics has also taken into account: the findings of the Gate 1 SEA; feedback from regulators; RAPID's Gate 1 decision; the ongoing assessment of the NWT SRO sub-options completed as part of the SEA of UU's WRMP24; the emerging findings of the other overarching assessments; and the Sub-Option Assessment Reports.

2.2.2 The appraisal topics are as follows:

- Population (socio-economics);
- Health;
- Biodiversity, flora and fauna;
- Land use, geology, geomorphology<sup>11</sup> and soils;
- Water:
  - Hydrology;
  - Groundwater;
  - Water quality.
- Flood risk;
- Noise and vibration;
- Air quality;
- Climate change (including greenhouse gas emissions and resilience);
- Traffic and transport;
- Resource use and waste management;
- Historic environment;
- Landscape and visual.

2.2.3 On a precautionary basis, the majority of topics cited within Schedule 4 of the EIA Regulations are included. This ensures that the topics provide a comprehensive framework to identify, describe and evaluate the likely significant effects of the NWT SRO Full Solution<sup>12</sup>.

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<sup>10</sup> Statutory Instrument No. 572 - The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

<sup>11</sup> Geomorphology in this context relates to terrestrial as opposed to fluvial geomorphology.

<sup>12</sup> It should be noted that, when considering the nature of the sub-options and the effects identified through the SEA of the sub-options undertaken in support of the preparation of UU's WRMP24, there are some considerations within Schedule 4 of the EIA regulations which have not been included within the topics to be considered by the IEA. These include: heat and radiation, the creation of nuisances; and major accidents or disasters.



## Geographic Scope

2.2.4 The geographic extent of the IEA principally reflects the operational area covered by the NWT SRO Full Solution but effects are considered, as appropriate, taking into account the location and extent of the specific NWT SRO sub-options. Such areas can be at some distance from an individual NWT SRO sub-option when considering, for example, hydrological connectivity, functional habitats and in-combination and cumulative effects.

## Duration of Effects

2.2.5 When considering the timing of potential effects of the NWT SRO Full Solution, the assessment has classified effects as 'short,' 'medium' or 'long-term.' This is to capture the differences that could arise at different timescales, with regard to the construction and operation of the sub-options along with the probability, duration, frequency and reversibility of the effects.

2.2.6 **Table 2.1** below summarises the timescales used in the IEA. For the purposes of this assessment, short-term is considered as up to 3 years (typically representing the construction period for the sub-options), medium-term from 3 years to 10 years and long-term for the period beyond 10 years.

Table 2.1 Duration of Short, Medium and Long Term

Estimated Length (years)	Duration
0-3 years	Short
>3-10 years	Medium
Over 10 years	Long

## 2.3 Appraisal Approach

2.3.1 The IEA of the NWT SRO Full Solution has been undertaken in three stages, as follows:

- **Stage 1:** Appraisal of NWT SRO sub-options;
- **Stage 2:** Appraisal of the NWT SRO Full Solution in terms of the cumulative effects of the component sub-options;
- **Stage 3:** Appraisal of the effects of the NWT Full Solution in-combination with other projects.

2.3.2 These stages are described in-turn below.



### Stage 1: Appraisal of NWT SRO Sub-Options

- 2.3.3 To determine the potential environmental effects of the NWT SRO Full Solution, it is necessary to understand the likely impacts of the associated sub-options. The RAPID Gate 2 guidance also requires that the effects of the alternatives considered and rejected are documented.
- 2.3.4 The individual sub-options that comprise the NWT SRO Full Solution (and alternatives) have therefore been assessed for each topic scoped into the IEA. Both the construction and operational effects of each sub-option have been considered, recognising that many of the sub-options under consideration are likely to be very different in nature in their construction and operational phases. A matrix similar to that shown in **Table 2.2** was used to record the assessment of each sub-option.

Table 2.2 Sub-Option Appraisal Matrix

Topic	Overall Appraisal of Effects	Appraisal Comments
Population (socio-economics)	<b>Construction Effect</b> Moderate effect	<b>Construction Effects</b> <i>A description of the construction effects of the sub-option has been included here.</i>
	<b>Operation Effect</b> Minor effect	<b>Operational Effects</b> <i>A description of the operational effects of the sub-option has been included here.</i>
Health		
Etc...		

- 2.3.5 The significance of effects for each topic has been categorised based on the following:
  - Major effect (likely significant);
  - Moderate effect (not significant);
  - Minor effect (not significant);
  - Negligible effect (not significant).
- 2.3.6 The commentary section of the matrices provides justification for how the assessment conclusion was reached and includes consideration of the following:
  - The nature of the potential effect (what is expected to happen and whether it is direct or indirect);
  - The timing and duration of the potential effect (e.g. short, medium or long term);
  - The geographic scale of the potential effect (e.g. local, regional, national);



- The location of the potential effect (e.g. whether it affects rural or urban communities);
- The potential effect on vulnerable communities or sensitive habitats; and
- The reasons for whether the effect is considered significant.

2.3.7 Specific thresholds have been developed for what constitutes a major, moderate, minor and negligible effect for each topic. These significance thresholds are shown in **Appendix A**. The thresholds are largely qualitative; however, where numerical data is available (for example, in respect of carbon emissions), quantitative thresholds are additionally adopted.

2.3.8 It should be noted that measures embedded into the design of the options have been taken into account in the appraisal; opportunities for further mitigation and enhancement have been identified in considering the effects of the NWT SRO Full Solution (**Stage 2** below).

2.3.9 The completed appraisal matrices are contained in **Appendix B**; a high-level summary of the appraisal is provided in **Section 3** and, for those sub-options that comprise the NWT SRO Full Solution, more detailed commentary is provided (on a topic-by-topic basis) in **Section 4**.

## Stage 2: Appraisal of NWT SRO Full Solution

2.3.10 Following the appraisal of individual sub-options (**Stage 1** above), the effects of the combination of options which comprise the NWT SRO Full Solution have been assessed to ensure that the impacts of SRO have been appropriately identified, described and evaluated. This appraisal is presented on a topic-by-topic basis considering first, the effects of the individual sub-options being taken forward at Gate 2 and, second, the cumulative effects of the NWT SRO Full Solution, adopting the same impact descriptors and significance thresholds outlined for **Stage 1**. Where additional programme-wide mitigation and enhancement measures are identified, these are set out and residual effects (i.e. following the application of the additional mitigation and enhancement measures) recorded.

2.3.11 The appraisal of the NWT SRO Full Solution is presented in **Section 4**. For each topic, information is provided relating to:

- Aspects of water resources infrastructure relevant to the topic being considered;
- The environmental baseline;
- Embedded mitigation and enhancement measures;
- Appraisal of effects of the NWT SRO Full Solution sub-options (with a focus on where potentially major (likely significant) and moderate effects have been identified));
- Appraisal of the cumulative effects of the NWT SRO Full Solution (again, with a focus on where potentially major (likely significant) and moderate effects have been identified));



- Additional mitigation and enhancement measures; and
- Residual effects and uncertainties.

### Stage 3: In-combination Effects

2.3.12 In accordance with the RAPID Gate 2 guidance, an assessment of the effects of the NWT SRO Full Solution in-combination with other plans and projects has been undertaken. This assessment has considered:

- Other UU plans (the draft WRMP24, Drought Plan and Drainage and Wastewater Management Plan (DWMP));
- Regional (WRW) and adjacent water company plans and projects (WRMPs and SROs);
- High Speed 2 (HS2);
- Local plans and strategies and National Policy Statements (NPSs);
- Nationally Significant Infrastructure Projects (NSIPs); and
- Major planning applications.

2.3.13 The appraisal of in-combination effects is presented in **Section 5**.

## 2.4 Baseline, Evidence and Data Sources

2.4.1 To provide contextual information for the IEA, baseline environmental information has been gathered for each topic across the North West region and parts of Wales. The extended geographic scope of the baseline information ensures consistency with the information gathered for UU's WRMP24 and permits the consideration of potential effects beyond the immediate area of the NWT SRO Full Solution sub-options (for example, effects on downstream receptors). The baseline environmental information has been drawn from a variety of sources, such as UU, the Office for National Statistics (ONS), Government departments and regulators, as well as the Sub-Option Assessment Reports (which provide further detailed information relating to, in particular, water resource availability and water quality).

2.4.2 As set out in **Section 1.4**, the IEA is an overarching assessment, informed by the other overarching assessments (WFD Assessment and HRA), the INNS Assessment and Sub-Option Assessment Reports, as well as the SEA undertaken of the SRO sub-options in support of the WRW Regional Plan and UU's WRMP24. **Table 2.3** sets out, for each topic included the IEA, the information sources that have been used to inform the appraisal of likely significant effects.

Table 2.3 IEA Evidence and Data Sources

Topic	WFD	HRA	BNG/ NCA	SEA	INNS	Sub-Option Assessment Reports
Population (socio-economics)				✓		
Health				✓		
Biodiversity, flora and fauna	✓	✓	✓	✓	✓	✓
Land use, geology, geomorphology and soils			✓	✓		
Water	✓	✓				✓
Flood risk				✓		
Noise and vibration				✓		
Air quality				✓		
Climate change (including greenhouse gas emissions and resilience)			✓	✓		
Traffic and transport				✓		
Resource use and waste management			✓	✓		
Historic environment				✓		
Landscape and visual			✓	✓		

## 2.5 Technical Difficulties and Limitations

2.5.1 The following difficulties/limitations have been encountered when undertaking the IEA of the NWT SRO sub-options and solution:

- The exact location of new infrastructure associated with the NWT SRO sub-options is subject to change as detailed designs are developed. However, the IEA of the sub-options has been based on the best available information provided by UU. Where any uncertainties have been encountered, these are highlighted in the appraisal;
- The NWT SRO sub-options are at the conceptual design stage only and many of the negative environmental effects identified in this IEA may be avoided or minimised through measures incorporated into detailed sub-option design as the NWT SRO progresses through Gate 3. The findings of this IEA are therefore preliminary with effects identified on a precautionary basis to inform sub-option design;
- The NWT SRO sub-options are unlikely to be implemented for 8+ years in which time baseline environmental conditions may change. Where possible, this has been taken



into account in the appraisal; however, some uncertainty still remains and this will require review at the consenting and permitting stage;

- Specific evidence collection and assessment has been completed in respect of aquatic (including wetland) ecology, INNS, hydrology and water quality which has informed the IEA. For other topics such as population, landscape, traffic and transport etc. specific, detailed assessment, surveys and modelling has not been completed at this stage and it is anticipated that this work will be undertaken at later gates (for example, as part of any EIA, if required). However, the effects of the NWT SRO sub-options and solution on these other topics have still been assessed in this report based on existing, publicly available evidence/data, latest option designs from UU and professional judgement. Topic specific data gaps and uncertainties are considered further in **Section 6** and form the basis for the Forward Plan. Given these uncertainties, the conclusions of this report are preliminary only with effects identified on a precautionary basis to support ongoing sub-option design;
- Surveys, monitoring and modelling are ongoing and recommendations for additional data collection are contained in the Sub-Option Assessment Reports. In consequence, and particularly in relation to the effects of the sub-options and NWT SRO Full Solution on biodiversity and water, the findings of the IEA are provisional;
- Owing to the extended programme for implementation of the NWT SRO Full Solution, there is considerable uncertainty with respect to the other plans and projects that may have in-combination effects with the SRO. It will therefore be necessary to keep the in-combination assessment under review.



## 3. Appraisal of the NWT SRO Sub-Options

### 3.1 Introduction

- 3.1.1 This section of the IEA Report summarises the appraisal of the NWT SRO sub-options. Further detail in respect of the environmental effects of the sub-options that are included in the NWT SRO Full Solution is provided in **Section 4**.

### 3.2 Sub-Option Appraisal Summary

- 3.2.1 The NWT SRO sub-options have been appraised using the approach set out in **Section 2** to identify likely significant environmental effects in respect of the 13 appraisal topics. The appraisal has taken into account (*inter alia*) the Sub-Option Assessment Reports, WFD Assessment, INNS Assessment, HRA and BNG/NC Assessment (which should be referred to for further detail) and the WRMP24 SEA.
- 3.2.2 Completed appraisal matrices for each sub-option are presented in **Appendix B**. The likely significant effects of the sub-options during construction and operation are summarised below.

#### Construction Effects

- 3.2.3 With the exception of Options WR105a, WR107a2, WR111, WR113 and WR144, all of the NWT SRO sub-options are assessed as having major positive population effects. This reflects the substantial capital investment associated with the sub-options that would be likely to generate a number of employment opportunities and supply chain benefits as well as increased spend in the local economy by contractors and construction workers (for the remaining three sub-options, capital expenditure would be lower and therefore positive effects in this regard are assessed as moderate). However, congestion/driver delay associated with construction vehicle movements could temporarily affect local businesses and, therefore, several sub-options are also assessed as having moderate negative effects.
- 3.2.4 Construction activity associated with the NWT SRO sub-options would generate emissions to air associated with the use of plant and machinery as well as vehicle movements. For three sub-options (STT041b, WR015 and WR049d), potentially major negative air quality effects have been identified reflecting the likely volume of vehicle movements that would be generated and/or the potential for works to result in a reduction in air quality in Air Quality Management Areas (AQMAs). The remaining sub-options have been assessed as having likely moderate or minor negative air quality effects. All air quality effects would be temporary.
- 3.2.5 Vehicle movements associated with the NWT SRO sub-options and/or pipeline works within roads may lead to temporary congestion and driver delay. For Options STT041b,



WR015 and WR049d, these traffic and transport effects are assessed as potentially major negative.

- 3.2.6 All NWT SRO sub-options are assessed as having moderate or major negative climate change effects. This reflects the anticipated emissions of greenhouse gases from vehicle movements, construction plant and the embodied carbon in raw materials. For nine sub-options (STTA4, STT041b, WR015, WR049d, WR076, WR102b, WR106b, WR107b and WR149), the quantum of emissions has been assessed as major negative. Material use, energy requirements and waste generation would also be substantial and, therefore, the majority of sub-options are also assessed as having major negative effects in respect of resource use.
- 3.2.7 No further major construction-related effects were identified in the appraisal; the effects of the NWT SRO sub-options in respect of the remaining IEA topics are assessed as moderate, minor or negligible.

## Operation

- 3.2.8 The NWT SRO sub-options will support the STT SRO, helping to ensure the continuity of water supplies in the South East of England and resilience of supply to UU's own customers in the North West. All sub-options have therefore been assessed as having positive population and health effects. For five of the sub-options with benefit volumes greater than 10MI/d, as well as Option STTA4, positive population and health effects are assessed as major.
- 3.2.9 The majority of the NWT SRO sub-options are assessed as having moderate biodiversity effects. This principally reflects the potential for increased abstraction from surface and ground water sources to affect aquatic habitats and species but also, for some sub-options, the risk associated with the transfer of INNS.
- 3.2.10 The operation of the NWT SRO sub-options would require energy and generate greenhouse gas emissions related to the pumping and/or treatment of water. Emissions associated with each of the six sub-options (STT041b, WR015, WR049d, WR076, WR102b and WR149) would generate in excess of 2,000 tCO<sub>2</sub>e during operation and consistent with the thresholds of significance contained in **Appendix A**, they have been assessed as having major negative climate change effects (the remaining SRO sub-options are assessed as having moderate or minor negative effects in this regard). However, it should be noted that the SRO sub-options would increase the resilience of water supplies to the effects of climate change which, for the majority of sub-options, has been as a moderate beneficial effect. In this regard, Option STTA4 has been assessed as having a major (likely significant) positive effect.
- 3.2.11 Operation of the NWT SRO sub-options will require chemicals and energy. For Options STT041b and WR105a, the volume of resource use during operation would be potentially substantial and major negative effects are therefore identified.
- 3.2.12 No further major operational effects were identified in the appraisal; the effects of the NWT SRO sub-options in respect of the remaining IEA topics are assessed as moderate, minor or negligible.



3.2.13 It should be noted that all of the NWT SRO sub-options have been assessed as having potentially moderate negative effects in respect of water, although residual uncertainties remain at this stage. This reflects the potential for abstraction to affect either (i) deterioration of WFD status and/or (ii) the ability of a water body to attain its target status. This is a precautionary conclusion pending the completion of further investigation post-Gate 2 and in this regard, the WFD Assessment has considered which sub-options are more likely to remain non-compliant following further assessment, and those where reduced uncertainty following further assessment may enable a conclusion of compliant.



## 4. Appraisal of the NWT SRO Full Solution

### 4.1 Introduction

4.1.1 This section of the IEA Report presents the appraisal of the NWT SRO Full Solution. The Full Solution comprises the following sub-options:

- STTA4: [REDACTED];
- WR015: [REDACTED];
- WR049d: [REDACTED];
- WR076: [REDACTED];
- WR102b: [REDACTED];
- WR107a2: [REDACTED];
- WR107b: [REDACTED];
- WR111: [REDACTED];
- WR113: [REDACTED];
- WR149: [REDACTED]

4.1.2 The Full Solution represents UU's best understanding at the present time of the combination of sub-options that will be required to facilitate the STT SRO. The trading volumes required by STT and the timing of these are likely to change during the finalisation of WRMP24 and the Regional Plans in 2023. In addition, the understanding of the best combination of sub-options to support STT may also change as NWT assessments and design work progress during 2023. As a result, the composition of the NWT Full Solution may change. The cumulative appraisal of the NWT Full Solution presented in this Section is considered to be reasonably conservative as the current Full Solution is designed to support the maximum trading volume that may be required by STT, however it should be acknowledged that the cumulative assessment may change and will be reassessed during Gate 3.

4.1.3 The appraisal of the NWT SRO Full Solution is presented on a topic-by-topic basis and with a focus on potentially major (likely significant) and moderate effects. The appraisal has taken into account the Sub-Option Assessment Reports, WFD Assessment, HRA, INNS Risk Assessment and BNG/NC Assessment which should be referred to for further detail.



## 4.2 Population (Socio-economics)

### Overview

- 4.2.1 The construction of water resources infrastructure may have both positive and negative economic and social effects on local communities, businesses and services. Positive effects can be related to the generation of employment opportunities and supply chain benefits associated with capital expenditure; negative effects can include impacts on the highway network, employment land uses and tourism and recreational facilities.
- 4.2.2 The increase in water resource availability associated with the operation of new infrastructure can support population and economic growth. However, there may also be negative effects on nearby communities, businesses and tourism and recreation facilities associated with, for example, noise and vehicle movements in the operational phase of infrastructure.

### Environmental Context

#### Population

- 4.2.3 As at the 2021 Census, the population of the North West region was 7,417,300, an increase of 5% from 2011. The majority of the region's residents live in urban areas, with 2011 Census data suggesting that this equates to 89% of total residents. Population densities vary greatly across the region. The estimated North West average population density was 522 people per square kilometre (sq km) in 2020; the most densely populated area was Manchester with 4,805 people per sq km, followed by Liverpool with 4,475 people per sq km<sup>13</sup>. The population of Wales stood at 3,107,500 in the 2021 Census which represents a 1.4% population increase from the 2011 Census data.
- 4.2.4 The population of the North West region is likely to continue to change, particularly with an increasing ageing population. The 2018-based sub-national population projections provide an indication of future population levels if current trends continue. The projections indicate that over the period 2018 to 2028, the population of the North West is expected to rise by 289,138 to reach 7,581,231 people. This equates to a 4.0% population increase across the 10-year period. Longer term, the population of the North West is expected to rise further to 7,912,587 by 2043<sup>14</sup>.

#### Economy

- 4.2.5 The North West region has a large and diverse economy and areas within the region are facing different challenges. The North West's share of total UK gross value added (GVA) has remained relatively stable over the period 2010 - 2020 (remaining between 9.8% -

<sup>13</sup> ONS (2021) Population midyear estimates 2020. Available via:

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalescotlandandnorthernireland> [Accessed July 2022]

<sup>14</sup> Office for National Statistics (2020) Population projections for regions: Table 1 Available online at:

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/regionsinenglandtable1> [Accessed July 2022]



9.5%) with a 9.6% share of total UK GVA in 2020. In absolute terms, the region's GVA grew by 32.3% over this period which is similar to the national average of 34.2%.<sup>15</sup>

- 4.2.6 The economic performance of sub-regional areas does vary significantly. The growth of areas such as Liverpool and Manchester has been strong, and the general economic performance of other areas such as Cheshire and Lancashire has also been positive. However, there does continue to be a degree of variation in economic performance within these sub-regions. Cumbria remains the poorest performing sub-region, particularly in areas such as Carlisle and Barrow-in-Furness which have been affected by the loss of some of the manufacturing base and agriculture; however, NWT SRO sub-options are not proposed in these areas.
- 4.2.7 The proportion of economically active people during the period March 2022 to May 2022 (seasonally adjusted) was 77.6% in the North West region and 76.6% in Wales with both being lower than for the UK as a whole (78.9%). Economically active in this context is defined as those persons of working age who are employed or looking to be employed. In the same period, the unemployment rate for the North West was 4.4% which is higher than both Wales (3.8%) and the UK average (3.8%).<sup>16</sup> It should be noted that unemployment rates have been recently affected by the global COVID-19 pandemic and whilst they had shown long term decline since 2012, there were increases between July 2020 and January 2021; however, they have again begun to reduce throughout 2021 and 2022.
- 4.2.8 The average gross weekly earnings for full-time employees in the North West in 2021 was £578/week (compared to £610/week for the UK), whilst the Wales average was £570/week.<sup>17</sup>
- 4.2.9 The largest proportion of jobs in the North West and Wales are within the wholesale and retail trade and human health and social work sectors, similar to UK trends. As at March 2022, a total of 22,000 jobs in the North West (0.6%) are within the water supply, sewerage and waste management sector, similar to the proportion of jobs in this sector in Wales (1.1%) and for the UK as a whole (0.7%).<sup>18</sup>

## Deprivation

- 4.2.10 The English Index of Deprivation measures relative levels of deprivation in small areas of England called Lower Layer Super Output Areas (LSOA). The Indices of Deprivation is based on seven different domains of deprivation:
- Income Deprivation;
  - Employment Deprivation;

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<sup>15</sup> ONS (2022) Regional gross value added (balanced) per head and income components. Available from <https://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/nominalregionalgrossvalueaddedbalancedperheadandincomecomponents> [Accessed July 2022]

<sup>16</sup> ONS (2022) Labour market profile by region. Available from <https://www.nomisweb.co.uk/reports/lmp/gor/2013265922/report.aspx> [Accessed July 2022]

<sup>17</sup> Nomis (2022) Earnings by Place of Residence. Available from <https://www.nomisweb.co.uk/reports/lmp/gor/2013265922/report.aspx> [Accessed July 2022]

<sup>18</sup> Nomis (2022) Workforce Jobs by Industry Section. Available from <https://www.nomisweb.co.uk/reports/lmp/gor/2013265922/report.aspx> [Accessed July 2022]



- Education, Skills and Training Deprivation;
- Health Deprivation and Disability;
- Crime;
- Barriers to Housing and Services; and
- Living Environment Deprivation.

4.2.11 The 2019 indices show that there are some significant pockets of deprivation in all of the counties and districts in the region, with particularly large concentrations in and around the urban conurbations of Knowsley, Liverpool and Manchester in proximity to the NWT SRO Full Solution sub-options.

4.2.12 **Figure 4.1** presents the index of deprivation for the LSOA for the UU area.

### Recreation and Tourism

4.2.13 The North West offers a variety of opportunities for recreation and tourism, from the cultural offerings of the major cities to recreation in the region's National Parks and Areas of Outstanding Natural Beauty (AONBs). Tourism also generates value for the region's economy. In 2019, 14.1 million UK domestic overnight trips were made to the North West, amounting to spending of just over £2.9 billion<sup>19</sup>.

### Embedded Mitigation and Enhancement

4.2.14 There are no current embedded mitigation or enhancement measures in relation to population.

### Sub-Option Appraisal Summary

#### STTA4: Vyrnwy Aqueduct Enabling Works

- 4.2.15 The construction of Option STTA4 would involve a significant capital expenditure that would be likely to generate employment opportunities and supply chain benefits. Capital expenditure would be spread across four years which could provide the potential for a number of local businesses to have sustained involvement and opportunities. This is assessed as a major (likely significant) positive effect.
- 4.2.16 [X], in-turn supporting the STT SRO and helping to ensure the continuity of water supplies in the South East of England as well as in UU's supply area, supporting economic/population growth. This is assessed as a major (likely significant) positive effect.
- 4.2.17 There would be no major or moderate negative population effects associated with the construction or operation of this sub-option.

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<sup>19</sup> Kantar (2020) The GB Tourist 2019 Annual Report. Available from <https://www.visitbritain.org/great-britain-tourism-survey-latest-monthly-overnight-data> [Accessed July 2022]



#### WR015: [X]

- 4.2.18 The construction of Option WR015 would involve a significant capital expenditure which would be likely to generate employment opportunities and supply chain benefits. Capital expenditure would be spread across four years which could provide the potential for a number of local businesses to have sustained involvement and opportunities. This is assessed as a major (likely significant) positive effect.
- 4.2.19 Construction activity may contribute to congestion and disruption/driver delay on the road network due to associated vehicle movements (the construction of the sub-option would require 45,684 vehicle movements, over the 2.63 year construction period) which could affect, for example, the M60, M66, M62, A56, A665, A667, B6473 and B6198. Congestion and delay could affect local businesses and is assessed as a moderate negative.
- 4.2.20 During operation of the sub-option, the provision of an additional 40MI/d capacity would support water transfers to the South East region, helping to ensure a continual supply of clean drinking water whilst maintaining resilience of supply to UU customers, indirectly supporting economic and population growth. This is assessed as a major (likely significant) positive effect.

#### WR049d: [X]

- 4.2.21 Option WR049d would involve a significant capital expenditure which would be likely to generate employment opportunities and supply chain benefits. Capital expenditure would be spread across four years which could provide the potential for a number of local businesses to have sustained involvement and opportunities. This is assessed as a major (likely significant) positive effect.
- 4.2.22 Construction activity may contribute to congestion and disruption/driver delay on the road network due to associated vehicle movements (the construction of the sub-option would require 52,186 vehicle movements over the 2.63-year construction period, equal to approximately 19,843 movements per year) and the requirement for pipeline crossings/works. This could affect, for example, the A59, B6230, A673, A674, A675, M61, M65, B5256 as well as a number of local roads. Congestion and delay could also affect local businesses and is assessed as a moderate negative effect.
- 4.2.23 The provision of an additional 40MI/d capacity would support water transfers to the South East region, helping to ensure a continual supply of clean drinking water whilst maintaining resilience of supply to UU customers, indirectly supporting economic and population growth. This is assessed as a major (likely significant) positive effect.

#### WR076: [X]

- 4.2.24 The construction of Option WR076 would involve a significant capital expenditure which would be likely to generate employment opportunities and supply chain benefits. Capital expenditure would be spread across four years which could provide the potential for a number of local businesses to have sustained involvement and opportunities. This is assessed as a major (likely significant) positive effect.



- 4.2.25 Construction is expected to generate an estimated 22,838 vehicle movements during the 1.92 year construction period. This may contribute to congestion and disruption/driver delay on the road network, affecting (for example) the A6144, B5159 and B5160. This is assessed as a moderate negative effect.
- 4.2.26 During operation, the provision of an additional 25MI/d capacity would support water transfers to the South East region, helping to ensure a continual supply of clean drinking water whilst maintaining resilience of supply to UU customers, indirectly supporting economic and population growth. This is assessed as a major (likely significant) positive effect.

#### WR102b: [✕]

- 4.2.27 Option WR102b would involve a significant capital expenditure, resulting in a positive effect on the local economy associated with potential employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors in the local economy. Capital spend would be spread across four years which could provide the potential for a number of local businesses to have sustained involvement and opportunities. This is assessed as a major (likely significant) positive effect.
- 4.2.28 The provision of an additional 17MI/d capacity would support water transfers to the South East region, helping to ensure a continual supply of clean drinking water whilst maintaining resilience of supply to UU customers, indirectly supporting economic and population growth. This is assessed as a moderate positive effect.
- 4.2.29 There would be no major or moderate negative population effects associated with the construction or operation of this sub-option.

#### WR107a2: [✕]

- 4.2.30 The construction of Option WR107a2 would involve a moderate capital spend, resulting in a positive effect on the local economy associated with potential employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors in the local economy. This is assessed as a moderate positive effect.
- 4.2.31 The provision of an additional 10MI/d capacity would support water transfers to the South East region, helping to ensure a continual supply of clean drinking water whilst maintaining resilience of supply to UU customers, indirectly supporting economic and population growth. This is assessed as a moderate positive effect.
- 4.2.32 There would be no major or moderate negative population effects associated with the construction or operation of this sub-option.

#### WR107b: [✕]

- 4.2.33 Construction activity associated with Option WR107b would generate additional vehicle movements (24,465 vehicle movements over the 1.92-year construction period) on the road network which may have effects on traffic/congestion (for example on the M57, M58,



A580, A5147, A59, A5208, A5207, A506, B5192, B5202, B5197, B5195). Congestion and delay could affect local businesses and is assessed as a moderate negative effect.

- 4.2.34 The construction of Option WR107b would involve a significant capital spend, resulting in a positive effect on the local economy associated with potential employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors in the local economy. Capital spend would be spread across a four year period which could provide the potential for a number of local businesses to have sustained involvement and opportunities. This is assessed as a major (likely significant) positive effect.
- 4.2.35 The provision of an additional 12MI/d capacity would support water transfers to the South East region, helping to ensure a continual supply of clean drinking water whilst maintaining resilience of supply to UU customers, indirectly supporting economic and population growth. This is assessed as a moderate positive effect.

#### WR111: [✕]

- 4.2.36 Option WR111 would involve a large capital expenditure, resulting in a positive effect on the local economy associated with potential employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors in the local economy. Capital spend would be spread across four years which could provide the potential for a number of local businesses to have sustained involvement and opportunities. This is assessed as a moderate positive effect.
- 4.2.37 The provision of an additional 9MI/d capacity would support water transfers to the South East region, helping to ensure a continual supply of clean drinking water whilst maintaining resilience of supply to UU customers, indirectly supporting economic and population growth. This is assessed as a moderate positive effect.
- 4.2.38 There would be no major or moderate negative population effects associated with the construction or operation of this sub-option.

#### WR113: [✕]

- 4.2.39 The construction of Option WR113 would involve a medium sized capital expenditure, resulting in a positive effect on the local economy associated with potential employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors in the local economy. This is assessed as a moderate positive effect.
- 4.2.40 There would be no major or moderate positive population effects associated with the operation of this sub-option, reflecting the relatively small capacity of the scheme (3MI/d).
- 4.2.41 There would be no major or moderate negative population effects associated with the construction or operation of this sub-option.

#### WR149: [✕]

- 4.2.42 There could be some traffic congestion during the construction period of Option WR149 (there would be an estimated 7,381 vehicle movements during the 1.81-year construction



period), particularly along the A573, A574, A580. Driver delay may affect local businesses and is assessed as a moderate negative effect.

- 4.2.43 The construction of Option WR149 would involve a large capital expenditure, resulting in a positive effect on the local economy associated with potential employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors in the local economy. Capital spend would be spread across four years which could provide the potential for a number of local businesses to have sustained involvement and opportunities. This is assessed as a major (likely significant) positive effect.
- 4.2.44 The provision of an additional 13.8Ml/d capacity would support water transfers to the South East region, helping to ensure a continual supply of clean drinking water whilst maintaining resilience of supply to UU customers, indirectly supporting economic and population growth. This is assessed as a moderate positive effect.

## Cumulative Effects of the NWT SRO Full Solution

### Construction

- 4.2.45 Construction of the NWT SRO Full Solution will generate a substantial volume of vehicle movements (178,015 movements in total over the construction period) with the potential to contribute to congestion and driver delay on local and strategic road networks which may affect local businesses. However, given the distance between the SRO sub-options and the fact that pipeline works would not affect the same sections of the network, it is considered unlikely that there will be additional significant cumulative effects on businesses over and above those effects identified in respect of the SRO sub-options.
- 4.2.46 Construction of the NWT SRO would represent a substantial capital investment of over £450 million. This is likely to generate considerable employment opportunities and supply chain benefits, as well as increased spend in the local economy by contractors and construction workers, over a sustained period. This socio-economic benefit is assessed as a major (likely significant) positive effect.
- 4.2.47 Overall, it is concluded that there will be moderate negative and major (likely significant) positive population effects during construction of the NWT SRO Full Solution.

### Operation

- 4.2.48 An estimated 22,464 vehicle movements per year (equivalent to around 100 movements per day) would be generated during the operational phase of the NWT SRO Full Solution. However, the movements would occur across a large area (reflecting the distance between the sub-options that comprise the SRO) and in consequence, any additional cumulative effects over and above those associated with the operation of individual SRO sub-options are predicted to be negligible.
- 4.2.49 The NWT SRO Full Solution promotes cost efficient source options, selected to facilitate transfer volumes by the release of raw water directly from Lake Vyrnwy into the River Vyrnwy or transferred through a new River Vyrnwy bypass pipeline into the River Severn as part of the STT SRO. The NWT SRO Full Solution provides new sources to be brought



online if water were to be transferred out of region, maintaining resilience for customers in the North West and indirectly helping to ensure a continual supply of drinking water in the South East region. This will, in-turn, support population and economic growth. In total, the NWT SRO will provide an additional capacity of up to 169.8ML/d which is assessed as a major (likely significant) positive effect.

4.2.50 Overall, it is concluded that there will be moderate negative and major (likely significant) positive population effects during operation of the NWT SRO Full Solution.

### Additional Mitigation and Enhancement Measures

4.2.51 The following additional mitigation and enhancement measures have been identified:

- Where practicable, UU and any contractors should seek to utilise local labour;
- Where practicable, UU and any contractors should seek to appoint local contractors/sub-contractors and utilise locally-sourced materials;
- Measures to mitigate potential impacts on the highway network are identified below in respect of traffic and transport (see **Section 4.11**);
- Measures to mitigate potential minor impacts on recreational receptors (as identified in the sub-option appraisal matrices in **Appendix B**) are detailed below in respect of health (see **Section 4.3**).

### Residual Effects and Uncertainties

4.2.52 The implementation of the traffic and transport mitigation measures will likely reduce effects on existing businesses associated with congestion and driver delay. However, there remains the potential for minor negative effects to occur during the construction and operational phases of the NWT SRO Full Solution.

## 4.3 Health

### Overview

4.3.1 The construction and operation of water resources infrastructure can have negative effects on health arising from, in particular, emissions to air, dust and noise and vibration. Development can also affect opportunities for physical activity both directly (where it results in the loss of/harm to recreational facilities/receptors) and indirectly (where development affects the amenity of recreational facilities/receptors).

### Environmental Context

4.3.2 The health of people residing in the North West region is relatively poor compared to other regions in England and the national average. Life expectancy is used as a broad measure of the health of an area and where a person is born can influence how long they will live. In the North West, the average life expectancy at birth for 2020 was 77.0 years for men and 81.0 years for women, compared to 78.7 and 82.7 years respectively for all of England. These figures are recognised to have declined in 2020 due to the COVID-19



pandemic and increased level of excess deaths. The region has one of the lowest life expectancies across all the English regions and one of the highest proportions of life spent with a persistent illness or disability. Compared with England as a whole, men and women in the North West can expect to live 1.7 years less on average based on the 2020 figures.<sup>20</sup> Within Wales, life expectancy for the 2018-20 period was 78 years for males and 82 years for females.<sup>21</sup>

## Embedded Mitigation and Enhancement

- 4.3.3 There are no current embedded mitigation or enhancement measures in relation to human health.

## Sub-Option Appraisal Summary

### STTA4: Vyrnwy Aqueduct Enabling Works

- 4.3.4 No major or moderate negative effects on health are predicated during either the construction or operational phase of Option SSTA4 (any negative effects would likely be minor or negligible).
- 4.3.5 The sub-option would maintain water supplies to UU customers supplied directly from the Vyrnwy Aqueduct, in-turn supporting the STT and helping to ensure the continuity of water supplies in the South-East of England. This is assessed as a major (likely significant) positive effect.

### WR015: [🔗]

- 4.3.6 Construction activity associated with Option WR105 may result in noise disturbance and air quality/dust issues, particularly in the urban area of Whitefield (including residential areas); however, any negative effects would be temporary and localised. This is assessed as a moderate negative effect.
- 4.3.7 The operation of the scheme would not adversely affect human health.
- 4.3.8 The increased capacity of 40MI/d associated with this sub-option would help ensure a continual supply of clean drinking water and increase resilience of supply to UU customers and the South East region. This is assessed as a major (likely significant) positive effect.

### WR049d: [🔗]

- 4.3.9 No major or moderate negative effects on health are predicated during either the construction or operation phases of Option WR049d (any negative effects would likely be minor).

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<sup>20</sup> Public Health England (2021) Health Profile for England 2021 [available at: [https://fingertips.phe.org.uk/static-reports/health-profile-for-england/hpfe\\_report.html#mortality-and-life-expectancy](https://fingertips.phe.org.uk/static-reports/health-profile-for-england/hpfe_report.html#mortality-and-life-expectancy) [Accessed July 2022]]

<sup>21</sup> Public Health Wales (2022) Inequalities in life expectancy on the increase in Wales. Available via: <https://phw.nhs.wales/news/inequalities-in-life-expectancy-on-the-increase-in-wales/> [Accessed July 2022]



- 4.3.10 The increased capacity of 40MI/d associated this Option WR049d would help ensure a continual supply of clean drinking water and increase resilience of supply to UU customers and the South East region. This is assessed as a major (likely significant) positive effect.

#### WR076: [X]

- 4.3.11 Works and related HGV movements associated with the construction of the new abstraction and intake on the River Bollin and the new WTW as part of Option WR076 could have noise and air quality impacts upon nearby residential receptors in Heatley, particularly those within Old Mill Close, as well as residential areas to the north of the proposed works. Construction activity and HGV movements associated with the pipeline works could also lead to noise and air quality impacts on a small number of residential receptors along the proposed route of the pipeline. Any effects would, however, be temporary and localised. This is assessed as a moderate negative effect.
- 4.3.12 Approximately 2.8km of the route of the pipeline follows the same route as the Trans-Pennine Trail/National Cycle Route 62 and works may temporarily affect opportunities for walking and cycling. However, any effects in this regard are anticipated to be temporary and not significant.
- 4.3.13 The operation of Option WR076 would not adversely affect human health.
- 4.3.14 The increased capacity of 25MI/d associated with this sub-option would help ensure a continual supply of clean drinking water and increase resilience of supply to UU customers and the South East region. This is assessed as a major (likely significant) positive effect.

#### WR102b: [X]

- 4.3.15 Air quality and noise impacts associated with construction activity under Option WR102b would have the potential to cause increased nuisance and disruption, particularly given the proximity of residential receptors to the borehole sites that form part of this sub-option. However, any negative effects would be temporary and localised. This is assessed as a moderate negative effect.
- 4.3.16 The operation of Option WR076 would not adversely affect human health.
- 4.3.17 The increased capacity of 17MI/d associated with this sub-option would help ensure a continual supply of clean drinking water and increase resilience of supply to UU customers and the South East region. This is assessed as a moderate positive effect.

#### WR107a2: [X]

- 4.3.18 No major or moderate negative effects on health are predicated during either the construction or operation of Option WR107a2; minor negative health effects have been identified during construction, although these would be temporary and localised.
- 4.3.19 The increased capacity of 10MI/d associated with this sub-option would help ensure a continual supply of clean drinking water and increase resilience of supply to UU customers and the South East region. This is assessed as a moderate positive effect.



#### WR107b: [X]

- 4.3.20 No major or moderate negative effects on health are predicated during either the construction or operation of Option WR107b (negative effects are assessed as minor).
- 4.3.21 The increased capacity of 12MI/d associated with this sub-option would help ensure a continual supply of clean drinking water and increase resilience of supply to UU customers and the South East region. This is assessed as a moderate positive effect.

#### WR111: [X]

- 4.3.22 No major or moderate negative effects on health are predicated during either the construction or operation of Option WR111; construction-related health effects are assessed as minor negative, although these would be temporary and localised.
- 4.3.23 The increased capacity of 9MI/d associated with this sub-option would help ensure a continual supply of clean drinking water and increase resilience of supply to UU customers and the South East region. This is assessed as a moderate positive effect.

#### WR113: [X]

- 4.3.24 There would be no major or moderate negative health effects associated with the construction or operation of Option WR113.
- 4.3.25 There would be no major or moderate positive effects associated with the operation of Option WR113, reflecting the relatively small capacity of the scheme (3MI/d).

#### WR149: [X]

- 4.3.26 No major or moderate negative effects on health are predicated during either the construction or operation of Option WR149.
- 4.3.27 The increased capacity of 13.8MI/d would help ensure a continual supply of clean drinking water and increase resilience of supply to UU customers and the South East region. This is assessed as a moderate positive effect.

## Cumulative Effects of the NWT SRO Full Solution

### Construction

- 4.3.28 Construction of the NWT SRO Full Solution sub-options will generate noise, vibration and emissions to air which could affect sensitive receptors in close proximity to development sites and along transport routes. However, any effects would be temporary and are not predicted to be significant. Further, given the distance between the sub-options that comprise the solution, it is unlikely that there would be any additional cumulative health effects.
- 4.3.29 Overall, it is concluded that there will be moderate negative health effects during the construction phase of the NWT SRO Full Solution.



## Operation

- 4.3.30 Health effects arising from the operation of infrastructure associated with the NWT SRO Full Solution are likely to be negligible. Associated vehicle movements may in some instances generate noise, vibration and air quality impacts on sensitive receptors along transport routes; however, any effects are predicted to be minor.
- 4.3.31 The NWT SRO Full Solution will deliver additional capacity of up to 169.8MI/d. This would help ensure a continual supply of clean drinking water and increase resilience of supply to UU customers and the South East region which is assessed as a major (likely significant) positive effect.

## Additional Mitigation and Enhancement Measures

- 4.3.32 The following additional mitigation and enhancement measures have been identified:
- A Construction Environmental Management Plan (CEMP) should be prepared for each sub-option, including measures to minimise construction-related health effects.
  - Works should be undertaken in accordance with the Code for Considerate Practice of the Considerate Constructors Scheme (or similar).
  - In the development of detailed designs for pipeline routes and the siting of above ground infrastructure, where practicable, care should be taken to minimise works near to the most sensitive health receptors.

## Residual Effects and Uncertainties

- 4.3.33 The implementation of the additional mitigation measures outlined above will likely reduce health effects such that no major or moderate negative effects are anticipated. No further effects or uncertainties are identified.

## 4.4 Biodiversity, Flora and Fauna

### Overview

- 4.4.1 Biodiversity is defined as the variety of plants (flora) and animals (fauna) in an area, and their associated habitats. The importance of preserving biodiversity is recognised from an international to a local level. Biodiversity is important in its own right and has value in terms of quality of life and amenity.
- 4.4.2 The development of water resources infrastructure could have impacts (both adverse and beneficial) on biodiversity and nature conservation interests during construction and operational phases. These effects could include, for example, the loss of/disturbance to habitats and species associated with land take and construction activities and effects on aquatic ecology associated with changes to river flows, water quality and the transfer of INNS.



## Environmental Context

- 4.4.3 The North West of England is rich in areas of biodiversity interest, and it contains some of the most varied upland and lowland terrain in England. The North West Biodiversity Audit<sup>22</sup> shows that the region contains 31 out of the 37 different 'Broad Biodiversity Action Plan habitat classifications', one of the most diverse in the country. Wildlife indicators show that the region is also a haven for a significant number of species, with 135 rare species that are a UK or regional priority to protect.
- 4.4.4 The region includes a number of sites that are designated at a European, national or local level as important for biodiversity, including:
- 18 Ramsar Sites;
  - 14 Special Protection Areas (SPA);
  - 42 Special Areas of Conservation (SAC);
  - 451 Sites of Special Scientific Interest (SSSI);
  - 4 Marine Conservation Zones (MCZ);
  - 32 National Nature Reserves (NNR); and
  - 154 Local Nature Reserves (LNR).
- 4.4.5 The distribution of designated sites across UU's supply area (including North Wales) is shown in **Figures 4.2 to 4.6**. A large number of sites are located within close proximity (circa 10km) of the NWT SRO Full Solution sub-options; the operation of these sub-options may also affect more distant, water dependent sites. These receptors are identified in the sub-option appraisals contained at **Appendix B**.
- 4.4.6 The condition of habitats in the region has improved over recent years, and this is reflected in a gradual increase in woodland and farmland wild bird populations, one of the UK's key indicators for biodiversity. Improvements in inland and coastal water based habitats have also been seen, including a noteworthy increase in numbers of some species such as otters and trout in specific areas. However, the long-term regional population trends for some of these species is still showing a general decline.
- 4.4.7 As at July 2022, 83.51% of the North West's SSSIs were in 'favourable' or 'unfavourable recovering' condition (41.86% and 41.65% respectively) whilst 10.03% were classified as being in 'unfavourable no change' condition and 6.42% were classified as being in 'unfavourable declining' condition<sup>23</sup>.
- 4.4.8 Specific information regarding the baseline ecological habitat and species in each river associated with the NWT SRO Full Solution is contained in the Sub-Option Assessment Reports. This includes information from walkover surveys conducted in May 2022.

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<sup>22</sup> North West Biodiversity (1999) *Wild About the North West: A Biodiversity Audit of North West England*.

<sup>23</sup> Natural England (2022) *Condition of SSSI Units in Region: North West*. Available online at: <https://designatedsites.naturalengland.org.uk/SearchRegion.aspx> [Accessed July 2022]



- 4.4.9 There has been a dramatic increase in the number of non-native species arriving in Britain over recent decades, as well as in the numbers of invasive species being established<sup>24</sup>. There are approximately 2,000 non-native species established in Britain, with the majority in the terrestrial environment and smaller numbers in marine and freshwater environments. Non-native species cause significant adverse impacts, including out-competing native species and spreading disease. The UK Government 2015 strategy on invasive non-native species<sup>25</sup> builds on previous strategies to provide a framework for coordination action to prevent spread and work to eradicate species across the UK.

## Embedded Mitigation and Enhancement

- 4.4.10 It is understood that the NWT SRO sub-options will include treatment processes sufficient to remove all life stages of aquatic INNS.

## Sub-Option Appraisal Summary

### STTA4: Vyrnwy Aqueduct Enabling Works

- 4.4.11 No major or moderate negative effects on ecological receptors are predicated during either the construction or operation of Option STTA4.
- 4.4.12 Option STTA4 would result in the localised loss of/disturbance to habitats and species (potentially including priority habitats and species). However, works at most development sites will be modest with associated land take being predominantly small in scale and temporary (to accommodate construction compounds). Where permanent land take is required, this is associated with the extension of Oswestry WTW and development of new pumping stations, kiosks and valve houses. Whilst these components of Option STTA4 would involve the development of greenfield land, land take (and associated effects on habitats and species) is likely to be minor.
- 4.4.13 Option STTA4 would not involve the abstraction of additional water and in consequence, there is not expected to be operational effects on biodiversity.

### WR015: [X]

- 4.4.14 The construction of sub-option WR015 is not expected to have any major negative biodiversity effects. Construction on the River Irwell and on undeveloped, greenfield sites in particular may cause short-term loss of/ disturbance to proximate habitats and species which, in the absence of mitigation, is assessed as a moderate negative effect.
- 4.4.15 Option WR015 would require a new abstraction from the River Irwell. The HRA concludes that the only international sites potentially affected by the sub-option during operation are the Mersey Estuary SPA and Mersey Estuary Ramsar sites, which are at a substantial distance downstream via the Manchester Ship Canal such that effects 'alone' would be

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<sup>24</sup> Defra (2012) *Non-Native Species in Great Britain: establishment, detection and reporting to inform effective decision making*. Available online at: <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16281> [Accessed July 2022]

<sup>25</sup> Defra (2015) *The Great Britain Invasive Non-native Species Strategy*. Available online at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/455526/gb-non-native-species-strategy-pb14324.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/455526/gb-non-native-species-strategy-pb14324.pdf) [Accessed July 2022]



unlikely due to flow accretion etc. Overall, effects on the Mersey Estuary sites are therefore expected to be negligible. Similarly, the Sub-Option Assessment Report identifies that effects on other designated sites such as Woolston Eyes SSSI are unlikely.

- 4.4.16 Habitat downstream of the abstraction is likely to overall be relatively insensitive to changes in flow. However, the WFD Assessment concludes that a reduction in flows in the River Irwell associated with the operation of Option WR015 and associated effects on the hydrological regime, river continuity and morphological conditions of the Irwell could impact fish (effects on invertebrate and macrophyte/phytobenthos populations are less likely). This is assessed as a moderate negative effect at this stage on a precautionary basis, recognising that further surveys and assessment are required at Gate 3.

#### WR049d: [X]

- 4.4.17 The construction of Option WR049d is not expected to have any major negative biodiversity effects. The proposed route of the proposed pipeline associated with this sub-option passes through two areas of Ancient Woodland, and in close proximity (within 1km) to 20 other areas (total of 22 ancient woodlands within 1km). Construction, particularly where the pipeline crosses these areas and excavation is required, has the potential to negatively impact the woodland habitat. This is assessed as a moderate negative effect at this stage. More generally, construction of the abstraction/pumping station and pipeline works could result in the loss of/disturbance to non-designated habitats and species during the construction phase; however, it is noted that land required for the excavation of the pipeline would be reinstated. In the absence of mitigation, this is also assessed as a moderate negative effect.
- 4.4.18 The operation of this option would involve the abstraction of 40MI/d of water from the River Ribble which may result in adverse impacts on in-river and water dependent habitats and species downstream as a result of the reduced flow. The HRA highlights that, as the Ribble and Alt Estuaries SPA / Ramsar sites are downstream receptors (via the River Ribble) located approximately 10km downstream of the proposed abstraction, there is a potential pathway for operational effects on these sites. However, the HRA concludes that, on the basis of available evidence including the Abstraction Licensing Strategy (ALS), the volumes proposed for abstraction on the Ribble are considered available and minor relative to the overall freshwater inputs to the estuary and the tidal flows such that no negative effects are expected.
- 4.4.19 The Sub-Option Assessment Report concludes that the invertebrate communities show fluctuations in LIFE scores (which are generally used to indicate flow stress), but those fluctuations do not appear to be related to flow. While it appears unlikely that the minor reduction in flow associated with the abstraction would have an observable impact on the macroinvertebrate communities, this would be better informed by review of the sampling site characteristics, and wider habitat survey. The Gate 2 fish assessment suggests that impacts on fish are likely to be low since impacts on flow are minor; however, further study is required to predict the likely impact that a reduction in freshwater flow to the estuary may have on returning migratory fish (salmonids). At this stage, moderate negative effects on macroinvertebrates and fish have been identified on a precautionary basis, recognising that further surveys and assessment are required at Gate 3.



4.4.20 The INNS Assessment identifies that high impact INNS are present within 1km of source water that are not present in the locale of the receptor waterbody. However, raw water would be transferred to a WTW to be processed to a level sufficient to remove all life stages of potential INNS. There are potential wash out points located at the proposed interstage pumping station at Coup Green (out of source water catchment) and at the WTW (also in an out of source water catchment) which could result in the transfer of INNS. With mitigation, the INNS Assessment has concluded that this carries a medium risk which is assessed as a potentially moderate negative effect on a precautionary basis at this stage.

#### WR076: [✕]

4.4.21 The construction of Option WR076 is not expected to have any major or moderate negative biodiversity effects.

4.4.22 The operation of Option WR076 would involve the abstraction of 25MI/d from the River Bollin. This could have effects on the Mersey Estuary SPA / Ramsar sites, which are downstream from the proposed abstraction point, due to reduced freshwater flow to the estuary. The sub-option is also in close proximity to Woolston Eyes SSSI, a wetland site. The HRA concludes that the operational effects of the sub-option alone would generally be very marginal relative to total freshwater inputs to the estuary such that negative effects are unlikely. The Sub-Option Assessment Report also confirms that effects on other designated sites including Woolston Eyes SSSI are unlikely.

4.4.23 There is some potential for the abstraction associated with this sub-option to impact ecological receptors in the River Bollin including migratory salmon, macrophytes and invertebrates due to flow regime change. In particular, the WFD Assessment highlights that reductions in flow velocity and depth may reduce cover/refuge and optimal flow habitat for adult fish. This is assessed as a moderate negative effect on a precautionary basis, recognising that further surveys and assessment are required at Gate 3.

#### WR102b: [✕]

4.4.24 The construction of Option WR102b is not expected to have any significant negative effects on internationally or nationally designated nature conservation sites due to their distance from the scheme and a lack of impact pathways identified. The sub-option would result in the loss of habitat and construction activity may cause disturbance to species which, in the absence of mitigation, is assessed as a moderate negative effect.

4.4.25 The Mersey Estuary SPA and Mersey Estuary Ramsar sites are downstream receptors and so may be affected by the operation of this sub-option. The EA assessment of groundwater resource availability has indicated that abstraction may exceed the groundwater resource available within the groundwater management units; however, the HRA concludes that this is unlikely to result in adverse effects on the SPA and Ramsar sites.

4.4.26 The WFD Assessment has identified that changes to the hydrological regime, river continuity and morphological conditions due to loss of baseflow could impact fish, invertebrate and macrophyte/phytobenthos populations. However, hydraulic connection between the aquifer and associated surface water bodies is likely limited and the ALS indicates that water is available across the flow regime in the surface water catchment. At



this stage, a moderate negative effect on fish, invertebrate and macrophyte/phytobenthos populations is identified on a precautionary basis.

#### WR107a2: [X]

- 4.4.27 The construction of Option WR107a2 is not expected to have any major or moderate negative biodiversity effects.
- 4.4.28 The HRA notes that the scheme's operation would likely reduce flows into the Alt (and hence the Ribble and Alt Estuaries SPA / Ramsar) marginally compared to current operation. Whilst the sub-option would operate within the existing licence, the ALS suggests that the groundwater unit has limited water available for new licensing; however, the HRA concludes that adverse effects on the SPA/Ramsar sites are unlikely (subject to further groundwater modelling).
- 4.4.29 The WFD Assessment highlights that the aquifer and overlying surface water bodies may be hydrologically connected. In this context, the Sub-Option Assessment Report identifies that there is potential for abstraction at [X] boreholes to flatten the northwards regional hydraulic gradient and affect groundwater discharge to Martin Mere, Burscough SSSI and SPA. It recommends that this should be considered further and a moderate negative effect is therefore identified on a precautionary basis.
- 4.4.30 The WFD Assessment also identifies that groundwater abstraction may result in changes to hydrological regime, river continuity or morphological conditions which could impact on ecology in the lower reaches of Downholland Brook. This is assessed as a moderate negative effect on precautionary basis.

#### WR107b: Randles Bridge, Knowsley and Primrose Hill

- 4.4.31 The construction of Option WR107b is not expected to have any major or moderate negative biodiversity effects.
- 4.4.32 As with Option WR107a2, scheme operation would likely reduce flows into the Alt (and hence the Ribble and Alt Estuaries SPA / Ramsar) marginally compared to current operation; however, the HRA concludes that adverse effects are unlikely (subject to groundwater modelling). There is potential for abstraction at [X] boreholes to affect Martin Mere, Burscough SSSI and SPA and a moderate negative effect is therefore identified on a precautionary basis.
- 4.4.33 The WFD Assessment identifies the potential for groundwater abstraction to result in changes to hydrological regime, river continuity and morphological conditions which could impact fish, invertebrates and macrophyte/phytobenthos populations in the Alt. This is assessed as a moderate negative effect on precautionary basis.

#### WR111: [X]

- 4.4.34 The construction of Option WR111 may result in the loss of/disturbance to habitats and species associated with the upgrading of the borehole and construction of the new WTW. Without mitigation, this is assessed as a moderate negative effect.



- 4.4.35 The ALS suggests there is only restricted water available for abstraction from the groundwater management unit associated with this sub-option. The Mersey Estuary sites are the ultimate downstream receptor (>35km direct, more via river); however, the HRA concludes that, alone, effects on these sites are likely to be negligible based on the scale of the abstraction increase and distance of the sub-option upstream.
- 4.4.36 Operation of the sub-option may reduce the water levels of tributaries and watercourses within the surrounding area which could potentially affect local and nearby in-river ecological features. The WFD Assessment highlights that changes to the hydrological regime, river continuity and morphological conditions in the Rivers Dean and Bollin due to loss of baseflow could impact fish, invertebrate and macrophyte/phytobenthos populations. The Sub-Option Assessment Report also identifies that effects on Lindow Common SSSI, which is approximately 6 km west of Woodford Borehole, may require further investigation due to its potential connectivity. However, a review of the hydrogeological setting indicates limited potential for connections to surface water and the ALS suggests that water is available across the flow regime in the surface water catchments. On this basis, it is unlikely the abstraction would cause a deterioration in ecological status, but at this stage, a moderate negative effect has been identified on a precautionary basis.

#### WR113: [✕]

- 4.4.37 Within 1km of Option WR113 there are a number of priority habitats. Borehole and WTW works would take place on greenfield land adjacent to an existing operational site and in consequence, there may be some negative effects on non-designated habitats and species during construction. This is assessed as a moderate negative effect.
- 4.4.38 The WFD Assessment highlights that increased groundwater abstraction associated with the operation of Option WR113 has the potential to reduce flows in overlying surface water bodies, with the potential for effects on ecology (although the HRA concludes that adverse effects on European sites are unlikely). In this context, the Sub-Option Assessment Report states that potential effects on Danes Moss SSSI and Lindow Common SSSI require further investigation. A moderate negative effect has therefore been identified at this stage on a precautionary basis.

#### WR149: [✕]

- 4.4.39 Reinstatement and refurbishment of the boreholes, the refurbishment of the WTW and the excavation of the pipeline route associated with Option WR149 could result in habitat losses and/or disturbance to species which is assessed as a moderate negative effect in the absence of mitigation.
- 4.4.40 The WFD Assessment identifies that surface water bodies are potentially hydraulically connected to the aquifer in the vicinity of the abstractions related to this sub-option, so flows could be reduced. In this context, there are several conservation sites in the area of this sub-option which support habitats and flora that are dependent upon groundwater tables and could be affected by the operation of the sub-option: Highfield Moss SSSI; Astley & Bedford Mosses SSSI/Manchester Mosses SAC; Holcroft Moss SSSI/SAC; Woolston Eyes SSSI; Abram Flashes SSSI; Bryn Marsh & Ince Moss SSSI; Rixton Clay Pits



SSSI; and Risley Moss SSSI/SAC. This is assessed as a moderate negative effect at this stage on a precautionary basis.

- 4.4.41 The HRA assumes that the sub-option involves utilisation within current licenced volumes, although the ALS suggests the groundwater management unit is over-abstracted without water available. The HRA notes that there is a potential pathway for effects on Manchester Mosses SAC and that the ultimate downstream receptor is the Mersey Estuary SPA / Ramsar which could be affected by reduced flows. However, the HRA concludes that, subject to the results of groundwater modelling, there are not likely to be operational effects on the SAC, SPA or RAMSAR sites.
- 4.4.42 The WFD Assessment identifies the potential for groundwater abstraction to result in changes to hydrological regime, river continuity and morphological conditions which could impact fish, invertebrates and macrophyte/phytobenthos populations in Spittle Brook, the Glaze, Pennington Brook and/or Hey/Bordsdane Brook. This is assessed as a moderate negative effect on precautionary basis.

## Cumulative Effects of the NWT SRO Full Solution

### Construction

- 4.4.43 Construction of the NWT SRO Full Solution is unlikely to result in significant negative effects on international or nationally designated nature conservation sites. Works would result in the loss of/disturbance to habitats and species including Ancient Woodland; however, owing to the distance between the individual SRO sub-options, no additional cumulative effects (over and above the effects recorded above) are predicted.
- 4.4.44 Overall, a moderate negative biodiversity effect is identified at this stage.

### Operation

- 4.4.45 The abstraction of water from rivers and groundwater sources during the operation of the NWT SRO sub-options may result in negative ecological effects, both alone (as set out above) and at the solution level.
- 4.4.46 The HRA has assessed the in-combination effects of the NWT SRO Full Solution on the following European sites: Manchester Mosses SAC; Martin Mere SPA/Ramsar; Ribble and Alt Estuaries SPA / Ramsar; Sefton Coast SAC; and the Mersey Estuary SPA / Ramsar. Its preliminary conclusion is that, whilst there are some residual uncertainties at the Gate 2 stage (principally associated with aquifer response that will be resolved with the development of the groundwater models), the currently available data indicate that the risk of the sub-options adversely affecting the integrity of any European sites, alone or in combination, is low – and so progression of the options beyond Gate 2 would be reasonable. In summary:
- **Ribble and Alt Estuaries SPA / Ramsar:** There are some residual uncertainties regarding the behaviour of the sandstone aquifer and Options WR107a and WR107b (which will be resolved by the development of the Lower Mersey Basin groundwater model); however, the initial conclusions of the assessment are there is a low risk of adverse effects, alone or in combination, on the Ribble and Alt Estuaries SPA / Ramsar



as a result of the sub-options. The effects on surface water flows to the estuary are likely to be negligible, and evidence demonstrates that the volumes proposed for abstraction on the Ribble are available and minor relative to the overall freshwater inputs to the estuary and the tidal flows;

- **Sefton Coast SAC:** There will be no adverse effects, alone or in combination, on the dune habitats of the Sefton Coast SAC; the dune systems are understood to be supplied primarily by rainfall and lateral flows from the local catchment, and not from connectivity with the underlying sandstone aquifer;
- **Mersey Estuary SPA / Ramsar:** There are some residual uncertainties regarding the behaviour of the sandstone aquifer and the groundwater options (which will be resolved by the development of the Lower Mersey Basin, and East Cheshire groundwater models); and water quality changes in relation to improvements required for the Ship Canal (in relation to freshwater fish) is being explored further by the WFD Assessment. However, the initial conclusions of the assessment are that there is a low risk of adverse effects, alone or in combination, on the Mersey Estuary SPA / Ramsar as a result of the sub-options; the maximum cumulative effect of the sub-options on flows from the River Mersey catchment is small relative to the overall freshwater inputs to the estuary and the dominating influence of tidal flows, and evidence suggests that any concerns over water availability from some groundwater bodies do not relate to estuary. As noted, this conclusion is preliminary subject to future investigations;
- **Martin Mere SPA / Ramsar:** Groundwater models for the aquifer are still in development, and so there is uncertainty over the precise extent and magnitude of any drawdown effects, and the extent to which surface watercourses supplying the SPA/Ramsar will be affected (although incidental data and information suggests many of these are likely to be perched, with a limited contribution from groundwater). Based on the currently available evidence and site data, the integrity of Martin Mere SPA and Martin Mere Ramsar will not be adversely affected by the NWT SRO Full Solution sub-options, alone or in combination, although this will need to be re-tested post-Gate 2 and relationships with the other estuaries in the region explored;
- **Manchester Mosses SAC:** The groundwater models for the aquifer are still in development, and so there is uncertainty over the precise extent and magnitude of any drawdown effects. In addition, none of the sites have been subject to field survey to determine the precise relationship / connectivity of the SAC and associated functional habitats with the sandstone aquifer at specific locations, which may be appropriate depending on the outputs of the model (i.e. the extent to which infiltration from the peat is prevented by high groundwater levels in the sandstone aquifer versus low-permeability strata, although the available evidence from borehole logs and similar suggest that the latter may be more common). However, drawdown in the aquifer at the SAC is expected to be relatively small, and the potential effects on the habitats of the SAC are likely to be buffered to some extent by the influence of the superficial deposits and the local water level management practices. The preliminary conclusion is therefore that the risk of adverse effects on integrity, alone or in combination, is low although additional modelling / project-level data collection is required to confirm this.



- 4.4.47 The WFD Assessment has also considered the cumulative effects of the sub-options (see **Section 4.6**) and has identified the potential for the NWT SRO Full Solution to result in non-compliance for groundwater and surface water bodies, relating to water quantity, water quality and biological elements. This is assessed as a moderate negative effect on a precautionary basis, pending further survey work.
- 4.4.48 No additional cumulative effects in respect of INNS, over and above those reported for the sub-options above, are predicted. On this basis, a moderate negative effect is identified at this stage (reflecting the INNS risk associated with Option WR049d).

### Additional Mitigation and Enhancement Measures

- 4.4.49 The following additional mitigation and enhancement measures have been identified:
- CEMPs should include measures to minimise disturbance to biodiversity;
  - With specific regard to Option WR049d, additional, bespoke design measures should be incorporated to further minimise INNS risk, informed by INNS assessment during Gate 3;
  - With specific regard to Sub-option WR049d, proposed pipeline routing should be revised in order to avoid Ancient Woodland;
  - Design measures to mitigate the risk of negative effects on aquatic flora and fauna should be implemented including, for example, fish passages and intake pipe screens;
  - The loss of habitat should be minimised and opportunities to deliver biodiversity net gain and improve natural capital should be identified. These opportunities are considered further in the NC/BNG Assessment.

### Residual Effects and Uncertainties

- 4.4.50 With the implementation of the mitigation measures outlined above, it is anticipated that moderate negative effects on biodiversity associated with construction of the NWT SRO Full Solution sub-options would be reduced to minor. Further, on the basis that an overall BNG will be achieved, there are likely to be moderate positive biodiversity effects associated with the creation of habitats. However, residual uncertainty remains pending detailed ecological surveys and confirmation of routeing and development site locations.
- 4.4.51 For all sub-options that comprise the NWT SRO Full Solution, further evidence and assessment is required before Gate 3 in order to determine the potential effects of abstraction on the ecological status of waterbodies and, in respect of Sub-option WR049, INNS (as noted above). In consequence, the SRO is assessed as having a residual moderate negative effect in respect of biodiversity at this stage.
- 4.4.52 As noted above, there are some residual uncertainties at the Gate 2 stage with regard to effects on European sites associated with aquifer response that will be resolved with the development of groundwater models.



## 4.5 Land Use, Geology, Geomorphology and Soils

### Overview

- 4.5.1 Development of water resources infrastructure can affect soils, including physical loss of, and damage to, soil resources, through land contamination and structural damage. Indirect impacts may also arise from changes in the local water regime, organic matter content, soil biodiversity and soil process. The Agricultural Land Classification System developed by Defra provides a method for assessing the quality of farmland, principally for use in land use planning. The system divides the quality of land into five categories, as well as non-agricultural and urban. The 'best and most versatile land' is generally defined as the agricultural land which falls into Grades 1, 2 and 3a. Development of new infrastructure can result in the loss of best and most versatile land and affect existing agricultural land uses.
- 4.5.2 The construction of water resources infrastructure can also affect geology, including sites designated for their geological interest, particularly where development results in the loss of/damage to assets.

### Environmental Context

#### Geology

- 4.5.3 There is a great diversity in the composition of geology across the North West region. The majority of the lowland Cheshire plains, Merseyside and western Lancashire within which the NWT SRO Full Solution sub-options are located are dominated largely by Triassic mudstone and sandstone. The uplands of Cumbria are partly made up of volcanic igneous rock from the Devonian period. Moving eastwards towards the Yorkshire Dales, the geology becomes dominated by distinctive carboniferous limestone, and south into Lancashire millstone grit and coal becomes abundant.
- 4.5.4 Within the North West region, there are 203 Geological Conservation Review (GCR) Sites, i.e., sites that are often SSSIs and selected on the basis of their national and international importance.<sup>26</sup> Information obtained from Natural England indicates that, UK-wide, 86% of SSSIs designated for one or more geodiversity features are in favourable or unfavourable recovering condition.<sup>27</sup> Within Wales, there are 452 GCR Sites<sup>28</sup>.
- 4.5.5 The main bedrock aquifer in the area of the NWT SRO Full Solution sub-options is the Sherwood Sandstone Group, classified by the EA as a Principal Aquifer. It is overlain and confined by the Mercia Mudstone Group which includes lower permeability mudstones and siltstones. Further detail relating to the geology of the area in which the SRO sub-options are located is presented in the Sub-Option Assessment Reports.

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<sup>26</sup> JNCC (2019) *Geological Conservation Review (GCR) csv extract of the GCR database (part) 2019* (filtered to Cheshire, East Cumbria, West Cumbria, Lancashire, Sefton, Greater Manchester North) Available online: <https://hub.jncc.gov.uk/assets/b0f53582-f93d-4e70-8ff9-0f16b660e4ad> [Accessed July 2022].

<sup>27</sup> Natural England (2015) *Natural England Access to Evidence Information Note EIN007: Summary of evidence: Geodiversity* [available at: <http://publications.naturalengland.org.uk/publication/5005683512573952>] [Accessed July 2022]

<sup>28</sup> JNCC (2019) *Geological Conservation Review (GCR) csv extract of the GCR database (part) 2019* Available online: <https://hub.jncc.gov.uk/assets/b0f53582-f93d-4e70-8ff9-0f16b660e4ad> [Accessed July 2022].



## Soils

- 4.5.6 The variety of underlying geology in the North West region is reflected in its soils, the agricultural value of which varies. Rural land covers 80% of the region, with the majority of this managed for agriculture. Intensive arable and livestock farming are supported in lowland areas, while upland areas may be managed for grouse, forestry or farming.
- 4.5.7 **Figure 4.7** shows agricultural land quality across UU's supply area. The quality of agricultural land in the North West region is relatively poor, with large swathes of land classed as 'Poor' (Grade 4) or 'Very Poor' (Grade 5) reflecting the large proportion of upland area which generally has low agricultural quality due to exposure and poor soil cover. Areas to the north of Liverpool, west of Blackpool and across the southern part of the region include small areas of agricultural land of 'Excellent' (Grade 1) or 'Very Good' (Grade 2) quality. Large areas of 'Good to Moderate' (Grade 3) land are also present in the far north, far south and central parts of the region (including the general area of the NWT SRO Full Solution). Areas of urban land are focussed around Manchester and Liverpool. In Wales, 7% of the total land cover is classified as the 'best and most versatile land'.<sup>29</sup>
- 4.5.8 Key threats to soils include draining soils, intensive agriculture, changes in land management, climate change, burning and extraction of peat, construction, and pollution. Loss of nitrate from agricultural soils, meanwhile, can lead to failure of drinking water standards and contribute to eutrophication in estuaries and the sea. Eutrophication can also be caused by excess phosphate entering water bodies, usually via soil erosion.

## Land Use

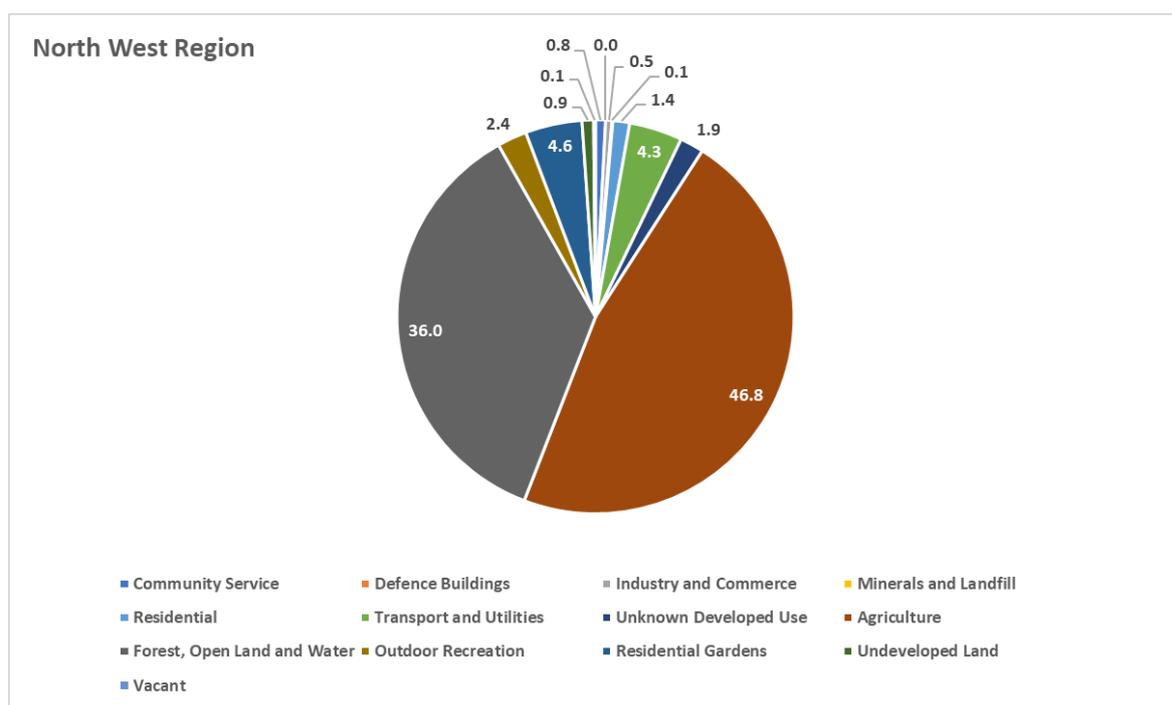
- 4.5.9 **Figure 4.8** shows land use in the North West region as reported in the Land Use Statistics for England (2018). This indicates that for the North West region, agriculture constitutes the majority of the total land area (46.8% and 62.8% respectively). The next largest area of land cover is forest, open land and water (36.0% of land cover).

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<sup>29</sup> Welsh Government (2021) *Agricultural Land Classification: Predictive Map*. Available at: <https://gov.wales/agricultural-land-classification-predictive-map> [Accessed July 2022].



Figure 4.8 Land Use in the North West Region



Source: Ministry of Housing, Communities and Local Government (2020). *Statistical data set - Live tables on land use England 2018*. Available online: <https://www.gov.uk/government/statistical-data-sets/live-tables-on-land-use> [Accessed July 2022]

### Embedded Mitigation and Enhancement

4.5.10 Land excavated during the construction of pipelines associated with the NWT SRO Full Solution sub-options would be reinstated following the construction phase.

### Sub-Option Appraisal Summary

#### STTA4: Vyrnwy Aqueduct Enabling Works

4.5.11 The majority of works associated with Option STTA4 would involve the replacement of existing pipelines with land excavated to facilitate the works (including that required to accommodate construction compounds) being reinstated following construction. However, the extension to Oswestry WTW, new pumping stations and new valve houses would be located on, and result in the loss of, greenfield land including that which is of Grade 2 and Grade 3 agricultural land quality. This is assessed as a moderate negative effect.

4.5.12 No major or moderate effects on land use, geology, geomorphology and soils are predicated during the operation of this sub-option.

#### WR015: [X]

4.5.13 No major or moderate effects on land use, geology, geomorphology and soils are predicated during either the construction or operation of Option WR015.



- 4.5.14 Development of abstraction infrastructure and the new WTW associated with this sub-option would result in the loss of greenfield land including Grade 3 agricultural land; however, the scale of development/land take is not significant. The route of the proposed water main also runs largely along the existing road network which helps decrease land disruption and any soil displaced during the excavation of the pipeline route would be reinstated following completion. Effects are therefore assessed as minor negative.

#### WR049d: [REDACTED]

- 4.5.15 No major or moderate effects on land use, geology, geomorphology and soils are predicated during either the construction or operation of Option WR049d.
- 4.5.16 Development associated with the abstraction, screens and pumping station and much of the pipeline associated with this sub-option would be situated on greenfield land, including Grade 3 agricultural land; however, the scale of development/land take is not significant. Land required for the excavation of the pipeline would be reinstated following the construction phase. Works at the WTW, meanwhile, are assumed to be situated within the existing operational boundary of the WTW site. Effects are therefore assessed as minor negative.

#### WR076: [REDACTED]

- 4.5.17 Development of the new abstraction infrastructure, WTW, service reservoir and pumping station under Option WR076 would result in the loss of greenfield agricultural land of Grade 2 and 3 quality. This is assessed as a moderate negative effect. The pipeline would also be situated within greenfield agricultural land; however, excavated land associated with pipeline works would be reinstated following the completion of construction.
- 4.5.18 No major or moderate effects on land use, geology, geomorphology and soils are predicated during the operation of this sub-option.

#### WR102b: [REDACTED]

- 4.5.19 No major or moderate effects on land use, geology, geomorphology and soils are predicated during either the construction or operation of Option WR102b.
- 4.5.20 Development of the upgraded WTW at [REDACTED] and new WTW at [REDACTED] associated with this sub-option would involve the development of Grade 3 agricultural land; however, the scale of development/land take would not be significant. Further, refurbishment/upgrading of the boreholes would take place at the existing borehole sites.

#### WR107a2: Aughton Park and Moss End Boreholes

- 4.5.21 No major or moderate effects on land use, geology, geomorphology and soils are predicated during either the construction or operation of Option WR107a2.
- 4.5.22 This sub-option is located wholly within an area of Grade 1 agricultural land; however, any excavated land associated with pipeline works would be reinstated following the completion of construction. Additionally, the WTW works would be situated within the existing WTW site, minimising land take. The two borehole sites would result in the loss of



two small areas of greenfield land but the scale of land take is not significant. Effects are therefore assessed as minor negative.

#### WR107b: [REDACTED]

- 4.5.23 No major or moderate effects on land use, geology, geomorphology and soils are predicated during either the construction or operation of Option WR107b.
- 4.5.24 The reinstatement/modification of boreholes and [REDACTED] WTW would be contained within existing sites such that new infrastructure should not substantially impact land use/soil quality. Pipeline excavation would be routed through Grade 1 and 2 agricultural land which may temporarily disrupt agricultural operations, though land would be reinstated following the completion of construction. Effects are therefore assessed as minor negative.

#### WR111: [REDACTED]

- 4.5.25 No major or moderate effects on land use, geology, geomorphology and soils are predicated during either the construction or operation of Option WR111.
- 4.5.26 The proposed WTW would be located within the operational footprint of a treated water storage site and the works to the borehole would be at the existing borehole site. Effects are therefore likely to be negligible.

#### WR113: [REDACTED]

- 4.5.27 No major or moderate effects on land use, geology, geomorphology and soils are predicated during either the construction or operation of Option WR113.
- 4.5.28 Pipeline works would involve the excavation of land; however, this land would be reinstated following the construction phase. Works would also be required on greenfield land adjacent to the existing [REDACTED] site; however, this would be small in scale with any negative effects likely to be minor.

#### WR149: [REDACTED]

- 4.5.29 No major or moderate effects on land use, geology, geomorphology and soils are predicated during either the construction or operation of Option WR149.
- 4.5.30 The refurbishment/modification of boreholes and WTW associated with this sub-option would be contained within existing sites and significant land take is not expected. Pipeline excavation would be routed through Grade 3 agricultural land, but any disturbed land would be reinstated following the completion of construction.
- 4.5.31 The route of the proposed pipeline would pass through an area of historic landfill (Lowton Sidings); however, with the adoption of standard best practice construction measure, this is not anticipated to have any negative effects.
- 4.5.32 Overall, effects are assessed as negligible.



## Cumulative Effects of the NWT SRO Full Solution

### Construction

- 4.5.33 Construction of the NWT SRO Full Solution would result in the loss of agricultural land which may include best and most versatile land. However, the total area of land that would be permanently developed is unlikely to be significant such that cumulative effects are assessed as moderate.
- 4.5.34 There remains a risk of the accidental release of pollutants during construction through, for example, spillages. Some development sites (for example, Lowton Sidings) may also be contaminated such that construction activity could release pollutants which may affect human health, surface and ground waters and habitats and species. With the adoption of standard best practice construction measures, however, this risk is likely to be low and the potential effect is assessed as minor negative at this stage.

### Operation

- 4.5.35 It is not expected that operation of the NWT SRO Full Solution would result in any major or moderate effects on land use, geology, geomorphology and soils.
- 4.5.36 As with construction of the NWT SRO Full Solution, there remains a risk of the accidental release of pollutants due to spillages and also equipment leaks during the operational phase. This potential effect is assessed as minor negative at this stage.

## Additional Mitigation and Enhancement Measures

- 4.5.37 The following additional mitigation and enhancement measures have been identified:
- Works should be carried out in accordance with relevant Construction Design Management (CDM) Regulations 2015;
  - Where necessary, a contaminated land assessment should be carried out prior to the commencement of the construction of the sub-options to determine potential risks to human health associated with contamination. Any contaminated material identified by ground investigation prior to construction should be either treated onsite and reused or removed – subject to risk-based assessment - and disposed of off-site by a suitably licensed waste disposal operator. Appropriate remediation should be carried out in accordance with a Remediation Strategy;
  - A CEMP should be prepared for each sub-option including measures to manage exposure to contaminants and control spillages;
  - Designated washdown areas with fully contained drainage should be used for plant, vehicles and equipment in contact with contaminated soils to avoid contaminants being moved around sites or taken off-site;
  - Pollution Incident Control Management Plans should be developed to limit adverse effects arising from pollution events;



- Adverse impacts on soil should be minimised through the management, retention and reuse of soils. Soil Management Plans should be prepared and implemented for each sub-option.

## Residual Effects and Uncertainties

- 4.5.38 With the implementation of the additional mitigation measures outlined above, significant effects in respect of land contamination are not expected (however, the presence of contamination at development sites is currently uncertain).
- 4.5.39 Notwithstanding the measures outlined above to minimise negative effects on soils, the NWT SRO Full Solution would result in the loss of agricultural land which may include best and most versatile land (although this would need to be confirmed). This remains a moderate negative effect (during the construction phase of the SRO only).

## 4.6 Water

### Overview

- 4.6.1 The construction and operation of water resources infrastructure can have negative effects on the local water environment. Effects may arise due to (*inter alia*) physical modifications to waterbodies, flow reductions, changes in water quality and the transfer of INNS which, in turn, can affect the ecology of rivers and some terrestrial habitats and species. These effects can result in waterbodies failing to meet environmental objectives established under the Water Framework Directive (Water Environment (Water Framework Directive) (England and Wales) Regulations 2017); the environmental objectives for specific waterbodies are set out in River Basin Management Plans (RBMPs). Where there is the potential for negative effects on WFD waterbodies, these can be mitigated through, for example, measures to avoid effects on water quality during construction, raw water treatment and constraints on abstraction applied to licences to make sure there is sufficient water available for the environment.

### Environmental Context

- 4.6.2 Most of the NWT SRO Full Solution sub-options are situated in urban or suburban catchments. The dominant surface water feature is the River Mersey with most of the watercourses in the area draining to the Mersey and its estuary:
- To the north of the Mersey channel, watercourses draining southwards to the Mersey and the estuary include (from east to west) Glaze Brook, Sankey Brook and Ditton Brook;
  - To the south of Manchester around the [⌘] sources, the key rivers are the River Dean and Bollin, which join to form a tributary to the River Mersey flowing northwest to join the Mersey to the east of Lymm;
  - The River Weaver, a northward flowing tributary to the Mersey, drains the area to the west and south of the [⌘] sources.



- 4.6.3 In the north Merseyside area, the River Alt and Downholland Brook drain north-westwards into the Irish Sea.
- 4.6.4 The River Ribble rises in the north Pennines, flowing through East Lancashire and discharging into the Irish Sea via the Ribble Estuary.
- 4.6.5 There are a number of significant canals running through the area, including the Leeds and Liverpool Canal, Manchester Ship Canal, Bridgewater Canal, Macclesfield Canal and Huddersfield Canal.

### Water Resource Availability

- 4.6.6 The EA and NRW have produced a series of ALSs for the North West and other areas from which water is sourced to supply the UU area (e.g., those sources in Wales). These ALSs set out how water resources will be managed in each catchment and provide information on how existing abstraction licences are managed and the availability of water for further abstraction. The availability of water for abstraction is determined by the relationship between the fully licensed and recent actual flows in relation to the Environmental Flow Indicator (EFI).
- 4.6.7 Within each ALS, river flows and groundwater levels are monitored at Assessment Points (significant points on rivers such as local gauging stations) and assessed alongside the amount of water which has been abstracted on average over the previous six years and the situation if all abstraction licences were used to full capacity. This data is used to determine the water availability for each waterbody. Water availability falls into the following categories:
- **Water available for licensing:** There is more water than required to meet the needs of the environment. New licences can be considered depending on local and downstream impacts;
  - **Restricted water available for licensing:** If all licensed water is abstracted there will not be enough water left for the needs of the environment – the fully licensed flows will fall below the EFI. No new consumptive licences would be granted and restrictions may be in place. Trading from an existing licence holder can occur;
  - **Water not available for licensing:** Recent actual waterbody flows are below the indicative flow requirement to help support Good Ecological Status. No further consumptive licences will be granted. Trading from an existing licence holder can occur (up to their recent abstraction and not the licence limit).
- 4.6.8 The water availability assessments for the most recent published ALSs relevant to the NWT SRO Full Solution are summarised in **Table 4.1** below. This shows the number of Assessments Points for each ALS area that fall into the categories listed above, as at 2013, which is the date of the currently published strategies. The EA has drafted but not yet published more recent ALSs, and therefore has provided up to date water availability assessments directly to UU in 2022 for this project, which are presented below.

Table 4.1 Summary of ALS Water Availability Assessments

Abstraction Licensing Strategy	Number of Assessment Points			
	Water Available	Restricted Water Available	Water Not Available	Total Number
Lower Mersey and Alt	10	4	6	20
Northern Manchester	0	11	2	13
Ribble, Douglas and Crossens	19	9	8	36
Upper Mersey	1	12	4	17

Source: Environment Agency (2013) *Abstraction Licensing Strategies*.

4.6.9 The EA’s current (as at March 2022) assessment of surface water availability in the context of the NWT SRO Full Solution sub-options is summarised in **Table 4.2**.

Table 4.2 Environment Agency Assessment of Surface Water Availability\*

Surface Water	Licence restriction*	Reason for restriction*	Amount available (MI/d)	EA updated screening comments (March 2022)
River Bollin	Unconstrained Water Available	N/A	+25	Waterbody is discharge rich.
River Irwell	Unconstrained Water Available	N/A	+40	Waterbody is discharge rich.

\*Data from the Environment Agency.

4.6.10 Updated screening work has been undertaken recently in March 2022 by the EA to evaluate the groundwater SRO sub-options based on groundwater resource availability at that scale (see **Table 4.3**).

Table 4.3 Environment Agency Assessment of Groundwater Management Unit Resource Availability\*

GWMU	Licence restriction*	Reason for restriction*	Amount available (MI/d)*	EA updated screening comments (March 2022)**
Liverpool Speke	Restricted Water Available	Saline Intrusion	34.5	Recent actual surplus
Halewood	Restricted Water Available	Over licensed on water balance & Saline Intrusion	0	
South Warrington	Restricted Water Available	Over licensed on water balance & Saline Intrusion	0	>2.9 MI/d would over-abstract GWMU
Kirkby Ormskirk	Restricted Water Available	Over licensed on water balance	0	GWMU overlicensed but recent actual surplus



GWMU	Licence restriction*	Reason for restriction*	Amount available (MI/d)*	EA updated screening comments (March 2022)**
Warrington	Restricted Water Available	Over licensed on water balance & Saline Intrusion	0	>4 MI/d would over-abstract GWMU
West Glaze	Water Not Available	Over abstracted on water balance	-28.7	
Dean & Bollin	Restricted Water Available	Over licensed on water balance	0	GWMU overlicensed but recent actual surplus

\*Data from Environment Agency.

\*\*From Environment Agency water availability summary by sub-option, provided to UU in March 2022

4.6.11 Further information relating to water resource availability is presented in the Sub-Option Assessment Reports which have informed the option appraisals contained at **Appendix B**.

### Water Quality

4.6.12 There are 1,266 surface water bodies covered by three RBMPs that lie within the North West region (North West, Solway Tweed and Dee). Additionally, Lake Vyrnwy is a source to the UU supply area which lies within the Severn RBMP district. All the water bodies in the region have been classified for their ecological status and have objectives set for 2021, 2027 and beyond.

4.6.13 The waterbodies associated with the NWT SRO are located in the North West River Basin District. **Table 4.4** shows the percentage of waterbodies in the River Basin District that are achieving good ecological status/potential or better, their target status by 2021 (based on data contained within the North West RBMP) and a summary of the key water management issues that need to be dealt with in each district. The EA has produced a draft North West RBMP for Cycle 3 (2021- 2027). Data for Cycle 3 supplements the data for Cycle 1 and Cycle 2 and is also presented in **Table 4.4**.



Table 4.4 Percentage of Water Bodies Achieving Good Ecological Status or Potential, 2015/2021

River Basin District	Surface Water (% of water bodies at good or better ecological status / potential)			Groundwater (% of water bodies at good or better quantitative status)			Significant Pressures
	2015	2021	Draft RBMP Cycle 3 data	2015	2021	Draft RBMP Cycle 3 data	
North West	22	25	22	89	94	72	<ul style="list-style-type: none"> <li>Physical modification;</li> <li>Phosphate;</li> <li>Pollution from waste water;</li> <li>Pollution from rural areas;</li> <li>Ammonia;</li> <li>Pollution from towns, cities and transport;</li> <li>Chemicals; and</li> <li>Dissolved oxygen.</li> </ul>

Source: Environment Agency, North West River Basin Management Plan. Draft RBMP data via: <https://environment.data.gov.uk/catchment-planning>

- 4.6.14 The majority of WFD River Water Body Catchments associated with the NWT SRO Full Solution sub-options are classed as 'Moderate' ecological status, with some assessed as 'Poor' or 'Bad' status. All WFD River Water Body Catchments are classed as 'Supports Good or High' hydromorphological status. These EA classification data suggest that failure to achieve good ecological status is thus primarily related to factors other than the hydrological regime (such as chemical failures).
- 4.6.15 It is important to recognise that most of the river waterbodies potentially impacted by the NWT SRO Full Solution are also subject to flow influences associated with many other surface water abstractions and discharges. Many of the waterbodies are designated as heavily modified and a few (River Dean) are associated with headwater reservoir operation.
- 4.6.16 The EA's National Framework analysis of water resources pressures into the future has highlighted the potentially significant reductions in low flows which may be associated with climate change and which are particularly marked in Wales and down the western half of England. By considering the need to raise the level of "environmental ambition", emphasising the requirement to meet river flow targets, and projecting how resources may be further squeezed by the climate and population growth into the future, the EA has challenged the water companies to set out a long term "environmental destination". For example, the EA has indicated to UU that there may be a need to consider some reductions in Fully Licensed annual limits at [X].
- 4.6.17 Further detail relating to the status of WFD waterbodies associated with the NWT SRO Full Solution is presented in the Sub-Option Assessment Reports.

## Embedded Mitigation and Enhancement

- 4.6.18 It is assumed that best practices construction methods are adhered to (such as dust suppression, soil containment and emergency response procedures).



## Sub-Option Appraisal Summary

- 4.6.19 It is anticipated that any effects on water during the construction phase of the NWT SRO Full Solution would be negligible. This is consistent with the conclusions of the WFD Assessment, which has confirmed that construction of the sub-options is highly unlikely to have more than a minor level of impact on a WFD waterbody, irrespective of WFD status. This is because the activities are limited in spatial extent, will occur for a short duration in time, and/or have limited scope for interaction with the water environment at the WFD waterbody scale. Potential effects can also be readily mitigated through the adoption of proven, standard best practice construction methods.
- 4.6.20 The construction effects of the SRO sub-options on water are therefore not considered further in the summary below.

### STTA4: Vyrnwy Aqueduct Enabling Works

- 4.6.21 No major or moderate effects on water are predicated during either the construction or operation of Option STTA4.
- 4.6.22 Option STTA4 would not involve the abstraction of additional water and in consequence, there is not expected to be operational effects on water resources or quality. The WFD Assessment concludes that, as this sub-option would not involve any new abstractions, it would be WFD compliant.

### WR015: [✕]

- 4.6.23 The sub-option impact assessment calculates that the impact of the proposed abstraction associated with Sub-option WR015 would be a maximum of 7% reduction from gauged flows at Q95 for the 'all years' utilisation scenario, and a maximum of 11% reduction for the 1 in 500 year utilisation scenario. The catchment is discharge-rich, with discharges supporting flows above natural at low flows, and the EA has indicated that sufficient water is available for the abstraction.
- 4.6.24 The WFD Assessment highlights that, with regard to the River Irwell (Croal to Irk) waterbody, a reduction in flow associated with Option WR015 could exacerbate sediment and potentially habitat pressures, impacting on invertebrates; however, invertebrate communities are likely to be relatively insensitive to changes in flow, in large, slow-flowing reaches like the Irwell. Water quality impacts may in theory result in increased phytoplankton and algal growth, which may influence the spawning success of certain fish species, but impacts on water quality associated with Option WR015 are expected to be small. Reductions in flow/water level could impact on fish through a reduction in marginal habitat for juveniles and lead to compromised fish passage (past weirs), therefore reducing connectivity between adjacent reaches.
- 4.6.25 Reductions in flow could in theory result in changes to physico-chemical quality elements (e.g. P, BOD, DO, pH, temperature) as a result of reduced dilution. While this is unlikely to result in deterioration of status, there is potential for the reduction in dilution to impede the effectiveness of planned water quality improvements in the catchment. This will be assessed through water quality modelling at Gate 3.



- 4.6.26 Option WR015 is assessed as potentially non-compliant in the WFD Assessment; however, this conclusion is assigned a low level of confidence and the assessment notes that the sub-option has the potential to be compliant, subject to further evidence and assessment.
- 4.6.27 Overall, a moderate negative effect is identified at this stage on a precautionary basis, recognising that further surveys and assessment are required at Gate 3. In this regard, some residual uncertainty remains.

#### WR049d: [✕]

- 4.6.28 The Sub-Option Assessment Report calculates that the impact on flow at Q95 would be less than 5% for the 'all years' utilisation scenario, and up to a maximum of 9.2% for the 1 in 500 utilisation scenario. The EA has confirmed that water is available in the Ribble at Q95.
- 4.6.29 The Gate 2 fish assessment (presented in the Sub-Option Assessment Report) suggests that impacts on fish are likely to be low since impacts on flow are low; however, further study is required to predict the likely effect that a reduction in freshwater flow to the estuary may have on returning migrant fish (salmonids).
- 4.6.30 The reduction in flow, particularly during times of low flow, could result in changes to physico-chemical quality elements (e.g. P, BOD, DO, pH, temperature) as a result of reduced dilution. While this is unlikely to result in deterioration of status, particularly given the small impact on flow associated with this option, there is some potential for the reduction in dilution to impede the effectiveness of planned water quality improvements in the catchment. This will be assessed by water quality modelling at Gate 3.
- 4.6.31 Option WR049d is assessed as potentially non-compliant in the WFD Assessment; however, this conclusion is assigned a low level of confidence and the assessment notes that the sub-option has the potential to be compliant, subject to further evidence and assessment
- 4.6.32 At this stage, a moderate negative effect has been identified on a precautionary basis, recognising that further surveys and assessment are required at Gate 3. In this regard, some residual uncertainty remains.

#### WR076: [✕]

- 4.6.33 The Gate 2 flow impact assessment has calculated the impacts on flow as up to a maximum 14% reduction from gauged in the 'all years' utilisation scenario, and a maximum 22% reduction in the 1 in 500 year scenario. The catchment is discharge-rich, and the draft Upper Mersey ALS indicates that there is water available for abstraction at the proposed rate.
- 4.6.34 The reduction in flow could result in changes to physico-chemical quality elements (e.g. P, BOD, DO, pH, temperature) as a result of reduced dilution. While this is unlikely to result in deterioration of status, there is potential for the reduction in dilution to impede the effectiveness of planned water quality improvements in the wider Mersey catchment. This will be assessed through water quality modelling at Gate 3.



- 4.6.35 The WFD Assessment highlights that reductions in flow velocity and depth may reduce cover/refuge and optimal flow habitat for adult fish; hydraulic modelling and detailed habitat surveys are therefore required. In this context, Option WR076 is assessed as potentially non-compliant in the WFD Assessment; however, this conclusion is assigned a low level of confidence and the Assessment notes that the sub-option has the potential to be compliant, subject to further evidence and assessment.
- 4.6.36 Overall, a moderate negative effect is identified at this stage on a precautionary basis, recognising that further surveys are required at Gate 3. In this regard, some residual uncertainty remains.

#### WR102b: [⌘]

- 4.6.37 Option WR102b would involve abstraction from the Lower Mersey Basin and North Merseyside Permo-Triassic Sandstone aquifer. This groundwater body is potentially non-compliant for dependent surface water body status, saline intrusion, water balance and chemical status. The ALS indicates that there is limited/restricted water availability in the aquifer, which is consistent with the EA's water availability update provided in March 2022 (8.2MI/d available).
- 4.6.38 On this basis, the WFD Assessment concludes (with a medium level of confidence) that increased groundwater abstraction could cause long term moderate decreases in groundwater levels with a risk of saline intrusion into the aquifer resulting in non-compliance. This is assessed as a moderate negative effect at this stage. This assessment will be updated once the Lower Mersey Basin groundwater model has been updated (for Gate 3).
- 4.6.39 Increased groundwater abstraction has the potential to reduce flows in overlying surface water bodies which could result in a deterioration of WFD classification. Affected surface waterbodies include Netherly Brook, Ditton Brook, Dog Clog Brook and Prescot Brook (effects in respect of the Mersey Estuary are likely to be negligible). However, hydraulic connections are likely limited by low permeability glacial till superficial cover, and the ALS indicates that water is available across the flow regime in the surface water catchment. At this stage, a moderate negative effect is identified, although residual uncertainty remains.
- 4.6.40 Further ecological evidence collection is being undertaken in the catchment, to support impact assessment should it be required, once flow impacts are available from the Lower Mersey Basin groundwater model.

#### WR107a2: [⌘]

- 4.6.41 As highlighted above in respect of Option WR102b, the Lower Mersey Basin and North Merseyside Permo-Triassic Sandstone groundwater body is potentially non-compliant for dependent surface waterbody status, saline intrusion, water balance and chemical status; Option WR107a2 would also involve abstraction from this aquifer. Although the EA has indicated that there is sufficient water available for the proposed capacity within the licensed surplus, this sub-option would require a new licence. On this basis, the WFD Assessment concludes that the sub-option is potentially not compliant with a medium level of confidence and a moderate negative effect is therefore identified at this stage.



This assessment will be updated once the Lower Mersey Basin groundwater model has been updated (for Gate 3).

- 4.6.42 The WFD Assessment highlights that the aquifer and overlying surface water bodies may be hydrologically connected due to the presence of permeable superficial deposits. The ALS indicates that water is available in the overlying surface water catchment, except at Q95 when there is no water available. The WFD Assessment identifies that the increased groundwater abstraction could cause long term moderate decreases in river flows in Downholland (Lydiate/Cheshires Lines) Brook, and water quality which could potentially result in a deterioration of WFD classification. This is assessed as a moderate negative effect on a precautionary basis at this stage and in the absence of a quantified understanding of the impacts on flow, although residual uncertainties remain. Further ecological evidence collection is being undertaken in the catchment, to support impact assessment should it be required, once flow impacts are available from the Lower Mersey Basin groundwater model.

#### WR107b: [X]

- 4.6.43 Option WR107b would also involve abstraction from the Lower Mersey Basin and North Merseyside Permo-Triassic Sandstone groundwater body. The WFD Assessment concludes that this sub-option is potentially non-compliant for dependent surface water body status, GWDTes and chemical status. However, this assessment is ascribed a low-confidence level in the WFD Assessment pending a spatially distributed assessment of connectivity to rivers and wetlands using the Lower Mersey & North Merseyside groundwater model (for Gate 3). On this basis, a moderate negative effect is identified at this stage on a precautionary basis, although residual uncertainties remain.
- 4.6.44 The Alt (upstream and downstream of Bull Bridge) has also been assessed as potentially non-compliant for biological and physico-chemical elements. Again, this is a precautionary conclusion in the absence of a quantified understanding of the impacts of the sub-option on flow and further ecological evidence collection is being undertaken in the catchment. A moderate negative effect is therefore identified at this stage on a precautionary basis at this stage, although residual uncertainties remain.

#### WR111: [X]

- 4.6.45 Option WR111 would involve abstraction from the Manchester and East Cheshire Permo-Triassic Sandstone groundwater body, which is potentially non-compliant for dependent surface waterbody status, GWDTes, water balance and chemical status.
- 4.6.46 The latest EA update indicates that the GWMU is over-licensed, but with sufficient water available (within licence) for the sub-option. However, a licence variation would be required and the WFD Assessment concludes (with a medium level of confidence at this stage) that the additional licenced quantity could lead to deterioration in the quantitative water balance of the aquifer. This assessment will be quantified and revisited once the East Cheshire groundwater model has been updated (for Gate 3). On this basis, a moderate negative effect is identified, although residual uncertainty remains.
- 4.6.47 The WFD Assessment also highlights that surface water bodies (the Dean and Bollin) are potentially in connectivity with the aquifer, such that there is the potential for ecological



effects. This is assessed as a moderate negative effect on a precautionary basis at this stage and residual uncertainty remains. Further ecological evidence collection is being undertaken in the catchments, to support impact assessment should it be required, once flow impacts are available from the East Cheshire groundwater model.

#### WR113: [REDACTED]

- 4.6.48 Option WR113 would also involve abstraction from the Manchester and East Cheshire Permo-Triassic Sandstone groundwater body. Whilst there is there is sufficient water available within licence for this sub-option, the [REDACTED] borehole has been flagged by the EA as 'at risk' from environmental destination. The WFD Assessment concludes that the sub-option is potentially non-compliant for dependent surface waterbody status (the Dean and Bollin), GWDTes, water balance and chemical status; however, this is ascribed a low level of confidence pending a spatially distributed assessment of connectivity to rivers and wetlands.
- 4.6.49 Further ecological evidence collection is being undertaken in the catchment, to support impact assessment should it be required. At this stage, a moderate negative effect is identified on a precautionary basis, although residual uncertainty remains.

#### WR149: [REDACTED]

- 4.6.50 Option WR149 would involve abstraction from the Lower Mersey Basin and North Merseyside Permo-Triassic Sandstone groundwater body. As highlighted above, this groundwater body is potentially non-compliant for dependent surface waterbody status, saline intrusion, water balance and chemical status.
- 4.6.51 The regulator review at SRO Gate 1 raised concerns for the West Glaze GWMU as this was over-abstracted and is still over-licensed. The Sub-Option Assessment Report identifies that the latest EA water availability update indicates that the GWMU is over-licensed, with insufficient water available for this sub-option. The WFD Assessment also highlights that there are EA concerns regarding the [REDACTED] Borehole in terms of salinity and that changed groundwater flow patterns due to the increased abstraction could potentially result in migration of pollutants, which could cause further deterioration in the Chemical Drinking Water Protected Area. In this context, the WFD Assessment concludes that the sub-option is potentially not WFD compliant (with medium confidence). This is assessed as a moderate negative effect at this stage, although residual uncertainty remains. This assessment will be updated once the Lower Mersey Basin groundwater model has been updated (for Gate 3).
- 4.6.52 The WFD Assessment also highlights that surface waterbodies are potentially in connectivity with the aquifer such that there is the potential for ecological effects. This is assessed as a moderate negative effect on a precautionary basis at this stage and in the absence of a quantified understanding of the impacts on flow in these water bodies. Further ecological evidence collection is being undertaken in these water bodies to support impact assessment should they be required, once flow impacts are available from the Lower Mersey Basin groundwater model.



## Cumulative Effects of the NWT SRO Full Solution

### Construction

4.6.53 No major or moderate effects have been identified. As set out above, it is assumed that best practices construction methods will be followed during the construction of the NWT SRO Full Solution sub-options such that effects on water during the construction phase of the NWT SRO Full Solution would be negligible. This is consistent with the conclusions of the WFD Assessment.

### Operation

4.6.54 Operation of the NWT SRO Full Solution will involve the abstraction of circa 105MI/d from rivers and 64.8MI/d from groundwater sources. As highlighted above in respect of the individual SRO sub-options, abstraction has the potential to affect either (i) deterioration of WFD status and/or (ii) the ability of a waterbody to attain its target status.

4.6.55 To understand the effects of the NWT SRO Full Solution on water in terms of WFD compliance, a cumulative assessment of the effects of the SRO sub-options has been undertaken and is presented in the WFD Assessment. The cumulative assessment has considered effects on those waterbodies that are impacted by more than one SRO sub-option. The waterbodies identified for the cumulative assessment are grouped as follows:

- River Bollin- Options WR076, WR111 and WR113 are in the Bollin catchment;
- River Mersey, Manchester Ship Canal and Mersey Estuary- Options WR015, WR076, WR111, WR113 and WR149 are in the catchment of the River Mersey. Option WR102b flows separately into the Mersey Estuary;
- Alt Estuary- Options WR107a2 and WR107b are in the catchment of the Alt Estuary;
- Ribble Estuary- Option WR049d and the Primrose Hill abstraction of WR107b are in the catchment of the Ribble Estuary, each discharging to different parts of the estuary;
- Lower Mersey and North Merseyside Permo-Triassic Sandstone Aquifers- Options WR102b, WR107a2, WR107b and WR149 abstract from this waterbody;
- Manchester and East Cheshire Permo-Triassic Sandstone Aquifers- Options WR111 and WR113 abstract from this waterbody.

4.6.56 The cumulative assessment of the NWT Full Solution as a whole identifies the potential for non-compliance in two groundwater bodies (with medium confidence), and 22 river water bodies (with low confidence). This considers all water bodies that could be influenced by one or more sub-options, across the catchments listed above. In all cases, further evidence collection and assessment is planned and/or underway, to reduce uncertainty and enable updated assessments for Gate 3. However, an overall moderate negative effect is identified on a precautionary basis on this stage, for both groundwater and rivers, although residual uncertainties remain.



## Additional Mitigation and Enhancement Measures

- 4.6.57 The following additional mitigation and enhancement measures have been identified:
- Taking into account additional data collection, evidence and assessment post-Gate 2, HoFs should be identified to ensure WFD compliance;
  - Opportunities to deliver nature-based solutions should be considered to: a) ensure water quality; b) mitigate the impacts of abstraction in a way that is also of business and environment benefit; and c) reduce UU's carbon footprint.

## Residual Effects and Uncertainties

- 4.6.58 For all sub-options that comprise the NWT SRO Full Solution, further evidence and assessment is required before Gate 3 in order to determine the potential effects of abstraction on waterbodies. In consequence, the SRO is assessed as having a residual moderate operational effect in respect of water at this stage.

## 4.7 Flood Risk

### Overview

- 4.7.1 The construction and operation of new water resources infrastructure can be affected by flooding, particularly where development is located in Flood Zones 2 and 3. Flood Zone 3 represents areas with a high probability of flooding, which could be flooded either from rivers or the sea if there were no flood defences. These areas could be affected by flooding from the sea that has a 0.5% (1 in 200) or greater chance of occurring each year, or flooding from rivers that has a 1% (1 in 100) or greater chance of occurring each year. Flood Zone 2 shows the additional extent of an extreme flood from rivers or the sea, with up to a 0.1% (1 in 1,000) chance of occurring each year.
- 4.7.2 New water resources infrastructure can also affect flood risk both negatively (for example, due to increased surface water run-off and changes in river flows) but also positively (for example, by providing extra space for flood water storage).

### Environmental Context

- 4.7.3 Parts of the area supplied by UU and within which the NWT SRO Full Solution sub-options are located are prone to flooding. **Figure 4.9** shows the location of areas most at risk from flooding (Flood Zones 3 and 2) in the UU supply area.
- 4.7.4 Climate change presents increased risk with respect to coastal flooding in the long term, while climate change combined with an increase in housing numbers or urban area presents an increased risk to fluvial and sewer flooding. The UK Climate Programme 2009 (UKCP09) projections for the North West (for the medium emissions scenario central) estimate (with a 50% probability) that:
- Winter mean precipitation will increase by 16% by the 2080s. It is very unlikely to increase by less than 3% and is very unlikely to increase by more than 34%;



- Summer mean precipitation will reduce by 22% by the 2080s. It is very unlikely that summer mean precipitation will reduce by more than 43% and it is very unlikely that it will increase by more than 0%.

4.7.5 UKCP18<sup>30</sup> has updated the UKCP09 projections. It has found that climate change trends projected over UK land for the 21<sup>st</sup> century are broadly consistent with earlier projections (UKCP09) showing an increased chance of milder, wetter winters and hotter, drier summers along with an increase in the frequency and intensity of extreme weather.

## Embedded Mitigation and Enhancement

4.7.6 Option WR102b includes flood defences to manage flood risk at the [§] WTW site.

## Sub-Option Appraisal Summary

### STTA4: Vyrnwy Aqueduct Enabling Works

4.7.7 No major or moderate construction or operational effects in respect of flood risk are predicted. The sub-option is wholly located within Flood Zone 1 and its operation is not expected to increase the risk of flooding elsewhere.

### WR015: [§]

4.7.8 The proposed abstraction point and two small sections of the pipeline associated with Option WR015 would be within Flood Zones 2 and 3. Construction activity could therefore be affected by flooding (depending on the timing of the works) which is assessed as a moderate negative effect.

4.7.9 No major or moderate effects in respect of flood risk are predicted during the operation of this sub-option. Whilst the new abstraction infrastructure would be located within Flood Zone 3, it is assumed that appropriate flood mitigation/resilience measures would be incorporated as appropriate. It is also very unlikely that the sub-option would cause or exacerbate flood risk elsewhere.

### WR049d: [§]

4.7.10 The site of the proposed new intake and pumping station, as well as four sections of the pipeline route associated with Option WR049d are located within areas of Flood Zone 3 and, therefore, works may be liable to flooding during the construction period. This is assessed as a moderate negative effect.

4.7.11 No major or moderate effects in respect of flood risk are predicted during the operation of this sub-option. Whilst the new intake and pumping station would be located within Flood Zone 3, it is assumed that appropriate flood mitigation/resilience measures would

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<sup>30</sup> UKCP18 website. *UK Climate projections (2019) Headline findings*. Available online: <https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp-headline-findings-v2.pdf> [Accessed September 2022].



be incorporated as appropriate. It is also very unlikely that the sub-option would cause or exacerbate flood risk elsewhere.

#### WR076: [REDACTED]

- 4.7.12 The proposed abstraction point, part of the site of the WTW/service reservoir and approximately 0.65km of the proposed 3.8km pipeline route associated with Option WR076 would be located within Flood Zone 3. An additional section of the pipeline (approx. 0.2km) would also be located within Flood Zone 2. Construction activity may therefore be liable to flooding (depending on the timing of the works). This is assessed as a moderate negative effect.
- 4.7.13 Owing to the location of new infrastructure in Flood Zone 3, which includes a new WTW, a moderate negative operational flood risk effect has been identified. However, operation of the scheme is not expected to increase the risk of flooding elsewhere.

#### WR102b: [REDACTED]

- 4.7.14 The [REDACTED] WTW site is largely situated within Flood Zone 3, whilst the remainder of the site is within Flood Zone 2. Construction activity at this site associated with Option WR102b may therefore be liable to flooding (depending on the timing of the works). This is assessed as a moderate negative effect.
- 4.7.15 The sub-option design includes flood defences at the site [REDACTED] WTW site such that operational effects are assessed as minor. Operation of the scheme is not expected to increase the risk of flooding elsewhere.

#### WR107a2: [REDACTED]

- 4.7.16 No major or moderate construction or operational effects in respect of flood risk are predicted. The sub-option is wholly located within Flood Zone 1 and its operation is not expected to increase the risk of flooding elsewhere.

#### WR107b: [REDACTED]

- 4.7.17 A section of the [REDACTED] pipeline associated with Option WR107b would cross an area of Flood Zone 3 and the [REDACTED] borehole site is partially located within Flood Zone 2. Consequently, construction activity could be at risk of flooding This is assessed as a moderate negative effect.
- 4.7.18 No major or moderate effects in respect of flood risk are predicted during the operation of this sub-option. Whilst the boreholes would be partially located within Flood Zone 2, it is assumed that appropriate flood mitigation/resilience measures already exist on site and/or would be incorporated into the design of the scheme. It is also very unlikely that the sub-option would cause or exacerbate flood risk elsewhere.



#### WR111: [✕]

4.7.19 No major or moderate construction or operational effects in respect of flood risk are predicted. New assets would not be within Flood Zones 3 or 3 and operation of the sub-option would not cause of exacerbate flood risk elsewhere.

#### WR113: [✕]

4.7.20 No major or moderate construction or operational effects in respect of flood risk are predicted. Option WR113 is wholly located within Flood Zone 1 and its operation is not expected to increase the risk of flooding elsewhere.

#### WR149: [✕]

4.7.21 A section of the proposed pipeline associated with Option WR149 would be situated within Flood Zone 3. Consequently, construction activity could be liable to flooding. This is assessed as a moderate negative effect.

4.7.22 No major or moderate effects in respect of flood risk are predicted during the operation of the sub-option (new assets would not be within Flood Zones 3 or 3) and operation of the sub-option would not cause of exacerbate flood risk elsewhere.

## Cumulative Effects of the NWT SRO Full Solution

### Construction

4.7.23 Construction of the NWT SRO Full Solution will require development within Flood Zones 2 and 3 and, in consequence, construction activity could be liable to flooding. Owing to the distance between the sub-options that comprise the NWT SRO Full Solution, however, their collective construction is not expected to increase the level of flood risk over and above that associated with the construction of the individual sub-options, as reported above.

4.7.24 On this basis, it is concluded that there would be an overall moderate negative flood risk effect during the construction phase of the NWT SRO Full Solution.

### Operation

4.7.25 The operation of infrastructure associated with the NWT SRO Full Solution may be affected by flooding, reflecting the location of scheme components in Flood Zones 2 and 3. As with construction, however, no additional cumulative effects are predicted, over and above those associated with the individual sub-options. Operation of the NWT SRO Full Solution would not cause or exacerbate flood risk elsewhere.

4.7.26 Overall, the NWT SRO Full Solution is predicted to result in a moderate negative flood risk effect during the operational phase.

## Additional Mitigation and Enhancement Measures

4.7.27 The following additional mitigation and enhancement measures have been identified:



- An appropriate Flood Risk Assessment (FRA) should be undertaken prior to the construction of the NWT SRO Full Solution sub-options (where required) to support the identification of appropriate mitigation measures and to ensure that flood risk is minimised. Measures may include sustainable drainage approaches and planting as well as flood storage.
- Detailed siting and design of new infrastructure should incorporate flood risk mitigation, in agreement with the EA.
- Infrastructure should, where practicable, be located outside the 1 in 100 year indicative flood plain. Where this is not possible due to operational requirements, the infrastructure should be designed such that it can continue to operate under flood conditions and not increase flood risk elsewhere.

## Residual Effects and Uncertainties

- 4.7.28 With implementation of the additional mitigation measures outlined above, it is predicted that the construction and operational flood risk effects of the NWT SRO Full Solution would be reduced to minor.

## 4.8 Noise and Vibration

### Overview

- 4.8.1 The construction of water resources infrastructure will generate noise both on-site from the use of plant and machinery and, potentially, along transport routes associated with construction vehicle movements. The operation of some water resources infrastructure may also generate noise. High levels of noise can have wide-ranging impacts on the quality of human life and health (e.g. owing to annoyance or sleep disturbance), use and enjoyment of areas of value (such as quiet or tranquil places) and areas with high landscape quality. Noise can also have ecological effects.

### Environmental Context

- 4.8.2 Background noise primarily comprises of noise from transport sources such as road, rail and aviation. In accordance with the Environmental Noise (England) Regulations 2006 (as amended), Defra produces noise maps every five years which show people's exposure to environmental noise. The latest noise maps were released in 2017 and are available via Defra's website<sup>31</sup>. Noise Important Areas (NIAs) for roads and railways have been identified in Noise Action Plans produced by Defra based on the strategic noise maps and highlight where the highest 1% of noise levels at residential locations can be found. The NIAs across UU's supply area (including North Wales), which are largely concentrated in the urban areas of Liverpool and Greater Manchester, are shown in **Figure 4.10**
- 4.8.3 Noise-sensitive receptors specific to the NWT SRO Full Solution are largely sub-option-specific and are identified in the sub-option appraisal matrices contained at **Appendix B**.

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<sup>31</sup> See <https://www.gov.uk/government/publications/strategic-noise-mapping-2019> [Accessed July 2022].



## Embedded Mitigation and Enhancement

- 4.8.4 There are no current embedded mitigation or enhancement measures in relation to noise and vibration effects.

## Sub-Option Appraisal Summary

### STTA4: Vyrnwy Aqueduct Enabling Works

- 4.8.5 No major or moderate construction or operational effects in respect of noise and vibration are predicted for Option STTA4.
- 4.8.6 There may be noise/vibration disturbance impacts on residential properties, farmsteads and community uses within close proximity of the development sites and along transport corridors during the construction phase of this sub-option; however, any negative effects would be temporary and localised and are likely to be minor.

### WR015: [REDACTED]

- 4.8.7 Works associated with the construction of Option WR015 may result in noise and vibration disturbance, particularly in the urban area of Whitefield (including residential areas), where the route of the proposed pipeline crosses. The transportation of equipment/material could further intensify these impacts. However, any negative effects would be temporary and localised and are assessed as moderate.
- 4.8.8 Operational noise and vibration effects are expected to be negligible.

### WR049d: [REDACTED]

- 4.8.9 No major or moderate construction or operational effects in respect of noise and vibration are predicted for Option WR049.
- 4.8.10 There may be noise/vibration disturbance impacts on residential properties within close proximity of the development sites and along transport corridors associated with this sub-option during the construction phase; however, any negative effects would be temporary and localised and are likely to be minor.

### WR076: [REDACTED]

- 4.8.11 Construction activity and HGV movements associated with Option WR076 could have noise impacts upon nearby residential receptors in [REDACTED], as well as residential areas to the north of the proposed works. Construction activity and HGV movements associated with the pipeline works could also lead to noise impacts on a small number of residential receptors along the proposed route of the pipeline. However, any negative effects would be temporary and localised and are assessed as moderate.
- 4.8.12 Operational noise and vibration effects associated with this sub-option are expected to be negligible.

### WR102b: [REDACTED]



- 4.8.13 Noise arising from construction activity including HGV movements associated with Option WR102b would have the potential to cause increased nuisance and disruption, particularly given the proximity of residential receptors to the borehole sites. However, any negative effects would be temporary and localised and are assessed as moderate.
- 4.8.14 Operational noise and vibration effects associated with this sub-option are expected to be negligible.

#### WR107a2: [REDACTED]

- 4.8.15 No major or moderate construction or operational effects in respect of noise and vibration for Option WR107a2 are predicted.

#### WR107b: [REDACTED]

- 4.8.16 No major or moderate construction or operational effects in respect of noise and vibration are predicted.
- 4.8.17 Construction of Option WR107b may lead to noise/vibration disturbance impacts which could affect residential receptors in [REDACTED], in addition to the scattered residential receptors and farmsteads in proximity to the works. The transportation of equipment/material could further intensify these impacts. However, effects would be temporary and are assessed as minor.

#### WR111: [REDACTED]

- 4.8.18 No major or moderate construction or operational effects in respect of noise and vibration are predicted.
- 4.8.19 There may be noise/vibration disturbance impacts during the construction of Option WR111 which could affect residential receptors. In particular, development of the new WTW at [REDACTED] poses a potential risk to the residential amenity of properties situated in [REDACTED]. The transportation of equipment/material could further intensify these impacts. However, effects would be temporary and localised and are assessed as minor.

#### WR113: [REDACTED]

- 4.8.20 No major or moderate construction or operational effects in respect of noise and vibration are predicted.
- 4.8.21 Pipeline works associated with Option WR113 could affect residential and commercial receptors as well as three schools whilst construction works at [REDACTED] WTW would also be within close proximity to residential properties. The transportation of equipment/material could further intensify these impacts. However, any noise/vibration effects would be temporary and localised and are predicted to be minor negative.

#### WR149: [REDACTED]

- 4.8.22 No major or moderate construction or operational effects in respect of noise and vibration are predicted.



- 4.8.23 There may be a risk of temporary noise disturbance associated with the refurbishment/modification of the boreholes/WTW and excavation of the pipeline associated with Option WR149 on residential properties and other receptors within the vicinity of the scheme including in [§]. The transportation of equipment/material could further intensify these impacts. However, any adverse impacts would be temporary and localised and are assessed as minor adverse.

## Cumulative Effects of the NWT SRO Full Solution

### Construction

- 4.8.24 Construction of the NWT SRO Full Solution sub-options will generate noise and vibration which could affect sensitive receptors in close proximity to development sites and along transport routes. However, any effects would be temporary and localised and are not predicted to be significant. Given the distance between the sub-options that comprise the solution, it is unlikely that there would be any additional cumulative noise effects.
- 4.8.25 Overall, it is concluded that there would be overall moderate negative effects in respect of noise and vibration during the construction phase of the NWT SRO Full Solution.

### Operation

- 4.8.26 Noise and vibration effects associated with the operation of infrastructure associated with the NWT SRO Full Solution are likely to be negligible. Associated vehicle movements may in some instances generate noise and vibration impacts on sensitive receptors along transport routes; however, any effects are predicted to be minor.
- 4.8.27 Overall, the NWT SRO Full Solution is predicted to result in a minor negative noise and vibration effect during the operational phase.

## Additional Mitigation and Enhancement Measures

- 4.8.28 The following additional mitigation and enhancement measures have been identified:
- CEMPs should include measures to minimise construction-related noise and vibration effects consistent with the recommendations in BS 5228-1<sup>32</sup> (or equivalent at the time of construction). These measures could include, for example, noise monitoring around the boundary of construction sites, use of the most suitable plant, reasonable hours of working for noisy operations and use of solid site hoardings to screen receptors.
  - Works should be undertaken in accordance with the Code for Considerate Practice of the Considerate Constructors Scheme (or similar).
  - HGV movements should be routed to avoid built-up areas where practicable.
  - In the development of detailed designs for pipeline routes and the siting of above ground infrastructure, care should be taken to avoid the most sensitive receptors.

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<sup>32</sup> British Standards Institution (2008). BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Noise.



- New above ground infrastructure should be designed to minimise emissions of noise and vibration.

## Residual Effects and Uncertainties

- 4.8.29 With implementation of the additional mitigation measures outlined above, it is predicted that the construction and operational noise and vibration effects of the NWT SRO Full Solution will be reduced to minor.
- 4.8.30 It should be noted that a number of uncertainties remain relating to (*inter alia*): current and future baseline noise levels; the detailed design and siting of new infrastructure; the phasing of sub-option implementation; and the exact noise levels associated with construction and operational vehicles, plant and equipment.

## 4.9 Air Quality

### Overview

- 4.9.1 The emission of pollutants to air from water resources infrastructure can pose a hazard to human health (e.g., respiratory illnesses and lung conditions) and can also have a negative impact on the environment (e.g., changes to ecosystems and damage to vegetation when present within the atmosphere in excess of certain concentrations). Such thresholds are set as objectives and include pollutants such as nitrogen dioxide (NO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>) volatile organic compounds (VOCs) and fine particles (known as 'particulates'). Air Quality Management Areas (AQMAs) are declared in specific locations where atmospheric concentrations of one or more pollutants are either close to or exceeding statutory objectives set out within the *Air Quality Strategy for England, Scotland, Wales and Northern Ireland*.<sup>33</sup>

### Environmental Context

- 4.9.2 A total of 36 local authorities across the North West have declared AQMAs for exceedance of NO<sub>2</sub> (within each local authority there may be several AQMAs). In the vicinity of the NWT SRO Full Solution sub-options specifically, there are two AQMAs, the Greater Manchester Combined Authority AQMA and the Liverpool City AQMA. With increasingly strong air quality legislation and de-industrialisation, coupled with technological improvements such as lower emission and electric vehicles, levels of the majority of air pollutants are expected to decline.
- 4.9.3 Receptors which may be affected by emissions to air arising from the NWT SRO Full Solution are identified in the sub-option appraisal matrices at **Appendix B**.

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<sup>33</sup> Defra (2007) *Air Quality Strategy for England, Scotland, Wales and Northern Ireland* Available online: <https://www.gov.uk/government/publications/the-air-quality-strategy-for-england-scotland-wales-and-northern-ireland-volume-2> [Accessed July 2022]



## Embedded Mitigation and Enhancement

- 4.9.4 There are no current embedded mitigation or enhancement measures in relation to air quality.

## Sub-Option Appraisal Summary

### STTA4: Vyrnwy Aqueduct Enabling Works

- 4.9.5 No major or moderate construction or operational air quality effects are predicted.
- 4.9.6 Option SSTA4 will require an estimated 5,848 vehicle movements over the 5-year construction period (equivalent to approximately 1,170 vehicle movements per annum) which, in addition to the operation of plant and machinery, could have a temporary and localised negative effect on air quality in the vicinity of development sites and along transport routes. This is assessed as a minor negative effect.
- 4.9.7 The operation of Option STTA4 will require an estimated 624 vehicle movements per year with associated air quality effects likely to be negligible.

### WR015: [REDACTED]

- 4.9.8 Option WR015 would require a total of 45,684 vehicle movements over the 2.63 year construction period which could contribute to congestion on, for example, the M60, M66, M62, A56, A665, A667, B6473 and B6198. Associated emissions could result in a worsening of local air quality including within the Greater Manchester Combined Authority AQMA. In the absence of mitigation, this is assessed as a major (likely significant) negative effect, although effects in this regard would be temporary
- 4.9.9 No major or moderate air quality effects are predicated during the operation of this sub-option (the sub-option would generate 832 vehicles movements per year which is likely to result in a negligible increase in emissions to air).

### WR049d: [REDACTED]

- 4.9.10 The construction of Option WR049d would generate a total of 52,186 vehicle movements over the 2.63-year construction stage which could contribute to road traffic congestion and associated emissions to air along roads leading to/in close proximity to the works. This could include, for example, the A59, B6230, A673, A674, A675, M61, M65 and B5256, as well as a number of local roads. Although the sub-option is not within an AQMA, in the absence of mitigation, this is assessed as a major (likely significant) negative effect, although effects in this regard would be temporary.
- 4.9.11 The operation of this sub-option would require 9,204 vehicle movements per year which could have a moderate negative affect on air quality.

### WR076: [REDACTED]

- 4.9.12 Option WR076 would generate 22,838 vehicle movements during the 1.92-year construction period. This could contribute to additional road traffic congestion (for



example, on the A6144, B5159 and B5160) from which the emissions may have a negative effect on local air quality. Furthermore, some sections of the A56 which may be used to access construction sites are within the Greater Manchester Combined Authority AQMA. In the absence of mitigation, this is assessed as a moderate negative effect, although effects in this regard would be temporary.

- 4.9.13 No major or moderate air quality effects are predicated during the operation of this sub-option (the sub-option would generate 844 vehicles movements per year which is likely to result in a negligible increase in emissions to air).

#### WR102b: [REDACTED]

- 4.9.14 No major or moderate construction or operational air quality effects are predicted.
- 4.9.15 The [REDACTED] sites fall within the boundary of the Liverpool City AQMA. Construction activity would generate additional vehicle movements (8,222 vehicle movements during the 1.92-year construction period) on the local road network (particularly the B5178 and other local roads in the area) which may, together with plant and machinery operation, have a negative effect on local air quality within the AQMA. However, effects in this regard would be temporary and are predicted to be minor negative.
- 4.9.16 No major or moderate air quality effects are predicated during the operation of this sub-option (the sub-option would generate 780 vehicles movements per year which is likely to result in a negligible increase in emissions to air).

#### WR107a2: [REDACTED]

- 4.9.17 No major or moderate construction or operational air quality effects are predicted.
- 4.9.18 Option WR107a is not located within an AQMA and would require 5,445 vehicle movements in total over the 1.8 year construction period. Whilst these vehicles and with the use of plant and machinery would result in emissions to air during the construction period, effects on local air quality are predicted to be temporary and minor.
- 4.9.19 The operation of the sub-option would require 884 vehicle movements per annum and as such, it is anticipated that any associated effects on air quality would be negligible.

#### WR107b: [REDACTED]

- 4.9.20 Whilst Option WR107b is not located within an AQMA, the [REDACTED] site is immediately adjacent to the Liverpool City AQMA. The scheme would require a total of 24,465 vehicle movements over the 1.92-year construction period which could contribute to congestion on roads leading to, crossed, or adjacent to the works, including the M57, M58, A580, A5147, A59, A5208, A5207, A506, B5192, B5202, B5197 and B5195 and across a range of local roads. Congestion, coupled with the use of plant and machinery, may generate a negative impact upon local air quality, including (potentially) within the Liverpool City AQMA. This is assessed as a moderate negative effect, although effects in this regard would be temporary.
- 4.9.21 The operation of this sub-option would generate circa 9,256 vehicle movements per year which could also affect local air quality including within the Liverpool City AQMA. A



moderate negative effect has therefore also been identified during the operational phase of Option WR107b.

#### WR111: [X]

- 4.9.22 Sections of the A6 and the A555 near the site of the new proposed WTW are located within the Greater Manchester Combined Authority AQMA. Construction activity including associated vehicle movements (estimated 2,658 vehicle movements in total during the construction phase) could therefore result in a worsening of air quality in the AQMA; however, effects in this regard would be temporary and minor.
- 4.9.23 The operation of Option WR111 would require 572 vehicle movements per year, which is not expected to have any discernible effect on local air quality.

#### WR113: [X]

- 4.9.24 No major or moderate construction or operational air quality effects are predicted.
- 4.9.25 A total of 3,288 vehicle movements would be generated during the 1.49-year construction period for Option WR113 which may contribute to road traffic congestion, particularly on the roads which the route of the pipeline would follow [X], and those which the route of the pipeline would cross (A523 and B5470). The associated emissions, in conjunction with plant and machinery operation, may have a temporary minor negative effect on local air quality.
- 4.9.26 The operation of the sub-option will require 104 vehicle movements per annum and as such, it is anticipated that any associated effects on air quality would be negligible.

#### WR149: [X]

- 4.9.27 No major or moderate construction or operational air quality effects are predicted.
- 4.9.28 Option WR149 would generate an estimated 7,381 vehicle movements during the 1.81-year construction period which may contribute to congestion, particularly along the A573, A574, A580 (some sections of which, including where the pipeline crosses, are located within the Greater Manchester Combined Authority AQMA) and B5207. However, any effects are likely to be minor and temporary.
- 4.9.29 The operation of Option WR149 would require 208 vehicle movements per year, which is not expected to have any discernible effect on local air quality.

## Cumulative Effects of the NWT SRO Full Solution

### Construction

- 4.9.30 Construction of the NWT SRO Full Solution sub-options would generate emissions to air which could affect local quality. The principal source of emissions would be pollutants associated with vehicle movements. Vehicle emissions could affect sensitive receptors along transport corridors and effects are likely to be more pronounced where development is located within/in close proximity to AQMAs. In this regard, the sub-



options that comprise the NWT SRO Full Solution could affect air quality in the Liverpool City and Greater Manchester Combined Authority AQMAs. Whilst any effects would be temporary (i.e. for the period of construction), this is assessed as a major negative (likely significant) effect (in the absence of mitigation).

- 4.9.31 Whilst the total number of vehicle movements associated with the construction of the NWT SRO Full Solution would be substantial, due to the distance between the sub-options, it is unlikely that there would be any additional major or moderate cumulative air quality effects on sensitive receptors, beyond those identified in respect of the sub-options above. However, multiple sub-options do potentially affect Liverpool City AQMA (Options WR102b and WR107b) and the Greater Manchester Combined Authority AQMA (Options WR015, WR076, WR111 and WR149) which could cumulatively lead to a worsening of air quality within these AQMAs; however, this would be dependent on construction traffic routes and the phasing of development.
- 4.9.32 Emissions to air associated with construction activity on site (including emissions from the operation of plant and machinery and dust) are unlikely to be significant both at the sub-option level and cumulatively for the NWT SRO Full Solution as a whole.
- 4.9.33 Overall, it is concluded that there would be potentially major (likely significant) negative air quality effects during the construction phase of the NWT SRO Full Solution, although effects would be temporary. However, it is anticipated that there will be a gradual transition to low emission/electric vehicles nationally over the SRO construction period. It is, therefore, reasonable to assume (particularly given the extended SRO implementation period) that background air quality will improve and, further, that a proportion of construction vehicle movements would comprise of low emission/electric vehicles. This would serve to reduce air quality effects associated with the construction phase of the NWT SRO Full Solution. In consequence, the assessment conclusion of major negative air quality effects is considered to be worst case and precautionary.

## Operation

- 4.9.34 Emissions to air associated with the operation of the NWT SRO Full Solution would be primarily associated with vehicle movements. For most sub-options, total annual operational vehicle movements and, therefore, emissions to air are expected to be very small but for two sub-options (Options WR049d and WR107b), vehicle movements would be larger and (in the absence of mitigation) could result in moderate negative air quality effects. With specific regard to Option WR107b, vehicle movements could result in a worsening of air quality in the Liverpool City AQMA (depending on the routing of operational vehicle traffic).
- 4.9.35 Taking into account the volume of vehicles movements associated with the operation of the majority of the SRO sub-options and the distance between them, no additional cumulative effects are predicted.
- 4.9.36 Overall, the NWT SRO Full Solution is predicted to result in potentially moderate negative air quality effects during operation. However, as with construction, it is anticipated that background air quality levels will improve and, further, that the majority of operational vehicles movements will be low emission/electric vehicles. In consequence, this assessment conclusion is considered to be worst case and precautionary.



## Additional Mitigation and Enhancement Measures

- 4.9.37 The following additional mitigation and enhancement measures have been identified:
- A Construction Traffic Management Plan (CTMP) should be prepared for each sub-option to manage the traffic impacts associated with construction. Measures to mitigate air quality effects could include the routing of traffic to avoid sensitive receptors and the timing of HGV movements to avoid peak traffic hours;
  - Measures to minimise emissions to air should be included in a CEMP. Measures could include the use of low emission plant and vehicles, air quality monitoring and preparation of a Dust Management Plan.

## Residual Effects and Uncertainties

- 4.9.38 With implementation of the additional mitigation measures outlined above, it is predicted that the construction and operational air quality effects of the NWT SRO Full Solution would be reduced to minor. However, it should be noted that a number of uncertainties remain relating to: the exact routing of construction and operational vehicles; the exact phasing of sub-option implementation; future background air quality levels; future baseline traffic flows; and the speed at which construction and operational vehicles transition to low emission/electric engines.

## 4.10 Climate Change

### Overview

- 4.10.1 The effects of climate change are potentially some of the most significant environmental problems facing the NWT SRO Full Solution area. These effects could include increased variability in precipitation and drought patterns, increased sea levels and a higher risk of flooding. Greenhouse gases (GHG) including carbon dioxide (CO<sub>2</sub>) emitted from human actions are a major contributor to climate change.
- 4.10.2 The UK is committed to net zero emissions in 2050 and is required to set carbon budgets to set out a trajectory for emissions reductions to 2050. For the UK, the Sixth Carbon Budget has been set at a 78% reduction in emissions between 1990 and 2030.
- 4.10.3 Under the third UK Climate Change Risk Assessment evidence report, there are significant reductions projected in the availability of public water supplies by the 2050s and the 2080s under both a medium and high climate change scenario<sup>34</sup>. Climate change is also identified as one of the potential key drivers associated with a significant and growing risk of severe drought.
- 4.10.4 Water resources infrastructure generates carbon emissions during both construction and operation which can contribute to climate change. Infrastructure can also be affected by climate change, particularly in terms of flooding. However, new infrastructure can provide

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<sup>34</sup> UK Climate Change Risk Assessment 2022. Available online:

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1047003/climate-change-risk-assessment-2022.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1047003/climate-change-risk-assessment-2022.pdf) [Accessed July 2022]



increased resilience to the effects of climate change, particularly in terms of the supply of additional water resources.

## Environmental Context

4.10.5 North West England emitted 11% of the UK's GHG emissions in 2019. The amount of CO<sub>2</sub> emitted in the North West between 2014 and 2019 is shown in **Table 4.5** and highlights that emissions have reduced since 2014 by nearly 13.6% to 38.5 million tonnes (Mt) CO<sub>2</sub> in 2019, principally because of declines in emissions from the industry and commercial and domestic sectors. Overall, since 2005, emissions in the North West have dropped by 36% (which is comparable to the UK average of 35.8%).<sup>35</sup> All local authorities in the North West region saw a decline in GHG emissions.

**Table 4.5 End User Estimates of Carbon Emissions (kt CO<sub>2</sub>), North West England 2014-2019**

End User	2014	2015	2016	2017	2018	2019
<b>Industry</b>	10,716.7	10,175.8	9,552.6	9,240.0	8,919.5	8,755.8
<b>Commercial</b>	5,329.9	4,601.5	3,941.9	4,057.5	3,789.6	3,482.2
<b>Public Sector</b>	1,944.4	1,992.5	1,787.6	1,525.8	1,563.0	1,529.2
<b>Domestic</b>	12,449.2	11,943.7	11,428.5	10,807.1	10,789.7	10,527.4
<b>Transport</b>	13,814.9	14,105.5	14,298.4	14,079.5	13,964.6	13,917.3
<b>LULUCF</b>	336.1	332.1	340.7	318.1	326.5	329.8
<b>Total</b>	<b>44,591.2</b>	<b>43,151.1</b>	<b>41,349.6</b>	<b>40,028.0</b>	<b>39,352.8</b>	<b>38,541.6</b>
<b>Per capita Emissions (t)</b>	6.3	6.0	5.7	5.5	5.4	5.3

Source: Department for Business, Energy and Industrial Strategy (2021)<sup>36</sup>

4.10.6 Wales also experienced a decline in emissions across the same period, with the amount of CO<sub>2</sub> emitted reducing by around 16.5% between 2014 and 2019. CO<sub>2</sub> emissions in 2019 were 23.8 MtCO<sub>2</sub> for Wales.

4.10.7 On a per capita basis, the North West emitted 5.3 tonnes (t) CO<sub>2</sub> per person in 2019. Across the UK as a whole, this averaged at 5.2 tCO<sub>2</sub> with figures ranging from 3.2 tCO<sub>2</sub> per person in London to 7.6 tCO<sub>2</sub> per person in Wales, the highest in the UK. This reflects the significant industrial base in Wales which resulted in a high contribution from industrial and commercial emissions.

<sup>35</sup> Department for Business, Energy and Industrial Strategy (2021) *2005 to 2019 UK local and regional CO<sub>2</sub> emissions – data tables* Available online at: <https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2019> [Accessed July 2022]

<sup>36</sup> Ibid



- 4.10.8 Increasing the amount of renewable energy generation is one response to the need to reduce CO<sub>2</sub> emissions, and the North West region has shown a steady year-on-year increase in renewable electricity generation from 2003 to 2020, with slight drops in 2010 and 2016 (compared to the previous year). The renewable electricity capacity in the region continued to rise in 2020. The most recent data from the Department for Business, Energy & Industrial Strategy (BEIS) shows that in 2020, the North West generated 11,606.3 GWh electricity from renewable sources, an increase of 514% compared to 2010 (primarily due to increases in wind capacity)<sup>37</sup>. In 2020, the North West had a total renewable energy installed capacity of 3,515.2MWe, equivalent to 7.4% of the UK total (47,815.5MWe), while Wales had 7.5% (3,589.6 MWe) of the UK's capacity.<sup>38</sup>

### Embedded Mitigation and Enhancement

- 4.10.9 There are no current embedded mitigation or enhancement measures in relation to climate change.

### Sub-Option Appraisal Summary

#### STTA4: Vyrnwy Aqueduct Enabling Works

- 4.10.10 The construction of Option STTA4 would use materials with a substantial amount of embodied carbon (17,358 tCO<sub>2</sub>e). In addition, the construction phase would require an estimated 5,848 vehicle movements over the five-year construction period that would contribute to carbon emissions. This is assessed as a major (likely significant) negative effect.
- 4.10.11 Carbon emissions associated with the operation of this sub-option are likely to be minor (the operational phase of the sub-option would result in 189 tCO<sub>2</sub>e annual carbon emissions).
- 4.10.12 Option STTA4 would maintain water supplies to UU customers supplied directly from the Vyrnwy Aqueduct, in-turn supporting the STT and helping to ensure the continuity and resilience of water supplies in the South-East of England, as well as in UU's supply area, to the effects of climate change. This is assessed as a major (likely significant) positive effect.

#### WR015: [⌘]

- 4.10.13 Construction works associated with Option WR015 would use materials with a substantial amount of embodied carbon (50,143tCO<sub>2</sub>e). In addition, the construction phase would require 45,684 vehicle movements, which together with the operation of machinery/plant, would result in GHG emissions. This is assessed as a major (likely significant) negative effect.
- 4.10.14 In the operational phase, the sub-option would require 916kWh/MI and would generate 7,072tCO<sub>2</sub>e/a. This is assessed as a major (likely significant) negative effect.

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<sup>37</sup> BEIS (2021) *Regional Statistics 2003-2020: Generation*. Available online: <https://www.gov.uk/government/statistics/regional-renewable-statistics> [Accessed July 2022].

<sup>38</sup> BEIS (2020) *Regional Statistics 2003-2020: Installed Capacity*. Available online: <https://www.gov.uk/government/statistics/regional-renewable-statistics> [Accessed July 2022].



- 4.10.15 The increased capacity of 40MI/d associated with Option WR015 would help ensure a continual supply of clean drinking water, increasing resilience and adaptability to the effects of climate change. This is assessed as a moderate positive effect.

#### WR049d: [✕]

- 4.10.16 Option WR049d would require materials with a significant amount of embodied carbon (58,769 tCO<sub>2</sub>e) and the 52,186 vehicle movements during the construction phase would, alongside the operation of machinery and plant, also contribute to carbon emissions. This is assessed as a major (likely significant) negative effect.
- 4.10.17 The operation of this sub-option would require 1,758kWh/MI and would have operational carbon emissions of 14,905 tCO<sub>2</sub>e/year. The operation of the sub-option would also require 9,204 vehicle movements per year which would result in carbon emissions. This is assessed as a major (likely significant) negative effect.
- 4.10.18 Option WR049d would deliver 40MI/d of additional capacity, helping to ensure a continual supply of clean drinking water and increasing resilience and adaptability to the effects of climate change. This is assessed as a moderate positive effect.

#### WR076: [✕]

- 4.10.19 Materials with a total embodied carbon of 35,349 tCO<sub>2</sub>e would be required to construct Option WR076. The construction of the sub-option would also generate 22,838 vehicle movements and would require the operation of machinery and plant, which would also contribute to carbon emissions. This is assessed as a major (likely significant) negative effect.
- 4.10.20 The sub-option would require ongoing energy use of 792kWh/MI and would have operational carbon emissions of 4,017 tCO<sub>2</sub>e/year. Operational vehicle movements (884 per year) would also contribute to carbon emissions. This is assessed as a major (likely significant) negative effect.
- 4.10.21 The increased capacity of 25MI/d associated with the operation of Option WR076 would help ensure a continual supply of clean drinking water and increase resilience of supply, thereby increasing resilience and adaptability to the effects of climate change. This is assessed as a moderate positive effect.

#### WR102b: [✕]

- 4.10.22 The construction of Option WR102b would require materials with 11,006 tCO<sub>2</sub>e of embodied carbon. Furthermore, the construction of the sub-option would generate 8,222 vehicle movements and would require the operation of machinery and plant, which would also contribute to carbon emissions. This is assessed as a major negative effect.
- 4.10.23 The sub-option would require ongoing energy use of 598kWh/MI and would have operational carbon emissions of 5,004CO<sub>2</sub>e/year. This is assessed as a major (likely significant) negative effect.



- 4.10.24 The 17MI/d increase in deployable output associated with the operation of Option WR102b would help ensure a continual supply of clean drinking water, increasing resilience and adaptability to the effects of climate change. This is assessed as a moderate positive effect.

#### WR107a2: [✕]

- 4.10.25 Construction of Option WR107a2 would require materials with 4,532 tCO<sub>2</sub>e of embodied carbon. The sub-option would also generate 5,445 vehicle movements which, alongside the use of plant and machinery, would generate carbon emissions. This is assessed as a moderate negative effect.
- 4.10.26 The sub-option would require ongoing energy use of 1,876 kWh/MI and would have operational carbon emissions of 891tCO<sub>2</sub>e/year. This is assessed as a moderate negative effect.
- 4.10.27 The 10MI/d increase in deployable output associated with this sub-option would help ensure a continual supply of clean drinking water, increasing resilience and adaptability to the effects of climate change. This is assessed as a moderate positive effect.

#### WR107b: [✕]

- 4.10.28 The construction of Option WR107b would require materials with 18,637 tCO<sub>2</sub>e embodied carbon. The sub-option would also require 24,465 vehicle movements which, alongside the use of plant and machinery, will also contribute to carbon emissions. This is assessed as a major (likely significant) negative effect.
- 4.10.29 In the operational phase, the sub-option would require ongoing energy use of 1,483 kWh/MI and would have operational carbon emissions of 742tCO<sub>2</sub>e/year. Operational vehicle movements (9,256 per year) would also contribute to carbon emissions. This is assessed as a moderate negative effect.
- 4.10.30 The 12MI/d increase in deployable output associated with Option WR107b would help ensure a continual supply of clean drinking water, increasing resilience and adaptability to the effects of climate change. This is assessed as a moderate positive effect.

#### WR111: [✕]

- 4.10.31 Materials with 2,834tCO<sub>2</sub>e embodied carbon would be required to construct Option WR111. The construction of the sub-option would also result in 2,658 vehicle movements and would require the operation of machinery and plant, which would contribute to carbon emissions. This is assessed as a moderate negative effect.
- 4.10.32 Option WR111 would have an ongoing energy use of 650kWh/MI, with operational carbon emissions of 1,395tCO<sub>2</sub>e/year. This is assessed as a moderate negative effect.
- 4.10.33 The operation of Option WR111 would secure an increase in capacity of 9MI/d. This would help ensure a continual supply of clean drinking water, increasing resilience and adaptability to the effects of climate change. This is assessed as a moderate positive effect.



### WR113: [X]

- 4.10.34 Option WR113 would require materials with 3,807 tCO<sub>2</sub>e of embodied carbon and generate carbon emissions associated with the 3,288 vehicle movements and operation of machinery and plant during the construction period. This has been assessed as a moderate negative effect.
- 4.10.35 The sub-option would require ongoing energy use of 559kWh/MI and would have operational carbon emissions of 524tCO<sub>2</sub>e/year. This is assessed as a moderate negative effect.

### WR149: [X]

- 4.10.36 The construction of Option WR149 would require materials with 8,857 tCO<sub>2</sub>e embodied carbon. Construction would also generate 7,381 vehicle movements and would require the operation of machinery and plant, which would also contribute to carbon emissions. This is assessed as a major (likely significant) negative effect.
- 4.10.37 The sub-option would require ongoing energy use of 576kWh/MI and would have operational carbon emissions of 2,058tCO<sub>2</sub>e/year. This is assessed as a major (likely significant) negative effect.
- 4.10.38 The increased capacity of 13.8MI/d associated with the operation of Option WR149 would help ensure a continual supply of clean drinking water, increasing resilience and adaptability to the effects of climate change. This is assessed as a moderate positive effect.

## Cumulative Effects of the NWT SRO Full Solution

### Construction

- 4.10.39 In total, the construction of the NWT SRO Full Solution sub-options would require materials with 211,290 tCO<sub>2</sub>e embodied carbon. Construction would also generate a substantial volume of vehicle movements which, together with the operation of plant and machinery, would additionally contribute to carbon emissions. Consistent with the thresholds of significance contained at **Appendix A**, the NWT SRO Full Solution is assessed as having potentially major (likely significant) negative carbon effects.
- 4.10.40 As set out in respect of flood risk above, construction activity associated with the NWT SRO Full Solution could be vulnerable to flooding which may be exacerbated by climate change. However, climate change effects are not expected to be significant.

### Operation

- 4.10.41 The operation of the NWT SRO Full Solution sub-options would have operational emissions of 36,797 tCO<sub>2</sub>e/year; there would also be carbon emissions associated with operational vehicle movements. In accordance with the thresholds of significance contained at **Appendix A**, the NWT SRO Full Solution is assessed as having potentially major (likely significant) negative carbon effects.



- 4.10.42 As set out in respect of flood risk above, new infrastructure associated with the NWT SRO Full Solution could be vulnerable to flooding which may be exacerbated by climate change. However, climate change effects are not expected to be significant.
- 4.10.43 The NWT SRO Full Solution would support the STT, increasing the resilience and adaptability of water supplies in the South East and North West to the effects of climate change. This is assessed as an overall major (likely significant) positive effect.

### Additional Mitigation and Enhancement Measures

- 4.10.44 The following additional mitigation and enhancement measures have been identified:
- A Carbon Management Plan should be developed for each sub option. Consistent with UU's commitment to achieve its science-based targets from 2030, which is aligned with the Water UK Net Zero 2030 Route Map, the Carbon Management Plans should be designed to minimise whole life carbon emissions and be informed by an assessment of carbon emissions. Where required, measures in the Carbon Management Plan could include:
    - ▶ The provision of on-site renewables during both the construction and operational phases of the sub-options;
    - ▶ Adoption of high quality, sustainable design principles to maximise energy efficiency in new infrastructure;
    - ▶ Use of low emission and electric vehicles in construction and operational fleets;
    - ▶ Use of low emission plant during construction;
    - ▶ Provision of enhanced carbon sequestration as part of biodiversity enhancement measures; and
    - ▶ Offsetting of all residual carbon emissions.
  - Design measures should be adopted to ensure the long-term resilience of infrastructure to the effects of climate change. Measures may include, for example, the provision/enhancement of natural flood management measures as part of wider biodiversity enhancement and habitat creation.

### Residual Effects and Uncertainties

- 4.10.45 With implementation of the additional mitigation measures outlined above, the negative construction and operational climate change effects of the NWT SRO Full Solution could be reduced to at least a minor effect.

## 4.11 Traffic and Transport

### Overview

- 4.11.1 The transport of materials, goods and personnel to and from water resources infrastructure sites can have a variety of impacts on the surrounding transport



infrastructure and potentially on connecting transport networks, during the construction and operational phases. Impacts are likely to be associated with the vehicle movements generated by development but there may also be direct impacts on transport infrastructure where proposals involve, for example, pipeline excavation within, or works to, highways.

## Environmental Context

- 4.11.2 The North West is easily accessible from the north and the south via the M6 and the West Coast mainline railway between London and Edinburgh; from east to west, the M62 connects Liverpool to Leeds. There are two major international airports in the region; Manchester Airport and Liverpool John Lennon Airport. The North West also has a major seaport, Liverpool. In the context of the NWT SRO Full Solution, the key strategic transport corridors include the M6, M56, M57, M58, M60 and M62 motorways together with a number of A and B roads, as highlighted in the sub-option appraisals contained at **Appendix B**.
- 4.11.3 The North West accounted for 11.4% of Great Britain's motor vehicle miles in 2019 with 40.5 billion million miles driven in the region. This figure was reduced in 2020, (32.3 billion miles) due to the impacts of COVID-19 on travel. Prior to 2020, vehicle miles driven had seen a steady increase since 2010.<sup>39</sup> In 2020, the average resident of the North West made around 752 (all transport mode) trips within England each year, slightly above the average for England (739 trips).<sup>40</sup> In 2020, the average distance travelled per person per year in the North West by all modes of transport was 4,233 miles, slightly lower than the England average of 4,334 miles. In the North West, over 3,536 miles (83.7%) were undertaken as a car/van driver or passenger, higher than the England average of 81.3%.<sup>41</sup>
- 4.11.4 Department for Transport (DfT) forecasts<sup>42</sup> indicate that vehicle miles travelled in the North West could increase by circa 40% by 2050 (compared to a 2015 baseline). This increase is likely to lead to impacts including increased congestion, driver delay and accidents. However, emissions to air are expected to decline.

## Embedded Mitigation and Enhancement

- 4.11.5 Where major road crossings are required as part of pipeline works, trenchless tunnelling would be utilised.

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<sup>39</sup> Department for Transport (2021) Motor vehicle traffic (vehicle miles) by local authority in Great Britain, annual from 1993. Available from <https://www.gov.uk/government/statistical-data-sets/road-traffic-statistics-tra> [Accessed July 2022]

<sup>40</sup> Department for Transport (2022) Average number of trips (trip rates) by main mode, region and Rural-Urban Classification: England. Available from <https://www.gov.uk/government/statistical-data-sets/nts99-travel-by-region-and-area-type-of-residence> [Accessed July 2022]

<sup>41</sup> Department for Transport (2022) Average distance travelled by mode, region and Rural-Urban Classification: England. Available from <https://www.gov.uk/government/statistical-data-sets/nts99-travel-by-region-and-area-type-of-residence> [Accessed July 2022]

<sup>42</sup> DfT (2018) Road Traffic Forecasts 2018. Available from [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/873929/road-traffic-forecasts-2018-document.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/873929/road-traffic-forecasts-2018-document.pdf) [Accessed July 2022]



## Sub-Option Appraisal Summary

### Option STTA4: Vyrnwy Aqueduct Enabling Works

- 4.11.6 The construction of Option STTA4 would require an estimated 5,848 vehicle movements over the five-year construction period (equivalent to approximately 1,170 vehicle movements per annum). This increase in traffic on the local road network may have localised and temporary effects on traffic/congestion during the construction period. This is assessed as a minor negative effect.
- 4.11.7 No major or moderate traffic and transport effects are predicated during the operation of this sub-option; the sub-option would generate 624 vehicles movements per year which is assessed as negligible.

### WR015: [✕]

- 4.11.8 The construction of Option WR015 would require 45,684 vehicle movements over the 2.63 year construction period, equal to approximately 79 movements per day<sup>43</sup>. This, together with pipeline works within roads, may contribute to congestion and disruption/driver delay on the local road network which could affect, for example, the M60, M66, M62, A56, A665, A667, B6473 and B6198; however, it is noted that major road crossings would be likely to utilise trenchless tunnelling. This is assessed as a major (likely significant) negative effect; however, any impacts resulting from intensified movements on the road network would be temporary.
- 4.11.9 No major or moderate traffic and transport effects are predicated during the operation of this sub-option; the sub-option would generate 832 vehicles movements per year which is assessed as negligible.

### WR049d: [✕]

- 4.11.10 The construction of Option WR049d would result in an additional 52,186 vehicle movements over the 2.63-year construction stage (the equivalent of 90 movements per day) which may contribute to road traffic congestion along roads leading to/in close proximity to the works, crossed by the pipeline route, or that the pipeline would be routed along. This could include, for example, the A59, B6230, A673, A674, A675, M61, M65 and B5256; however, major road crossings would be likely to utilise trenchless tunnelling. This is assessed as a major (likely significant) negative effect; however, any impacts resulting from intensified movements on the road network would be temporary.
- 4.11.11 The operation of this sub-option would require 9,204 vehicle movements per year which could have a moderate negative effect in respect of road traffic congestion on local roads.

### WR076: [✕]

- 4.11.12 Construction is expected to generate 22,838 vehicle movements during the 1.92-year construction period (equivalent of 54 movements per day), which may contribute to road traffic congestion, for example, on the A6144, B5159 and B5160 leading to the WTW site

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<sup>43</sup> Based on 220 working days per year.



and the point of abstraction and additionally where the pipeline crosses the B5160 and local roads. However, any impacts resulting from intensified movements on the road network would be temporary. Overall, this is assessed as a moderate negative effect

- 4.11.13 No major or moderate traffic and transport effects are predicated during the operation of this sub-option. The sub-option would require 884 vehicle movements per year during operation meaning that any effects are likely to be negligible.

#### WR102b: [X]

- 4.11.14 No major or moderate traffic and transport effects are predicated during the construction of this sub-option.
- 4.11.15 Construction activity associated with Option WR012b would generate an additional 8,222 vehicle movements during the 1.92-year construction period (equivalent to circa 20 vehicle movements per day) on the local road network (particularly the B5178) which may contribute to traffic/congestion during the construction period. This is assessed as a temporary, minor negative effect.
- 4.11.16 No major or moderate traffic and transport effects are predicated during the operation of this sub-option. The operation of the sub-option would require 780 vehicle movements per year. This would not give rise to significant traffic and transport effects (effects are assessed as negligible).

#### WR107a2: [X]

- 4.11.17 No major or moderate traffic and transport effects are predicated during the construction of this sub-option.
- 4.11.18 The construction of Option WR107a2 would generate 5,445 vehicle movements over the 1.8-year construction period (an average of 3,025 movements per year, equivalent to circa 14 movements per day) on the road network which may contribute to traffic/congestion (for example, on the M56, A570, A506, A59, B5197 and the B5195). This is assessed as a temporary, minor negative effect.
- 4.11.19 No major or moderate traffic and transport effects are predicated during the operation of this sub-option. The operation of the sub-option would require 884 vehicle movements per year. This would not give rise to significant traffic and transport effects (effects are assessed as negligible).

#### WR107b: [X]

- 4.11.20 Construction activity associated with Option WR107b would generate additional vehicle movements (24,465 vehicle movements within the 1.92-year construction period, an equivalent of 58 movements per day) on the road network which may contribute to traffic/congestion, for example on the M57, M58, A580, A5147, A59, A5208, A5207, A506, B5192, B5202, B5197 and B5195. This is assessed as a moderate negative effect; however, any impacts resulting from intensified movements on the road network would be temporary.



- 4.11.21 This sub-option would require 9,256 vehicle movements per year throughout operation which may result in congestion on the strategic and local road network. This is assessed as a moderate negative effect.

#### WR111: [🔒]

- 4.11.22 No major or moderate construction or operational traffic and transport effects are predicted.
- 4.11.23 Construction activity associated with Option WR111 would generate circa 2,658 vehicle movements per day which is likely to have only temporary minor negative effects on the local highways network. Operational effects, meanwhile, are expected to be negligible (there would be an average of 2.6 movements per day).

#### WR113: [🔒]

- 4.11.24 No major or moderate construction or operational traffic and transport effects are predicted.
- 4.11.25 The construction of Option WR113 may contribute to congestion and disruption/driver delay on the road network due to associated vehicle movements (the sub-option would generate 3,288 vehicle movements during the 1.49-year construction period, equivalent to 10 vehicle movements per day), which could affect, for example, the A523 and B5470 as well as local roads and residential streets that join onto these routes. This is assessed as a minor negative effect. Operational effects, meanwhile, are expected to be negligible (there would be only 104 movements per year associated with the operation of Option WR113).

#### WR149: [🔒]

- 4.11.26 No major or moderate construction or operational traffic and transport effects are predicted.
- 4.11.27 Option WR149 would generate an estimated 7,381 vehicle movements during the 1.81-year construction period, equivalent to 19 movements per day. This may contribute to congestion and driver delay, particularly along the A573, A574, A580, B5207, [🔒], although any impact would be very minor. It is also noted that the sub-option would require the crossing of a railway line; however, this would utilise trenchless tunnelling. Overall, this is assessed as a temporary, minor negative effect.
- 4.11.28 Operational traffic and transport effects associated with this sub-option would be negligible.

## Cumulative Effects of the NWT SRO Full Solution

### Construction

- 4.11.29 Construction of the NWT SRO Full Solution would generate a substantial volume of vehicle movements (178,015 movements in total over the construction period) which may contribute to congestion and driver delay on the local and strategic road network.



However, due to the distance between the SRO sub-options, the different phasing of sub-option construction and the fact that pipeline works would not affect the same sections of the network, it is considered unlikely that there will be additional cumulative effects on local road networks.

- 4.11.30 There is potential for cumulative effects on the strategic road network including, in particular, the M6 and M62 motorways. However, this would be dependent on the routing of traffic and the phasing of construction.
- 4.11.31 Overall, it is concluded that there would be major (likely significant) negative traffic and transport effects during the construction of the NWT SRO Full Solution; however, any impacts resulting from intensified movements on the road network would be temporary.

### Operation

- 4.11.32 In the long term, during operation, the NWT SRO Full Solution would generate circa 22,464 vehicle movements per year, equivalent to around 100 movements per day. Whilst substantial, the movements would occur across a large area (reflecting the distance between the sub-options that comprise the SRO) and in consequence, any additional cumulative effects over and above those associated with the operation of individual sub-options are predicted to be negligible.
- 4.11.33 On this basis, the NWT SRO Full Solution is assessed as having overall moderate negative traffic and transport effects.

### Additional Mitigation and Enhancement Measures

- 4.11.34 The following additional mitigation and enhancement measures have been identified:
- A CTMP should be prepared for each sub-option to manage the traffic impacts associated with construction. Measures to mitigate traffic and transport effects could include the timing of HGV movements to avoid peak traffic hours, routing of HGV movements to avoid minor roads and the removal of spoil from sites at night;
  - Where required, a Transport Statement or Transport Assessment should be undertaken to inform proposals including detailed access arrangements and any necessary highway improvements.

### Residual Effects and Uncertainties

- 4.11.35 With implementation of the additional mitigation measures outlined above, it is predicted that the construction traffic and transport effects of the NWT SRO Full Solution would be reduced from major to moderate; operational effects are predicted to be minor. However, it should be noted that a number of uncertainties remain relating to (*inter alia*): the exact routing of construction and operational vehicles; the exact phasing of sub-option implementation; and future baseline traffic flows.



## 4.12 Resource Use and Waste Management

### Overview

- 4.12.1 The construction of water resources infrastructure will require resources associated with construction materials and energy use and will generate waste. The operation of facilities may also require chemicals and energy to treat and pump water and can generate waste (such as sludge).
- 4.12.2 Government policy promotes the sustainable management of waste in accordance with the following waste hierarchy:
- Prevention;
  - Preparing for reuse;
  - Recycling;
  - Other recovery, including energy recovery; and
  - Disposal.

### Environmental Context

#### Energy Use

- 4.12.3 **Table 4.6** provides a breakdown of total energy use in 2019 for the North West region for industry and commercial uses, domestic and road transport. It shows that for the region, energy use by sector is broadly in line with the UK average, while for Wales, the proportion of energy use in the industrial and commercial sector is notably higher than the rest of the UK.

Table 4.6 Breakdown of Energy Consumption in North West England and Comparison with UK, 2019

Sector	North West Proportion of Total Regional Energy Use (%)	Wales Proportion of Total Regional Energy Use (%)	UK Proportional Energy Use (%)
Domestic	32.6	27.6	32.8
Transport	30.1	25.2	30.5
Industrial, Commercial and other	37.3	47.2	36.7

Source: BEIS<sup>44</sup>

- 4.12.4 Energy consumption by source in the North West is fairly representative of national trends, with most energy coming from petroleum (36.6%) and natural gas (37.9%)<sup>45</sup>. North West

<sup>44</sup> BEIS (2021) *Total final energy consumption at regional and local authority level: 2005 to 2019*. Available online: <https://www.gov.uk/government/statistics/total-final-energy-consumption-at-regional-and-local-authority-level-2005-to-2019> [Accessed September 2022]

<sup>45</sup> Ibid.



generated 11,606.3 GWh of electricity from renewable sources, an increase of 514% compared to 2010. In 2020, in Wales, 8,790.7GWh of electricity was generated from renewable sources, whilst in Scotland 32,031.2GWh was generated from renewable sources.<sup>46</sup>

- 4.12.5 Total energy consumption in Wales over the period 2005 to 2019 reduced from 109,883.7 GWh to 92,803.9 GWh, a decrease of 15.5%. Petroleum (primarily associated with road transport) and natural gas are the most dominant energy sources in Wales, although manufactured fuels also make a notable contribution to the energy mix in Wales.<sup>47</sup>

### Material Use and Waste Generation

- 4.12.6 In 2020/21, around 3.6 million tonnes of waste was collected by local authorities in the North West. Recycling rates across the region have remained level in the last six years (44-46%) but have risen significantly from 31% in 2006/07, and are higher than the national average of 41.5% in 2020/21. Whilst the volume of local authority collected waste sent to landfill in the North West has fallen from 66% to 9.2% over the same period, it is slightly higher than the national average (7.8 %)<sup>48</sup>.

### Embedded Mitigation and Enhancement

- 4.12.7 There are no current embedded mitigation or enhancement measures in relation to resource use and waste management.

### Sub-Option Appraisal Summary

#### Option STTA4: Vyrnwy Aqueduct Enabling Works

- 4.12.8 The construction of Option STTA4 would require 17,434 tonnes of concrete, 3,354 tonnes of steel and 48 tonnes of plastic and would generate waste. The use of plant and machinery as well as vehicle movements to site would also require the use of fossil fuels. This is assessed as a major (likely significant) negative effect.
- 4.12.9 Resource use and waste generation associated with the operation of this sub-option is likely to be minor.

#### WR015: [🔊]

- 4.12.10 The construction of Option WR015 would require 180,069 tonnes of concrete, 2,996 tonnes of steel and 43 tonnes of plastics and would generate waste. Energy would also be required for the operation of machinery and plant. This is assessed as a major (likely significant) negative effect.
- 4.12.11 The operation of this sub-option would require the use of a number of chemicals for the treatment of raw water and would have an ongoing energy use of 916kWh/MI, which

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<sup>46</sup> BEIS (2021) *Regional Statistics 2003-2020: Generation*. Available online: <https://www.gov.uk/government/statistics/regional-renewable-statistics> [Accessed October 2022]

<sup>47</sup> Ibid

<sup>48</sup> Ibid.



could require the use of fossil fuels to generate energy. This is assessed as a moderate negative effect.

#### WR049d: [X]

- 4.12.12 Option WR049d would involve considerable new infrastructure, the construction of which would require 234,574 tonnes of concrete, 3,814 tonnes of steel and 55 tonnes of plastic and would generate waste. Energy would also be required for the operation of machinery and plant. This is assessed as a major (likely significant) negative effect.
- 4.12.13 The operation of this sub-option would require the use of a number of chemicals for the treatment of raw water and would have an ongoing energy use of 1,759kWh/MI, which could, together with vehicle movements, require the use of fossil fuels to generate energy. This is assessed as a moderate negative effect.

#### WR076: [X]

- 4.12.14 The construction of Option WR076 would require 101,367 tonnes of concrete, 1,806 tonnes of steel and 26 tonnes of plastic and would generate waste. Energy would also be required for the operation of machinery and plant. This is assessed as a major (likely significant) negative effect.
- 4.12.15 The operation of this sub-option would require the use of a number of chemicals for the treatment of raw water and would have an ongoing energy use of 792kWh/MI, which could, together with vehicle movements, require the use of fossil fuels to generate energy. This is assessed as a moderate negative effect.

#### WR102b: [X]

- 4.12.16 In the region of 41,533 tonnes of concrete, 883 tonnes of steel and 13 tonnes of plastic would be required during the construction of infrastructure associated with Option WR102b. Construction activity would also generate waste. Energy would be required for the operation of machinery and plant as well as vehicle movements during the construction phase. This is assessed as a major (likely significant) negative effect.
- 4.12.17 The operation of this sub-option would require the use of a number of chemicals for the treatment of raw water and would have an ongoing energy use of 598kWh/MI, which could, together with vehicle movements, require the use of fossil fuels to generate energy. This is assessed as a moderate negative effect.

#### WR107a2: [X]

- 4.12.18 The construction of Option WR107a2 would require 23,171 tonnes of concrete, 391 tonnes of steel and 6 tonnes of plastic and would generate waste. Energy would also be required for the operation of machinery and plant as well as vehicle movements during the construction phase. This is assessed as a major (likely significant) negative effect.



- 4.12.19 Resource use and waste generation associated with the operation of this sub-option is likely to be minor.

**WR107b:** [X]

- 4.12.20 Option WR107b would require 101,870 tonnes of concrete, 1,472 tonnes of steel and 21 tonnes of plastic, and would generate waste during the construction phase. Energy would also be required for the operation of machinery and plant as well as vehicle movements during the construction phase. This is assessed as a major (likely significant) negative effect.
- 4.12.21 The operation of this sub-option would require the use of a number of chemicals for the treatment of raw water and would have an ongoing energy use of 1,483kWh/MI, which could, together with vehicle movements, require the use of fossil fuels to generate energy. This is assessed as a moderate negative effect.

**WR111:** [X]

- 4.12.22 The construction of Option WR111 would require 12,512 tonnes of concrete, 272 tonnes of steel and 4 tonnes of plastics and would generate waste. Energy would also be required for the operation of machinery and plant. This is assessed as a moderate negative effect.
- 4.12.23 Resource use and waste generation associated with the operation of this sub-option is likely to be minor.

**WR113:** [X]

- 4.12.24 The construction of Option WR113 would require 9,363 tonnes of concrete, 156 tonnes of steel and 2 tonnes of plastic and would generate waste. Energy would also be required for the operation of machinery and plant. This is assessed as a moderate negative effect.
- 4.12.25 Resource use and waste generation associated with the operation of this sub-option is likely to be minor.

**WR149:** [X]

- 4.12.26 An estimated 30,789 tonnes of concrete, 560 tonnes of steel and 8 tonnes of plastic would be required for the construction of Option WR149, which would also generate waste. Energy would also be required for the operation of machinery and plant as well as vehicle movements during the construction phase. This is assessed as a major (likely significant) negative effect.
- 4.12.27 The operation of this sub-option would require the use of a number of chemicals for the treatment of raw water and would have an ongoing energy use of 576kWh/MI, which could, together with vehicle movements, require the use of fossil fuels to generate energy. This is assessed as a moderate negative effect.



## Cumulative Effects of the NWT SRO Full Solution

### Construction

- 4.12.28 Construction of the NWT SRO Full Solution sub-options would require a substantial volume of materials; in total, it is estimated that 752,682 tonnes of concrete, 15,794 tonnes of steel and 226 tonnes of plastic will be used in the construction of the SRO. Energy will also be required for the operation of plant, machinery and, potentially, associated vehicle movements, that would involve the burning of fossil fuels. Taking into account the total volume of resources required, this is assessed as a major (likely significant) negative effect.
- 4.12.29 Construction waste would be generated during the construction of the NWT SRO Full Solution arising from (*inter alia*) the demolition of existing infrastructure and hardstanding, excavation/earthworks and waste construction materials. Arisings may include hazardous waste, particularly where construction involves land remediation. There is the potential for waste generated during the construction phase of the SRO to affect the capacity of waste management facilities that receive arisings; however, this would be dependent on the volume of waste generated, the extent to which this can be reused on site and the future capacity of waste management facilities. At this stage, an overall major (likely significant) negative effect has been identified.

### Operation

- 4.12.30 Operation of the sub-options that comprise the NWT SRO Full Solution would, cumulatively, require a substantial volume of chemicals and energy which, together with vehicle movements, may require the use of fossil fuels. This is assessed as an overall major (likely significant) negative effect.
- 4.12.31 The volume of waste arisings likely to be generated by the SRO during operation, which may include (for example) sludge and chemicals from the operation of water treatment works, is unknown at this stage.

## Additional Mitigation and Enhancement Measures

- 4.12.32 The following additional mitigation and enhancement measures have been identified:
- Opportunities should be sought to use locally sourced, sustainable construction materials;
  - Measures to reduce energy consumption should be implemented during construction and operation including the use of on-site renewables and adoption of high quality, sustainable design principles to maximise energy efficiency in new infrastructure;
  - Site Waste Management Plans should be developed, providing detailed procedures for managing construction waste, including measures to minimise waste generation and maximise segregation, reuse, recycling and recovery, details relating to disposal routes, and measures for handling hazardous waste materials;
  - Operational waste arisings should be reused/recycled where practicable.



## Residual Effects and Uncertainties

- 4.12.33 Notwithstanding the implementation of the additional mitigation and enhancement measures above, it is anticipated that the volume of materials required during the construction phase of the NWT SRO Full Solution and chemicals in the operational phase would remain substantial. In consequence, the solution is assessed as having a potentially major (likely significant) residual negative effect.
- 4.12.34 There remains a number of uncertainties relating to (*inter alia*), sub-option phasing, the volume of waste that would be generated during construction and operation of the NWT SRO Full Solution, the future capacity of facilities to manage that waste and the extent to which energy consumption can be reduced through sustainable design and the provision of on-site renewables.

## 4.13 Historic Environment

### Overview

- 4.13.1 The historic environment includes all aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora.
- 4.13.2 Those elements of the historic environment identified as having a degree of significance meriting consideration in planning decisions because of their historic, archaeological, architectural or artistic interest are called 'heritage assets'. Heritage assets may be buildings, monuments, sites, places, areas or landscapes, or any combination of these. The value of a heritage asset to this and future generations because of its heritage interest is referred to as its significance. The interest may be historic, archaeological, architectural or artistic. Significance derives not only from a heritage asset's physical presence, but also from its setting.
- 4.13.3 Some heritage assets have a level of significance that justifies official designation. Categories of designated heritage assets are:
- World Heritage Sites;
  - Scheduled Monuments;
  - Listed Buildings;
  - Protected Wreck Sites;
  - Registered Parks and Gardens;
  - Registered Battlefields; and
  - Conservation Areas.
- 4.13.4 The construction and operation of water resources infrastructure has the potential to result in adverse impacts on heritage assets. Effects may be direct, for example, where



works result in the loss of, or damage to, assets, or indirect, where development affects the setting of assets.

## Environmental Context

- 4.13.5 The cultural and historic heritage of the North West region is largely dominated by its contribution towards the UK's industrial history, largely due to its wealth of natural resources and good connections via sea and inland waters to other areas of the UK and other countries. Appreciation of the North West's industrial heritage is marked through the conservation of buildings dating from the Industrial Revolution in the cities of Manchester, Salford and Liverpool. Conversely, the majority of the region's ancient historical and archaeological heritage occurs in the more rural areas. The heritage and cultural value of the region's diverse range of landscapes are also deemed of importance, with three National Parks or parts of National Parks being located within the region.
- 4.13.6 **Figure 4.11** highlights the key cultural heritage designations within and around the UU area. This includes:
- 3 World Heritage Sites;
  - 1,325 scheduled monuments;
  - 436 Grade I listed buildings;
  - 1,506 Grade II\* listed buildings;
  - 24,139 Grade II listed buildings;
  - 137 registered parks and gardens;
  - 4 registered battlefields; and
  - 876 conservation areas.
- 4.13.7 The NWT SRO sub-options are located in proximity to a large number of designated heritage assets (principally scheduled monuments and listed buildings) and these receptors are identified in the sub-option appraisals presented in **Appendix B**.

## Embedded Mitigation and Enhancement

- 4.13.8 The following measures are embedded into the design of the NTW SRO Full Solution (or are assumed) in order to mitigate effects in respect of the historic environment:
- Standard best practice would be employed during the design and construction to avoid adverse effects on the structural integrity of historic assets;
  - New pipelines would be buried with planting and re-seeding expected to return sites to a pre-development state.



## Sub-Option Appraisal Summary

### Option STTA4: Vyrnwy Aqueduct Enabling Works

- 4.13.9 No major or moderate construction or operational historic environment effects are predicted.
- 4.13.10 Several construction sites associated with Option STTA4 are in close proximity to designated heritage assets including listed buildings, scheduled monuments and registered parks and gardens. However, no significant effects are anticipated on the setting or integrity of these assets given both their distance from the construction sites associated with the sub-option, the modest scale of construction activity that would take place at each site and the temporary nature of the works; however, there may be some minor, temporary effects on their settings.
- 4.13.11 It is not anticipated that there will be any significant effects on heritage assets during the operational phase of the Option STTA4 given the scale of new above ground infrastructure and the distance of development from designated heritage assets.

### WR015: [REDACTED]

- 4.13.12 The new WTW would be adjacent to [REDACTED]. Construction activity and the introduction of new above-ground infrastructure in operation may have a negative effect on the setting and character of the park. This is assessed as a moderate negative effect during both construction and operation.
- 4.13.13 [REDACTED]. Due to the proximity of these assets to the sub-option, construction activity may have a negative effect on their setting; however, effects on all receptors are likely to be minor.

### WR049d: [REDACTED]

- 4.13.14 No major or moderate construction or operational historic environment effects are predicted.
- 4.13.15 [REDACTED] Given the proximity of these assets, it is likely there would be some temporary effects on their setting during construction (particularly those which are within 0.1km). [REDACTED]. Construction-related effects on these assets would be temporary and are assessed as minor or negligible. With the exception of the listed buildings noted below, no operational effects on these assets are predicted.
- 4.13.16 [REDACTED]. Due to the introduction of new above ground infrastructure, these assets may also experience minor negative effects during operation.

### WR076: River Bollin

- 4.13.17 No major or moderate construction or operational historic environment effects are predicted.
- 4.13.18 [REDACTED]



4.13.19 [REDACTED], which could cause access issues as well as affecting visual amenity/obscuring scenery with new above ground infrastructure. Construction effects would be temporary and are assessed as minor. There would be no operational effects on this asset.

#### WR102b: [REDACTED]

4.13.20 No major or moderate construction or operational historic environment effects are predicted.

4.13.21 There are no Scheduled Monuments, Registered Parks/Gardens or Conservation Areas in close proximity to the development sites associated with Option WR102b. [REDACTED]. However, works would take place within/adjacent to existing operational sites and effects on the settings of these assets are therefore likely to be negligible in the construction and operational phases of the sub-option.

#### WR107a2: [REDACTED]

4.13.22 No major or moderate construction or operational historic environment effects are predicted.

4.13.23 Option WR107a2 is located within 1km of seven listed buildings, of which six would be situated within 0.1km of the sub-option (there are no scheduled monuments, battlefield or parks within 1km of the sub-option). There may be minor negative effects on the settings of these assets during construction only.

4.13.24 Operational effects are predicted to be negligible.

#### WR107b: [REDACTED]

4.13.25 No major or moderate construction or operational historic environment effects are predicted.

4.13.26 [REDACTED]. Given the scale of development associated with this sub-option and the location of the boreholes and WTW within existing sites, any effects on the settings of these assets are predicted to be negligible in both the construction and operational phases.

#### WR111: [REDACTED]

4.13.27 No major or moderate construction or operational historic environment effects are predicted.

4.13.28 Construction works associated with Option WR11 are not expected to significantly impact heritage receptors. A total of 11 listed buildings are within 1km of the works, with two listed buildings being within 100m [REDACTED]. It is not anticipated that construction works will affect the integrity of these sites, assuming construction best practice, however, there may be minor negative effects on their settings.

4.13.29 Operational effects are expected to be negligible; the WTW and boreholes would be at existing operational sites.



#### WR113: [REDACTED]

- 4.13.30 No major or moderate construction or operational historic environment effects are predicted.
- 4.13.31 [REDACTED] is approximately 450m from the sub-option and there are 48 listed buildings within 1km. With the exception of one listed building, effects on the settings of these assets during construction and operation are predicted to be negligible due to the distance between the sub-option and the assets and the urban setting of the sub-option.
- 4.13.32 [REDACTED]. Given the proximity of the asset to the sub-option, there is the potential for construction effects on the integrity and setting of the bridge. With the adoption of standard construction best practices, however, no effects on the structural integrity of this asset are expected; however, there may be temporary effects on its setting during construction which is assessed as minor negative.

#### WR149: [REDACTED]

- 4.13.33 No major or moderate construction or operational historic environment effects are predicted.
- 4.13.34 There are 17 listed buildings within 1km of the various components of Option WR149; however, given the scale of works and the distance of sites to these assets, construction and operational effects are expected to be negligible.

## Cumulative Effects of the NWT SRO Full Solution

### Construction

- 4.13.35 Construction activity associated with the development of the NWT SRO Full Solution sub-options may result in effects on the settings of historic assets including scheduled monuments, listed buildings and registered parks and gardens where receptors are in close proximity to works. However, any effects would be temporary (i.e. for the duration of construction) and taking into account the scale of construction activity at each site, effects are not predicted to be significant. It is assumed that standard best practice would be employed during the design and construction to avoid negative effects on the structural integrity of historic assets.
- 4.13.36 As noted above, the new WTW associated with Sub-option WR015 would be adjacent to [REDACTED]. Construction activity and the introduction of new above-ground infrastructure in operation may affect the setting and character of the park. This is assessed as an overall moderate negative effect.
- 4.13.37 Given the distance between the sub-options that comprise the NWT SRO Full Solution, it is not expected that any historic environment receptor would be affected by two or more sub-options. In consequence, there would be no additional cumulative historic environment effects.
- 4.13.38 It should be noted that construction activity could affect unidentified heritage assets including sites of historic and archaeological interest. However, this is currently uncertain.



- 4.13.39 Overall, the NWT SRO Full Solution is predicted to result in a moderate negative effect in respect of the historic environment during the construction phase, which is consistent with the appraisal of Sub-option WR015.

### Operation

- 4.13.40 In a small number of instances, the presence of new above ground infrastructure associated with the sub-options that comprise the NWT SRO Full Solution may have effects on the settings of heritage assets. However, given the anticipated scale of development, any effects are predicted to be minor negative. The exception to this is the new WTW associated with Sub-option WR015 which may have moderate negative effects on the setting and character of [X].
- 4.13.41 As with the construction phase of the NWT SRO Full Solution, no additional cumulative historic environment effects are anticipated.
- 4.13.42 Overall, the NWT SRO Full Solution is predicted to result in a moderate negative effect in respect of the historic environment during the operational phase, which is consistent with the appraisal of Sub-option WR015.

### Additional Mitigation and Enhancement Measures

- 4.13.43 The following additional mitigation and enhancement measures have been identified:
- Careful consideration should be given to the presence of heritage assets when finalising proposals for pipeline routing;
  - Where practicable, new above-ground infrastructure should be sited and screened to minimise effects on the settings of heritage assets. Such measures should be informed by a heritage appraisal/assessment where required;
  - Where required, a programme of trial trenching and archaeological recording should be undertaken at development sites, with results disseminated.

### Residual Effects and Uncertainties

- 4.13.44 Whilst there is the potential to minimise adverse effects on heritage assets, with implementation of the additional mitigation measures outlined above, it is predicted that the construction and operational effects of the NWT SRO Full Solution would remain moderate negative.
- 4.13.45 The potential for construction activity associated with the NWT SRO Full Solution to affect unidentified heritage assets including sites of historic and archaeological interest remains uncertain.



## 4.14 Landscape and Visual

### Overview

- 4.14.1 Water resources infrastructure can affect landscape (including townscape) character during both the construction and operational phases of development, particularly where proposals include new above ground infrastructure. Effects may be more pronounced in designated landscapes including National Parks and Areas of Outstanding Natural Beauty (AONBs), which are afforded a high degree of protection by national legislation and planning policy. The construction and operation of water resources infrastructure can also result in negative effects on visual amenity, particularly where proposals are located in close proximity to settlements or recreational areas.

### Landscape

- 4.14.2 The landscape of the North West of England is some of the most diverse in the country, containing 29 National Character Areas as defined by Natural England<sup>49</sup>. **Figure 4.12** shows those landscape designations in the UU area and North Wales. The Lake District National Park and World Heritage Site in Cumbria covers an area of 2,362 km<sup>2</sup>. The National Park boundary was extended by 3% towards the east in August 2016, up to the M6 and the newly extended Yorkshire Dales National Park. Two other National Parks also fall partly within the North West region; the Yorkshire Dales and the Peak District. In total, 18% of the North West is designated as National Parks.
- 4.14.3 The North West has three AONBs which lie wholly or mainly in the region (Solway Coast, Arnside and Silverdale and Forest of Bowland). The North Pennines AONB also straddles Cumbria's eastern border. Snowdonia National Park and the Clwydian Range and Dee Valley AONB are the significant designated landscape sites within the region of Lake Vyrnwy and the River Dee. In total, 25 per cent of Wales is designated as either a National Park or an AONB.
- 4.14.4 The sites within which the NWT SRO sub-options are located do not include any nationally designated landscapes; the nearest designated landscape is the Peak District National Park which is located circa 1.7km from Option WR113. Landscape receptors are described further in the sub-option appraisals contained in **Appendix B**

### Visual

- 4.14.5 Visual receptors are varied. With specific regard to the NWT SRO Full Solution, sensitive receptors include (*inter alia*) residential properties, recreational receptors including users of the PRow network and community facilities such as schools. Visual receptors are identified in the sub-option appraisals contained in **Appendix B**

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<sup>49</sup> Natural England (2014) National Character Area Profiles. Available from <https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles> [Accessed September 2022]



## Embedded Mitigation and Enhancement

- 4.14.6 The following measures are embedded into the design of the NTW SRO Full Solution (or are assumed) in order to mitigate landscape and visual effects:
- New pipelines would be buried with planting and re-seeding expected to return sites to a pre-development state.

## Sub-Option Appraisal Summary

### Option STTA4: Vyrnwy Aqueduct Enabling Works

- 4.14.7 No major or moderate construction or operational landscape and visual effects are predicted.
- 4.14.8 The construction sites associated with Option STTA4 are not within, or in close proximity to, any landscape designations. The majority of works associated with this sub-option would involve the replacement of existing pipeline with land excavated to facilitate the works (including that required to accommodate construction compounds) being reinstated following construction. In consequence, landscape and visual effects associated with these elements are likely to be negligible.
- 4.14.9 The extension to [REDACTED], new pumping stations and new valve houses would be located on greenfield land and in close proximity to residential receptors. However, taking into account the scale of development, associated landscape and visual effects are expected to be minor during both construction and operation.

### WR015: [REDACTED]

- 4.14.10 Option WR015 is not located within any designated landscapes; however, a small section of the pipeline, in addition to the WTW and the works at the reservoir, would be situated within/adjacent to [REDACTED]. Construction within/adjacent to the Park and the presence of new above ground infrastructure (in the operational phase) may have an effect on the character of the Park and the visual amenity of recreational users, as well as [REDACTED] to the north west; this is assessed as a moderate negative effect.
- 4.14.11 Construction on the River Irwell may lead to a minor negative effect on the character of the area and visual amenity.
- 4.14.12 Pipeline works may affect the visual amenity of proximate residential receptors in [REDACTED]; however, the effects in this regard are anticipated to be minor and temporary only.

### WR049d: [REDACTED]

- 4.14.13 No major or moderate construction or operational landscape and visual effects are predicted.
- 4.14.14 The components of Option WR049d are not situated within any designated landscapes. The construction of the new abstraction and ancillary infrastructure on the River Ribble, and the presence of this new above ground infrastructure during the operational phase, may have a negative impact on the character of the area, particularly for the adjacent [REDACTED].



However, construction and operational effects associated with this element of the scheme are likely to be minor.

- 4.14.15 The construction of the pipeline may have a minor negative effect on the local landscape and visual amenity of proximate residential receptors; however, effects in this regard are anticipated to be temporary and minor.
- 4.14.16 The WTW works would take place within/adjacent to the existing WTW site but construction activity and new above ground infrastructure may have an effect on the local landscape and visual amenity in both the construction and operational phases of the sub-option, although any effects in this regard are anticipated to be minor.

#### WR076: [X]

- 4.14.17 No major or moderate construction or operational landscape and visual effects are predicted.
- 4.14.18 Option WR076 is not within or in close proximity to any landscape designations. Development would, however, be situated within a rural/ semi-rural setting and in consequence, there is the potential for construction activity and new above ground infrastructure including a new WTW and service reservoir, to have negative effects on local landscape character.
- 4.14.19 The visual amenity of residential and recreational receptors along the pipeline route may be affected during the construction phase of the sub-option. However, any effects would be temporary and are assessed as minor negative.

#### WR102b: [X]

- 4.14.20 No major or moderate construction or operational landscape and visual effects are predicted.
- 4.14.21 The development sites associated with this sub-option are not within, or in close proximity to, any nationally designated landscape areas. Construction activity may have short term negative effects on landscape character and the visual amenity of nearby residential receptors. New above ground infrastructure at [X], in addition to the modified infrastructure at the existing sites, may also have minor negative effects on local landscape/townscape character and the visual amenity of nearby residential receptors during the operational phase of the sub-option. However, development would be within/adjacent to existing operational sites and any negative effects in this regard are not expected to be significant.

#### WR107a2: [X]

- 4.14.22 No major or moderate construction or operational landscape and visual effects are predicted.
- 4.14.23 Option WR107a2 is not located within any nationally designated landscape areas and whilst the borehole sites and proposed pipeline route are located within a rural setting, landscape and visual effects during construction and operation are predicted to be minor



given the scale of development. Works at [REDACTED], meanwhile, are not expected to have significant landscape or visual impacts as this is an existing operational site.

**WR107b:** [REDACTED]

- 4.14.24 No major or moderate construction or operational landscape and visual effects are predicted.
- 4.14.25 Option WR107b is not situated within or in close proximity to any nationally designated landscapes. The [REDACTED] borehole sites, the WTW, and the pipeline routes are located in rural/semi-rural locations and in consequence, construction activity may have short term adverse impacts on local landscape character. However, the works at each borehole site and at the WTW will be contained within existing sites and would be temporary. In consequence, construction-related landscape and visual effects are assessed as a minor negative.
- 4.14.26 As new above ground infrastructure associated with this sub-option would be within existing sites, operational effects are expected to be negligible.

**WR111:** [REDACTED]

- 4.14.27 No major or moderate construction or operational landscape and visual effects are predicted.
- 4.14.28 Works at the WTW would be within 3km of the Peak District National Park; however, as the works are on the periphery of existing urban areas, and given their temporary nature, it is not anticipated that there will be any effects on the setting of the National Park.
- 4.14.29 Construction activity associated with the WTW and boreholes could result in negative effects on local landscape character and the visual amenity of nearby receptors. However, any negative effects would be temporary and are assessed as minor.
- 4.14.30 New above ground infrastructure (the WTW) may have negative landscape and visual effects during the operational phase of the sub-option; however, given the limited footprint of this component and its location within an existing site, any effects are predicted to be minor.

**WR113:** [REDACTED]

- 4.14.31 No major or moderate construction or operational landscape and visual effects are predicted.
- 4.14.32 Option WR113 is not within or in proximity to any landscape designations. The Peak District National Park is located approximately 1.7km from the sub-option; however, due to the urban location of the sub-option and distance between it and the National Park, no effects are anticipated.
- 4.14.33 Approximately the final 0.3km of the pipeline is located within the Green Belt; however, as this is located on the edge of a residential area and would not result in the construction of above ground infrastructure at this location, no negative effects on openness are anticipated. Construction could, however, have short term, temporary negative effects on



the visual amenity of residential receptors adjacent to the WTW/borehole site and along the pipeline route. This is assessed as a minor negative effect.

- 4.14.34 As the boreholes and WTW would be within an existing operational area, landscape and visual effects are predicted to be negligible during the operational phase of Option WR113.

#### WR149: [REDACTED]

- 4.14.35 No major or moderate construction or operational landscape and visual effects are predicted.
- 4.14.36 The development sites and proposed pipeline route associated with Option WR149 are not affected by any landscape designations. Construction activity could, however, have short term negative effects on landscape character and visual amenity, although given the scale of the works, any negative effects would be minor.
- 4.14.37 The refurbishment/modification of the boreholes and WTW would be within existing sites such that any negative effects on the surrounding semi-rural landscape would be minor, if not negligible.

## Cumulative Effects of the NWT SRO Full Solution

### Construction

- 4.14.38 The NWT SRO Full Solution is not within any nationally designated landscapes. Options WR111 and WR113 would be in relative close proximity to the Peak District National Park; however, taking into account the scale of construction activity, its location and the temporary nature of the works, any effects on the National Park are predicted to be negligible and no cumulative effects on this receptor are predicted (particularly given the distance between Options WR111 and WR113).
- 4.14.39 Construction activity associated with the NWT SRO Full Solution is likely to have negative effects on landscape character and, for some sub-options, townscape character. However, given the scale of development and the temporary nature of the works, effects are likely to be largely be minor. Further, owing to the distance between the sub-options, no additional cumulative landscape or townscape effects are predicted. Where works are in close proximity to residential and recreational receptors, construction activity associated with the NWT SRO Full Solution may have short term effects on visual amenity. As with landscape, however, any effects would be temporary, are largely assessed as minor and no additional cumulative effects are predicted.
- 4.14.40 As noted above, works associated with Sub-option WR015 would be situated within/adjacent to [REDACTED]. Construction within/adjacent to the Park may have an effect on the character of the Park and the visual amenity of recreational users, as well as [REDACTED] to the north west; this is assessed as a moderate negative effect.
- 4.14.41 Overall, the NWT SRO Full Solution is predicted to result in a minor negative landscape and visual effect during the construction phase, which is consistent with the appraisal of Sub-option WR015.



## Operation

- 4.14.42 No major or moderate landscape and visual effects are predicted during the operational phase of the NWT SRO Full Solution.
- 4.14.43 As noted above, a small number of above ground infrastructure components would be located in relatively close proximity to the Peak District National Park. However, the elements of the NWT SRO Full Solution would be located within existing operational areas and, taking into account their scale, are unlikely to result in negative effects on the National Park.
- 4.14.44 New above ground infrastructure associated with the NWT SRO may have negative effects on landscape character, particularly where it is located on undeveloped greenfield sites in rural locations. However, given the scale of development and the location of the majority of components being within/adjacent to existing sites, any negative effects are expected to be localised and not significant. Similarly, effects on visual receptors are predicted to be minor. The exception to this is Sub-option WR015 for which effects are assessed as moderate negative. This reflects the potential for new above ground infrastructure associated with this sub-option to affect the character of [§] and the visual amenity of recreational users, as well as [§] to the north west; this is assessed as a moderate negative effect
- 4.14.45 As with the construction stage, no additional cumulative landscape or townscape effects are predicted.
- 4.14.46 Overall, the NWT SRO Full Solution is predicted to result in a moderate negative landscape and visual effect during the operational phase, which is consistent with the appraisal of Sub-option WR015.

## Additional Mitigation and Enhancement Measures

- 4.14.47 The following additional mitigation and enhancement measures have been identified:
- Construction activity should be screened where practicable so as to avoid/minimise adverse landscape and visual affects during the construction phase;
  - Vegetation/tree protection plans should be considered as part of the detailed design process;
  - Where required, proposals should be accompanied by a lighting strategy that is designed to minimise outward glows;
  - New above ground infrastructure should adopt high quality design principles where practicable (for example, siting and the use of appropriate materials);
  - Proposals should be accompanied by a landscape mitigation plan, informed by a landscape and visual assessment (where required);
  - With specific regard to Option WR015, proposals should seek to minimise effects on the character of [§] and the visual amenity of recreational receptors.



## Residual Effects and Uncertainties

- 4.14.48 The implementation of the additional mitigation measures outlined above is expected to lessen the landscape and visual effects of the NWT SRO Full Solution. However, there remains the potential for minor negative construction and operational effects.

### 4.15 Summary of Effects

- 4.15.1 **Table 4.7** presents a summary of the effects predicted to arise as a result of the construction and operation of the NWT SRO Full Solution at this stage. Effects are summarised by topic.



Table 4.7 Summary of Effects

IEA Topic	Significance (Construction)	Significance (Operation)	Residual Effects (After Mitigation) - Construction	Residual Effects (After Mitigation) - Operation	Summary Rationale
<b>Population (Socio-economics)</b>	Major (positive) effect	Major (positive) effect	Major (positive) effect	Major (positive) effect	Construction and operation of the NWT SRO Full Solution will generate a large amount of vehicle movements, contributing to congestion and driver delay and potentially affecting local businesses. With mitigation (as set out under traffic and transport below), however, effects on the highway network would likely be reduced from moderate to minor.
	Moderate (negative) effect	Moderate (negative) effect	Minor (negative) effect	Minor (negative) effect	<p>Construction of the NWT SRO Full Solution would require substantial capital investment, generating local employment opportunities and supply chain benefits, as well as increased spend in the local economy.</p> <p>Operation of the NWT SRO Full Solution will provide an additional capacity of up to 169.8MI/d, supporting population growth and economic development in the North West region and, indirectly, in the South East.</p>
<b>Health</b>	Moderate (negative) effect	Major (positive) effect	Minor (negative) effect	Major (positive) effect	<p>Construction activity associated with the NWT SRO Full Solution will generate noise, vibration and emissions to air which could affect sensitive receptors in close proximity to development sites and along transport routes; however, effects in this regard would be temporary. Further, implementation of measures (such as the preparation of a CEMP) will likely reduce adverse health effects such that no major or moderate (residual) negative effects are anticipated.</p> <p>Vehicle movements during operation of the sub-options may generate noise, vibration and air quality impacts; however, these effects are not expected to be significant.</p> <p>The NWT SRO Full Solution will deliver additional capacity of up to 169.8MI/d. This would help ensure a continual supply of clean drinking water and increase resilience of supply to UU customers and the South East region.</p>
		Minor (negative) effect		Minor (negative) effect	
<b>Biodiversity, Flora and Fauna</b>	Moderate (negative) effect	Moderate (negative) effect	Minor (negative) effect	Moderate (negative) effect	Construction works would result in the loss of/disturbance to habitats and species including Ancient Woodland, resulting in adverse effects. However, with additional





IEA Topic	Significance (Construction)	Significance (Operation)	Residual Effects (After Mitigation) - Construction	Residual Effects (After Mitigation) - Operation	Summary Rationale
			Moderate (positive) effect		<p>mitigation (for example, pipeline re-routing and implementation of a CEMP), negative effects are expected to be minor.</p> <p>On the basis that an overall BNG will be achieved, there are likely to be moderate positive biodiversity effects associated with the creation of habitats.</p> <p>Abstraction of water during operation of the NWT SRO Full Solution sub-options may result in negative ecological effects. Currently available data indicate that the risk of the sub-options adversely affecting the integrity of any European sites, alone or in combination, is low – and so progression of the options beyond Gate 2 would be reasonable. The WFD Assessment, meanwhile, has identified the potential for the NWT SRO Full Solution to result in non-compliance for groundwater and surface water bodies, relating to water quantity, water quality and biological elements.</p> <p>For all sub-options, further evidence and assessment is required before Gate 3 to determine the potential effects of abstraction on the ecological status of waterbodies. On this basis the SRO is assessed as having a residual moderate negative effect on biodiversity until further evidence and assessment is available to demonstrate otherwise.</p>
<b>Land Use, Geology, Geomorphology and Soils</b>	Moderate (negative) effect	Minor (negative) effect	Moderate (negative) effect	Minor (negative) effect	<p>Construction of the NWT SRO Full Solution sub-options would result in the loss of agricultural land which may include best and most versatile land.</p> <p>There is a risk of the accidental release of pollutants due to spillages and equipment leaks during the construction and operational phases. However, pollution control measures would be expected to ensure that effects in this regard are not minor.</p>
<b>Water</b>	Negligible effect	Moderate (negative) effect	Negligible effect	Moderate (negative) effect	<p>It is assumed that best practice construction methods will be followed during the construction phase of the NWT SRO Full Solution sub-options such that effects on water would be negligible.</p> <p>Operation of the NWT SRO Full Solution will involve significant abstraction from both rivers and groundwater sources, potentially affecting WFD status. For all sub-options, further evidence and assessment is required before Gate 3 to determine the potential effects of abstraction on waterbodies. On this basis the SRO is assessed as having a</p>





IEA Topic	Significance (Construction)	Significance (Operation)	Residual Effects (After Mitigation) - Construction	Residual Effects (After Mitigation) - Operation	Summary Rationale
					residual moderate negative effect on water until further evidence and assessment is available to demonstrate otherwise. In this regard, residual uncertainties remain.
<b>Flood Risk</b>	Moderate (negative) effect	Moderate (negative) effect	Minor (negative) effect	Minor (negative) effect	<p>Construction of the NWT SRO Full Solution sub-options will require development within Flood Zones 2 and 3. Construction activity and new infrastructure could therefore be liable to flooding. However, the construction and operation of the NWT SRO Full Solution is not expected to exacerbate flood risk elsewhere.</p> <p>With mitigation (informed by Flood Risk Assessments), construction and operational flood risk is predicted to be minor.</p>
<b>Noise and Vibration</b>	Moderate (negative) effect	Minor (negative) effect	Minor (negative) effect	Minor (negative) effect	<p>Construction of the NWT SRO Full Solution sub-options will generate noise and vibration, potentially affecting sensitive receptors in close proximity to development sites and along transport routes. However, effects would be temporary and localised. Noise and vibration effects associated with operation are expected to be negligible; however, vehicle movements may result in minor negative effects.</p> <p>With the implementation of additional mitigation measures (such as a CEMP), it is predicted that the construction and operational noise and vibration effects of the NWT SRO Full Solution will be minor.</p>
<b>Air Quality</b>	Major (negative) effect	Moderate (negative) effect	Minor (negative) effect	Minor (negative) effect	Construction and operation of the NWT SRO Full Solution sub-options would generate emissions (principally from vehicle movements) that could affect local air quality including within the Liverpool City and Greater Manchester Combined Authority AQMAs. However, it is expected that there will be a transition to low emission/electric vehicles, improving background air quality and that the implementation of additional mitigation measures including a CEMP will mean that residual negative effects are minor.
<b>Climate Change</b>	Major (negative) effect	Major (positive) effect  Major (negative) effect	Minor (negative) effect	Major (positive) effect  Minor (negative) effect	Construction of the NWT SRO Full Solution sub-options would require materials with a significant total amount of embodied carbon and would generate a substantial number of vehicle movements. Operation of the sub-options would also require a significant amount of energy with associated carbon emissions. However, with the implementation of additional mitigation measures, including Carbon Management Plans, effects are predicted to be minor.





IEA Topic	Significance (Construction)	Significance (Operation)	Residual Effects (After Mitigation) - Construction	Residual Effects (After Mitigation) - Operation	Summary Rationale
					The NWT SRO Full Solution would support the STT, increasing the resilience and adaptability of water supplies in the South East and North West to the effects of climate change.
<b>Traffic and Transport</b>	Major (negative) effect	Moderate (negative) effect	Moderate (negative) effect	Minor (negative) effect	Construction of the NWT SRO Full Solution sub-options would generate a substantial number of vehicle movements which may contribute to congestion and driver delay on the local and strategic road network. Operational vehicle movements would also be substantial. However, with additional mitigation such as the preparation of a CTMP for each sub-option and, where required, a Transport Statement or Transport Assessment to inform proposals, it is predicted that effects will not be significant.
<b>Resource Use and Waste Management</b>	Major (negative) effect	Major (negative) effect	Major (negative) effect	Major (negative) effect	Construction of the NWT SRO Full Solution sub-options would require a substantial volume of materials and energy and would generate waste. Operation of the sub-options would, cumulatively, also require a substantial volume of chemicals and energy use.  Whilst the implementation of additional mitigation measures may reduce resource use and waste, it is anticipated that the volume of materials required during the construction phase of the NWT SRO Full Solution and chemicals in the operational phase would remain substantial.
<b>Historic Environment</b>	Moderate (negative) effect	Moderate (negative) effect	Moderate (negative) effect	Moderate (negative) effect	Construction and operation of the NWT SRO Full Solution sub-options may result in negative effects on the settings of historic assets. Whilst there is the potential to minimise negative effects on heritage assets in this regard, it is predicted that the construction and operational effects of the NWT SRO Full Solution would remain moderate negative.
<b>Landscape and Visual</b>	Minor (negative) effect	Moderate (negative) effect	Minor (negative) effect	Minor (negative) effect	Construction of the NWT SRO Full Solution sub-options is likely to have negative effects on landscape and, in some cases, townscape character, although effects would be temporary. Where works are in close proximity to residential and recreational receptors, construction activity may have short term effects on visual amenity.





IEA Topic	Significance (Construction)	Significance (Operation)	Residual Effects (After Mitigation) - Construction	Residual Effects (After Mitigation) - Operation	Summary Rationale
					New above ground infrastructure may have negative effects on landscape character and visual amenity during operation, although with additional mitigation (such as screening) negative effects are expected to be localised and not significant.





## 5. Appraisal of In-Combination Effects

### 5.1 Introduction

5.1.1 This section considers the cumulative effects of the NWT SRO Full Solution in-combination with other plans, programmes and projects, including:

- Other UU plans (the draft WRMP24, Drought Plan and Drainage and Wastewater Management Plan (DWMP));
- The WRW Regional Plan, adjacent water company plans (WRMPs) and projects (SROs);
- Local plans and strategies and National Policy Statements (NPSs);
- Nationally Significant Infrastructure Projects (NSIPs);
- High Speed 2 (HS2); and
- Major planning applications.

5.1.2 The cumulative effects of the NWT SRO Full Solution in-combination with other plans and projects are difficult to accurately assess at this stage given the inherent uncertainties concerning (*inter alia*): future changes to baseline environmental conditions; future population and economic growth; the deliverability of some NSIPs (and the potential for new NSIPs to be brought forward); future major planning applications; and the proposals of emerging water company plans and projects. As such, it will be necessary to keep under review these factors in subsequent gates to ensure that the latest information is taken into account.

### 5.2 Other United Utilities Plans

#### Water Resources Management Plan 2024

5.2.1 The NWT SRO Full Solution is developed in the context of UU's WRMP24 and the NWT SRO sub-options will be included in the WRMP. The SRO sub-options are the only supply-side options included in WRMP24 at the time of writing such that significant in-combination effects are very unlikely.

#### Drought Plan

5.2.2 UU published its Draft Final Drought Plan in 2022. The Drought Plan provides a comprehensive statement of the actions that UU will consider implementing during drought conditions in order to protect essential water supplies for customers and to minimise environmental impact. The Plan includes a range of drought management actions (linked to drought triggers), that can be broadly categorised as:

- Operational actions;



- Demand-side actions (water efficiency measures, identifying and repairing leaks, managing pressure in the water network and water use restrictions);
- Water use restrictions (temporary use bans, ordinary drought orders to ban non-essential use and emergency drought orders);
- Supply-side actions (drive increased use of boreholes across the region, enforce tighter compensation control and utilise strategic pumping, where available and outage management);
- Drought permits and orders; and
- Extreme drought measures.

5.2.3 The requirements of UU's current Drought Plan are accounted for within the WRMP calculations and so there cannot be additional 'in combination' effects between the NWT SRO Full Solution and the Drought Plan.

## Drainage and Wastewater Management Plan

5.2.4 The DWMP will set out how UU intends to extend, improve and maintain a robust and resilient drainage and wastewater system. It will take a long-term view, setting out a planning period that is appropriate to the risks faced by UU, covering 2025 to 2050.

5.2.5 The DWMP is currently in preparation with a draft DWMP published in June 2022. UU has identified 372 Tactical Planning Unit (TPU) drainage areas where drainage, flooding, pollution and treatment risks have been identified. The draft DWMP sets out options that have been developed to address the identified risks at the TPU level and to deliver one or more of the three UU planning objectives. These options are based around the following themes:

- Combined and Foul Sewer Systems;
- Customer Side Management;
- Indirect Measures;
- Sludge;
- Surface Water Management; and
- Wastewater Treatment.

5.2.6 The DWMP options are largely generic and do not identify specific locations for interventions below the TPU level. In consequence, there is insufficient information to assess the effects of the DWMP in-combination with the NWT SRO Full Solution.

5.2.7 Notwithstanding this, the DWMP options will involve minor and/or unexceptional construction works such that significant in-combination construction effects are considered highly unlikely to occur. Regarding operational in-combination effects, implementation of the DWMP options must be consistent with the DWMP objectives and these include meeting all permitting requirements (now, or in the future) and protecting, restoring or improving the environment by reducing spills from storm overflows and delivering WINEP-driven schemes. Operational effects on water quality would therefore



be neutral or positive both collectively and for individual schemes. Other operational effects are conceivable (for example, new pumping stations may introduce noise and vibration effects), but these will be scheme-specific, not systematically driven by the options in the DWMP, and avoidable with best-practice design measures.

## 5.3 Regional Plans, Adjacent Water Company Plans and Other Strategic Resource Options

- 5.3.1 The NWT SRO Full Solution is developed in the context of the WRW Regional Plan and the NWT SRO sub-options will be included in that Plan. In consequence, the NWT SRO Full Solution will not result in negative effects in-combination with the WRW Regional Plan.
- 5.3.2 There are five further SROs being taken forward by the water companies in the WRW region (STT, Grand Union Canal transfer, Upper Derwent Valley Reservoir Expansion, Minworth Effluent Reuse and Severn Trent Sources). However, based on information currently available, it is understood that the NWT SRO sub-options would not be located in close proximity to these SROs, or other options contained in adjacent water company WRMPs in the WRW region. Further, the NWT SRO sub-options would not involve abstraction from/discharge to the same waterbodies as those associated with other SROs and adjacent water company WRMP options. The NWT SRO Full Solution is therefore unlikely to have negative in-combination (construction and operational) effects with these SROs and WRMPs.
- 5.3.3 The NWT SRO will, in-combination with the operation of the STT, Minworth Effluent Reuse and Severn Trent Sources SROs, help to ensure a continual supply of drinking water in the South East region, supporting population and economic growth, health and climate change resilience.

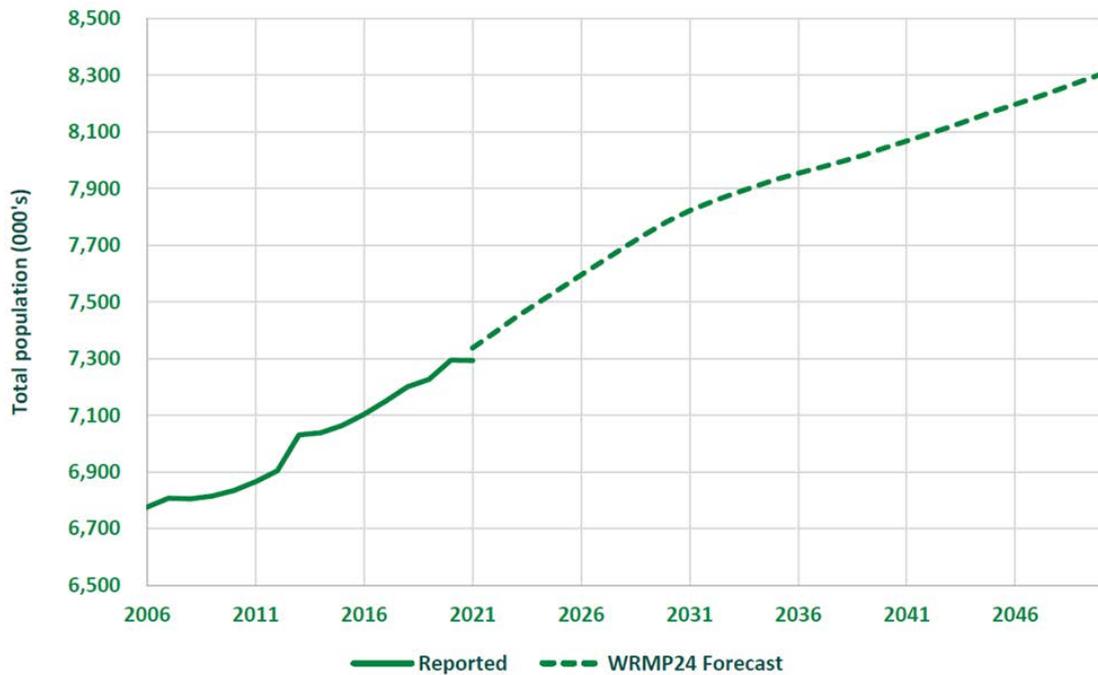
## 5.4 Other Plans

### Local Plans and Strategies

- 5.4.1 As noted above, the NWT SRO Full Solution is developed in the context of UU's WRMP. Population change in the UU region has already been considered in the draft WRMP24 along with the potential for further changes in demographics throughout the plan period. These forecasts have been based upon population projections published by the ONS and engagement with local and unitary authorities regarding their local plans to determine how many household properties are likely to be built in the region over the planning horizon. The forecasts have also taken into account potential economic growth in the North West region. UU has also carried out an initial impact assessment of the 2021 Census findings on population data. **Figure 5.1** shows the draft WRMP24 plan based population forecast.



Figure 5.1 Population Forecast



Source: United Utilities (2022) Draft WRMP24

5.4.2 As a result, the in-combination water-resource effects of growth promoted by other plans (for example, local planning authority local plans including the emerging 'Places for People' development plan being jointly prepared by Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Tameside, Trafford and Wigan councils) and strategies (such as the Greater Manchester Strategy 2021 to 2031) are considered and accounted for during the draft WRMP24 development process, and therefore, in the NWT SRO Full Solution. Arguably, therefore, potential in-combination effects in respect of water-resource demands due to other plans or projects are unlikely since these demands are explicitly modelled when determining the supply-demand balance.

5.4.3 No local plan allocations or site specific proposals with the potential for significant cumulative effects in-combination with the NWT SRO Full Solution have been identified.

### National Policy Statements (NPSs)

5.4.4 The Planning Act 2008 introduced a procedure to streamline the decision-making process for NSIPs. Under the Act, a developer wishing to construct a Nationally Significant Infrastructure Projects (NSIP) must first apply to the Secretary of State for development consent. National Policy Statements (NPSs) establish the need for specific types of infrastructure and provide planning guidance for promoters of NSIPs, and the basis for the examination by the Examining Authority and decisions by the Secretary of State on development consent order applications. A number of NPSs have been published which set out the definition, and in some cases the location, of NSIPs. The current status of NPSs is set out in **Table 5.1**.



Table 5.1 Current Status of National Policy Statements

National Policy Statement (NPS)	Status	Are Potential Locations of NSIPs included in the NPS?
Overarching Energy EN-1 <sup>50</sup>	Designated July 2011	No
Fossil Fuel Electricity Generating Infrastructure EN-2	Designated July 2011	No
Renewable Energy Infrastructure EN-3	Designated July 2011	No
Gas Supply Infrastructure and Oil and Gas Pipelines EN-4	Designated July 2011	No
Electricity Networks Infrastructure EN-5	Designated July 2011	No
Nuclear Power Generation EN-6	Designated July 2011	Yes
Ports	Designated January 2012	No
Waste Water Infrastructure	Designated March 2012	Yes
Hazardous Waste Infrastructure	Designated June 2013	No
National Networks	Designated January 2015	No
Airports NPS: new runway capacity and infrastructure at airports in the South East of England	Designated June 2018	Yes
Water Resources Infrastructure	Draft published November 2018	No
Geological Disposal Infrastructure	Designated July 2019	No

5.4.5 The NWT SRO Full Solution is not expected to have any negative cumulative effects in combination with the NPSs listed above. This is because the NPSs are either not site specific or because specific NSIP proposals are unlikely to affect, or be affected by, the SRO sub-options as they are not located within the same geographic area.

## 5.5 Nationally Significant Infrastructure Projects (NSIPs)

5.5.1 A number of other NSIPs that are not detailed in NPSs are listed on the Planning Inspectorate website<sup>51</sup>. At the time of writing, seventeen additional projects in the North West region were at various stages (with a further project withdrawn from consideration):

- 7 at pre-application;
- 1 at pre-examination;
- 1 at recommendation; and
- 8 decided.

5.5.2 These are detailed in **Table 5.2**.

<sup>50</sup> A revised draft National Policy Statement for Energy (and for EN2 to EN5) was published by the Government for consultation in September 2021.

<sup>51</sup> [https://infrastructure.planninginspectorate.gov.uk/projects/North West/](https://infrastructure.planninginspectorate.gov.uk/projects/North%20West/) [Accessed August 2022].



Table 5.2 NSIPs in the North West region

Project	Developer	Stage
<b>HyNet Carbon Dioxide Pipeline</b>	Liverpool Bay CCS Limited	Pre Application
<b>A66 Northern Trans-Pennine Project</b>	National Highways	Pre Examination
<b>Morecambe Offshore Windfarm</b>	Cobra Instalaciones y Servicios S.A. (Cobra) and Flotation energy plc. (Flotation Energy)	Pre Application
<b>A57 Link Roads (previously known as Trans Pennine Upgrade Programme)</b>	Highways England	Recommendation
<b>Morgan Offshore Wind Farm</b>	Morgan Offshore Wind Limited	Pre Application
<b>Hynet North West Hydrogen Pipeline</b>	Cadent Gas Limited	Pre Application
<b>M60/M62/M66 Simister Island</b>	Highways England	Pre Application
<b>Preesall Saltfield Underground Gas Storage</b>	Halite energy Group Ltd	Decided
<b>A585 Windy Harbour to Skippool Improvement Scheme</b>	Highways England	Decided
<b>Whitemoss Landfill Western Extension</b>	Whitemoss Landfill Limited	Decided
<b>Heysham to M6 Link Road</b>	Lancashire County Council	Decided
<b>Walney Extension Offshore Wind Farm</b>	DONG Energy Walney Extension (UK) Ltd	Decided
<b>Burbo Bank Extension offshore wind farm</b>	DONG Energy Burbo Extension (UK) Ltd.	Decided
<b>A556 Knutsford to Bowdon Scheme</b>	Highways Agency	Decided
<b>Keuper Gas Storage Project</b>	Keuper Gas Storage Limited	Decided
<b>A5036 Port of Liverpool Access Scheme</b>	Highways England	Pre Application
<b>Hydrodec Oil Re-Refinery Eastham</b>	Hydrodec Re-refining (UK) Limited	Pre Application

5.5.3 Most of the proposed NSIP schemes would not be in close proximity to any of the NWT SRO sub-options such that no significant cumulative effects are anticipated at this stage. Further, it is anticipated that the majority of NSIPs would be brought forward in advance of the NWT SRO Full Solution such that cumulative construction effects would not be expected.

5.5.4 The Whitemoss Landfill Western Extension would be approximately [X] of sub-options WR107a2 and WR107b. It is understood that construction of this project has been completed and, therefore, construction-related in-combination effects are not possible.



No in-combination operational effects are predicted given the nature of the project and its distance from Sub-options WR107a2 and WR107b.

- 5.5.5 There is a potential operational interaction between the NWT SRO Full Solution and the Keuper Gas Storage Project, as this will discharge brine to the Manchester Ship Canal and hence the Mersey Estuary at Runcorn. In theory, the NWT SRO Full Solution may marginally reduce flows in the Ship Canal which may affect brine dilution; however, the HRA concludes that reduction (and the corresponding effects on salinity) will be negligible such that negative in-combination effects will not therefore occur with this project.

## 5.6 High Speed 2

- 5.6.1 HS2 is a planned high-speed railway line between London and major cities in the north of England. HS2 is being constructed in phases; of relevance to the NWT SRO Full Solution is Phase 2b and, specifically the 'Western Leg' connection from Crewe to Manchester.
- 5.6.2 On 24 January 2022, the Government introduced the High Speed Rail (Crewe - Manchester) Bill into Parliament to secure the powers to construct and maintain HS2 Phase 2b. The Western Leg route is in the general geographic area of the NWT SRO Full Solution with several sub-options being within/in proximity to the route corridor including STTA4, WR076, WR111 and WR149. In particular, a section of the proposed pipeline, new abstraction and WTW associated with Option WR076 is within the corridor of the proposed Phase 2b route.
- 5.6.3 Phase 2b construction is expected to commence in 2025 with operation starting in 2038. In consequence, there is the potential for cumulative environmental effects in-combination with the construction of the NWT SRO Full Solution, and in particular the sub-options noted above. Any potential in-combination effects are, however, likely to be localised and primarily associated with noise/vibration disturbance, emissions to air and landscape and visual impacts which could affect receptors that are in close proximity to both projects. Construction traffic associated with both the NWT SRO Full Solution and Phase 2b may additionally result in wider in-combination effects on the strategic and local road network (depending on the routing of traffic). However, in-combination effects are considered unlikely to be of a magnitude that is substantially greater than those associated with each project alone.
- 5.6.4 The potential for in-combination effects to occur during construction will be dependent on the exact timing of works associated with Phase 2b and implementation of the sub-options that comprise the NWT SRO Full Solution and in consequence, there is a high degree of uncertainty at this stage. The in-combination effects assessment will therefore require further, more detailed investigation during Gate 3.
- 5.6.5 Given the nature of the NWT SRO Full Solution sub-options and HS2, it is considered unlikely that there would be significant in-combination effects during the operation of both projects, particularly as the operation of Phase 2b will not involve the abstraction of water. However, the WFD Compliance Assessment for HS2 (Crewe-Manchester) identifies potential impacts on a number of water bodies that have also been identified in the NWT Gate 2 WFD Assessment, as a result of physical modifications (these are summarised in **Table 5.3**). Of those, one water body that is relevant to both assessments is identified in the HS2 assessment as having a potential risk of deterioration (Hey/Bordsane Brook,



GB112069064520). Mitigation has been proposed to address that risk, but the assessment concludes that *"the risk of causing deterioration in status... is considered to remain at this stage"*.

- 5.6.6 Impacts associated with HS2 on waterbodies would be a result of construction activities and associated physical modifications. In contrast, the potential for non-compliance identified in the NWT WFD Assessment is associated with operation of abstractions and associated impacts on river flows. These aspects will need to be considered together in a cumulative assessment with respect to hydro-morphology and potential for resulting effects on biological or physico-chemical elements as part of the NWT WFD Assessments during Gate 3.

Table 5.3 HS2 WFD Compliance Summary

Water body name	Water body ID	Risk of deterioration and non-compliance, as concluded in Table 7
<b>Bollin (Ashley Mill to Manchester Ship Canal)</b>	GB112069061382	Localised, adverse effects anticipated at the water body scale. No risk of deterioration in current status identified at this stage.
<b>Mersey/Manchester Ship Canal (Irwell/Manchester Ship Canal to Bollin)</b>	GB112069061011	Localised, adverse effects anticipated at the water body scale. No risk of deterioration in current status identified at this stage.
<b>Glaze</b>	GB112069061420	Localised, adverse effects anticipated at the water body scale. No risk of deterioration in current status identified at this stage.
<b>Hey/ Bordsane Brook</b>	GB112069064520	Risk of deterioration and non-compliance identified. Additional mitigation measures required.
<b>Bollin (River Dean to Ashley Mill)</b>	GB112069061381	Localised, adverse effects anticipated at the water body scale. No risk of deterioration in current status identified at this stage.
<b>Rosterne Mere*</b>	GB31232650	Localised, adverse effects anticipated at the water body scale. No risk of deterioration in current status identified at this stage.
<b>Mersey (Upstream of Manchester Ship Canal)</b>	GB112069061030	Localised, adverse effects anticipated at the water body scale. No risk of deterioration in current status identified at this stage.

\*Rosterne Mere is not included in the Gate 2 WFD assessment but is identified in the groundwater report from a designated sites perspective, and in the HRA

- 5.6.7 The NWT HRA highlights that HS2 involves construction close to the western boundary of Holcroft Moss SSSI and has been subject to an appropriate assessment, which concluded that:
- Construction and operation of the railway would not adversely affect this SSSI, and hence the Manchester Mosses SAC (with the addition of mitigation measures to safeguard water levels in the superficial underlying strata); and



- The scheme would not affect groundwater levels in the sandstone aquifer.

5.6.8 Effects in-combination with the NWT SRO Full Solution and, in particular, Option WR149 are therefore unlikely (particularly as Holcroft Moss SSSI is ~4km from the Croft boreholes), although this will be considered in more detail during Gate 3.

## 5.7 Major Planning Applications

- 5.7.1 The Haweswater Aqueduct Resilience Programme (HARP), promoted by UU, involves major upgrade and replacement works across six sections of the 110km Haweswater Aqueduct through Cumbria, Lancashire and Greater Manchester in order to maintain water supply and quality. The NWT SRO Full Solution sub-options are not in the general geographic area of the HARP; the exception is Sub-option WR015 which is circa 10km to the south of the [§]. It is the subject of a planning application submitted by UU to Hyndburn Borough Council in April 2021<sup>52</sup>.
- 5.7.2 There is the potential for traffic generated by construction of the HARP and Sub-option WR015 to result in a cumulative increase in traffic volumes on, for example, the M60 and M66; however, it is currently anticipated that the HARP will be completed by 2029, prior to construction of Sub-option WR015. In consequence, significant in-combination effects are not predicted.
- 5.7.3 No in-combination operational effects are predicted, although both the HARP and the NWT SRO Full Solution will enhance resilience of supplies to UU customers.
- 5.7.4 Taking into account the nature, scale and timing of proposals, no further major planning applications with the potential for cumulative effects in-combination with the NWT SRO Full Solution have been identified at this stage. As for NSIPs, it will be necessary to monitor major planning applications in the region and update the in-combination assessment for Gate 3.

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<sup>52</sup> Planning application reference 11/21/0237.



## 6. Summary and Forward Plan

### 6.1 Summary

- 6.1.1 This report has presented the IEA of the NWT SRO in support of UU's Gate 2 submission to RAPID. By drawing together the results of the Gate 2 environmental assessment work, the potential environmental effects of the SRO during both construction and operation have been characterised and appraised. Where appropriate, measures to mitigate the negative effects of the SRO have been identified, together with opportunities to deliver additional benefits.

#### Significant Construction Effects

- 6.1.2 Construction of the NWT SRO Full Solution would represent a substantial capital investment which is likely to generate considerable employment opportunities and supply chain benefits, as well as increased spend in the local economy by contractors and construction workers, over a sustained period. This socio-economic benefit has been assessed as a **major (likely significant) positive effect**.
- 6.1.3 Emissions to air (principally associated with vehicle movements) would be generated during the construction phase which could affect local quality, including within the Liverpool City and Greater Manchester Combined Authority AQMAs. Whilst any effects would be temporary (i.e. for the period of construction), this has been assessed as a **major negative (likely significant) effect**. However, it is anticipated that there will be a gradual transition to low emission/EV vehicles over the SRO implementation period. In consequence, this assessment conclusion is considered to be worst case and with additional mitigation, it is predicted that the air quality effects of the SRO would be reduced to minor negative.
- 6.1.4 The embodied carbon associated with the NWT SRO Full Solution would be 211,290 tCO<sub>2</sub>e and, therefore, it has been assessed as having potentially **major (likely significant) negative** carbon effects. However, with the progression of sub-option design from concept to detailed and implementation of additional mitigation measures including Carbon Management Plans consistent with UU's commitment to achieve net zero emissions by 2030, the negative construction climate change effects of the NWT SRO Full Solution could be reduced to at least a minor effect.
- 6.1.5 Construction of the NWT SRO Full Solution would generate a substantial volume of vehicle movements (178,015 movements in total over the construction period) with the potential to result in congestion and driver delay on the local and strategic road network. This has been assessed as a **major (likely significant) negative effect**. However, with implementation of additional mitigation measures including a CTMP, it is predicted that the construction traffic and transport effects of the NWT SRO Full Solution would be reduced from major to moderate.
- 6.1.6 Construction of the NWT SRO Full Solution sub-options would require a substantial volume of materials and energy which has been assessed as a **major (likely significant)**



**negative effect.** Construction waste would also be generated during the construction of the NWT SRO Full Solution which could affect the capacity of waste management facilities that receive arisings. At this stage, a **major (likely significant) negative effect** has been identified.

- 6.1.7 No further major (likely significant) construction effects have been identified.
- 6.1.8 There is the potential for construction associated with the NWT SRO Full Solution to result in negative effects in respect of the other IEA topics including, for example, health, biodiversity and landscape. However, it is not predicted that these effects would be significant and, further, it is likely that measures could be employed to avoid/mitigate effects at the project stage.

### Significant Operational Effects

- 6.1.9 The NWT SRO Full Solution promotes cost efficient source options, selected to facilitate transfer volumes by the release of raw water directly from Lake Vyrnwy into the River Vyrnwy or transferred through a new River Vyrnwy bypass pipeline into the River Severn as part of the STT SRO. The NWT SRO Full Solution provides new sources to be brought online if water were to be transferred out of region, maintaining resilience for customers in the North West and indirectly helping to ensure a continual supply of drinking water in the South East region. This will, in-turn, support population and economic growth. In total, the NWT SRO will provide an additional capacity of up to 169.8MI/d which has been **assessed as a major (likely significant) positive effect** in respect of the population, health and climate change IEA topics.
- 6.1.10 The operation of the NWT SRO Full Solution sub-options would have operational emissions of 36,797 tCO<sub>2</sub>e/year; there would also be carbon emissions associated with operational vehicle movements. The NWT SRO Full Solution has, therefore, been assessed as having potentially **major (likely significant) negative carbon effects** as well as in respect of resource use. However, as for construction, the implementation of Carbon Management Plans would reduce the magnitude of these effects.
- 6.1.11 No further major (likely significant) operational effects have been identified.
- 6.1.12 Operation of the NWT SRO Full Solution would involve the abstraction of circa 105MI/d from rivers and 64.8MI/d from groundwater sources which has the potential to affect either (i) deterioration of WFD status and/or (ii) the ability of a waterbody to attain its target status. The abstraction of water may also result in negative ecological effects, both alone and at the solution level. However, there remains some uncertainty regarding the likelihood of these effects occurring and their magnitude and further evidence and assessment is required before Gate 3 in order to determine the potential effects of abstraction on waterbodies and associated ecological receptors. At this stage, **moderate negative effects** have been identified in respect of the **biodiversity** and **water** IEA topics on a precautionary basis and residual uncertainties remain.

### In-combination Effects

- 6.1.13 The cumulative effects of the NWT SRO Full Solution in-combination with other plans, programmes and projects have been considered. At this stage, **no significant cumulative**



**effects** have been identified, although further investigation in respect of in-combination effects associated with HS2 will be required during Gate 3.

## 6.2 Consenting Strategy

- 6.2.1 It is anticipated that all the NWT sub-options would be consented individually under the Town and Country Planning Act 1990, either under permitted development rights and/or express planning permissions.
- 6.2.2 The five new river sub-options and one of the groundwater sub-options (WR107a2) would require new abstraction licences, and one groundwater sub-option (WR111) would require a variation to an existing abstraction licence. The remaining six groundwater sub-options would operate within current conditions/limits on existing abstraction licences.
- 6.2.3 UU is proposing that Gate 3 will coincide with the submission of planning applications and abstraction licence applications. Gate 3 is likely to be phased, depending on the programme for delivering each sub-option, with the earliest Gate 3 and applications in December 2024. A Gate 3 Checkpoint will occur in December 2023, following the adoption of UUs WRMP24, and progression of Gate 3 investigations and assessments, at which the Full Solution and implementation programme will be confirmed. Further information on the consenting strategy and plan for Gate 3 is presented in **Section 7** of UU's Detailed Feasibility and Concept Design Report.

## 6.3 Data Gaps and Uncertainties

- 6.3.1 While significant progress has been made during Gate 2 in understanding the baseline environment and the potential environmental impacts associated with each of the sub-options and the NWT SRO Full Solution, there remain a number of uncertainties and data gaps. The key uncertainties and data gaps (i.e. those linked to the impact of abstractions on the water environment and aquatic biodiversity) are listed in **Table 6.1** along with how these will be addressed during Gate 3. Further description of the Environmental Workstream Plan for Gate 3 is set out in **Section 6.4**. Data gaps and uncertainties associated with other topics and construction impacts are discussed in the final section of each topic assessment in **Section 4**.



Table 6.1 Key Environment Uncertainties and Data Gaps

No.	Uncertainty/ Data Gap	Description	Further Information	How this will be addressed in Gate 3
1	Groundwater Resource Availability	Water availability is uncertain for all groundwater options. The EA have provided updated assessments of groundwater resource availability at the Groundwater Body scale. This data indicates that Fully Licensed abstraction exceeds the available resource, but that water may be available under Recent Actual conditions. However, these numbers are not directly relatable to the summaries of water availability data at the GWMU level, provided by the EA in March 2022. The groundwater resource baseline is changing due to post-industrial groundwater level recovery, with no up to date regional conceptual or numerical groundwater model available.	NWT-G02-006-001: Assessment of Sub-Options Involving Groundwater Abstractions	Groundwater Balance Calculations. Engagement on Water Availability Status. Groundwater Modelling.
2	Surface Water Resource Availability/Hands off Flows	The EA has provided updated water availability screening which indicates that the surface water option capacities are available unconstrained, but the rivers are often discharge rich. Further discussion is required with the EA to agree whether a HOF (or Minimum Residual Flow) would be applied to any of the options. It is unclear if water quality or ecology impacts may limit the availability of water, even where the EA indicates unconstrained water is available.	NWT-G02-006-002: Assessment of Sub-Options Involving Surface Water Abstractions	Engagement on Water Availability Status. River Flow Modelling. Water quality modelling. Ecology monitoring.
3	Hydrogeological connectivity of groundwater abstractions and surface water courses and resulting impacts on river flows.	The assessment of groundwater sub-options has identified that there may be impacts from increased groundwater abstraction on the Ditton Brook, the Alt, the Dean, the Bollin, the Downholland Brook, Croxteth/Knowsley Brook, the Spittle Brook and Glaze, but it is not possible to draw conclusions about the magnitude of impacts on river flows with certainty at this stage.	NWT-G02-006-001: Assessment of Sub-Options Involving Groundwater Abstractions	Hydrogeological conceptualisation. Groundwater Modelling. Spot flow and bed elevation surveys. Pumping tests (where required).
4	Impacts on river flows from new	The assessment of surface water sub-options has quantified the impact of the abstractions on historical gauged flows, but hydrological modelling is required to fully investigate the impacts on future flows.	NWT-G02-006-002: Assessment of Sub-Options	River flow modelling.





No.	Uncertainty/ Data Gap	Description	Further Information	How this will be addressed in Gate 3
	surface water abstractions.		Involving Surface Water Abstractions	
5	Sensitivity of physical river habitats to changes in river flows due to new or increased groundwater or surface water abstractions.	Initial surveys of the habitats likely to be impacted by the sub-options were undertaken on limited reaches and constrained to areas with public access. Further survey of reaches likely to be impacted by the sub-options is required.	NWT-G02-006-001: Assessment of Sub-Options Involving Groundwater Abstractions NWT-G02-006-002: Assessment of Sub-Options Involving Surface Water Abstractions	River geomorphology and physical habitat surveys.
6	Impacts of increased groundwater abstraction on GWDTes	<p>The appropriate assessments presented in the informal HRA for Gate 2 indicate a low risk that any of the sub-options will adversely affect the integrity of any European sites, alone or in combination, but there is some residual uncertainty over this conclusion, and further evidence and assessment is required during Gate 3.</p> <p>The assessment of groundwater options identified additional GWDTes (in addition to those assessed in the HRA because they form part of SPA, SAC or Ramsar) which require further assessment to improve the understanding of drawdown risks to water levels and ecology in these conservation sites. These include Rixton Clay Pits SSSI and SAC, Woolston Eyes SSSI, Bryn Marsh and Ince Moss SSSI, Abram Flashes SSSI and Highfield Moss SSSI.</p>	NWT-G02-006-001: Assessment of Sub-Options Involving Groundwater Abstractions NWT-G02-006-004: Informal Habitats Regulation Assessment (HRA)	Assessment of water dependent designated sites. Groundwater Modelling Further consideration in Gate 3 HRA.
7	Impacts of decreased river flows on surface water dependent designated sites	The appropriate assessments presented in the informal HRA for Gate 2 indicate a low risk that any of the sub-options will adversely affect the integrity of any European sites, alone or in combination, but there is residual uncertainty over this conclusion, and further evidence and assessment is required during Gate 3.	NWT-G02-006-002: Assessment of Sub-Options Involving Surface Water Abstractions	Assessment of water dependent designated sites. River flow modelling. Further consideration in Gate 3 HRA.





No.	Uncertainty/ Data Gap	Description	Further Information	How this will be addressed in Gate 3
		The assessment of surface water options identified two additional SSSI (in addition to those assessed in the HRA because they form part of SPA or Ramsar), Woolston Eyes SSSI and Ashclough SSSI which require further assessment to understand if changes in rivers flows could impact these sites.	NWT-G02-006-004: Informal Habitats Regulation Assessment (HRA)	
8	Impacts on river water quality	<p>River water quality assessments at Gate 2 have focussed on impacts of changes of flow on the current water quality baseline and potential changes to WFD status close to the point of abstraction.</p> <p>Modelling of river water quality is required to assess impacts more fully, for example to consider if the options will introduce impediments to meeting water body objectives for water quality, impacts on catchments downstream of the abstractions, and assessing the impacts on the effectiveness of other planned improvements to river water quality.</p>	NWT-G02-006-002: Assessment of Sub-Options Involving Surface Water Abstractions	River Water Quality Modelling.
9	Saline intrusion to aquifers	The risk of saline intrusion, including upwards movement of saline water or intrusion from the sea, has been identified for some groundwater options and requires further investigation.	NWT-G02-006-001: Assessment of Sub-Options Involving Groundwater Abstractions	Hydrogeological conceptualisation. Groundwater Modelling.
10	Impacts on fish communities	The Gate 2 assessments show that potential impacts on fish cannot be discounted without further consideration of the characteristics of fish populations, habitat availability, passability of downstream barriers to fish movement, and salmonid migration.	<p>NWT-G02-006-001: Assessment of Sub-Options Involving Groundwater Abstractions</p> <p>NWT-G02-006-002: Assessment of Sub-Options Involving Surface Water Abstractions</p>	Fish population surveys. Fish barrier surveys. Physical habitat surveys. Assessment of impacts on migratory species.
11	Impacts on aquatic invertebrate and	The Gate 2 assessments indicate that river invertebrate communities appear to be relatively insensitive to changes in flow, but further habitat and	NWT-G02-006-001: Assessment of Sub-Options	Physical habitat surveys.





No.	Uncertainty/ Data Gap	Description	Further Information	How this will be addressed in Gate 3
	macrophyte communities	population surveys are required to confirm this. Many options lacked data for macrophytes, and the assessment indicated that macrophyte communities may be impacted by changes in flows and to physical habitats. Further survey and assessment are required.	Involving Groundwater Abstractions NWT-G02-006-002: Assessment of Sub-Options Involving Surface Water Abstractions	Macroinvertebrate and macrophyte surveys.
12	Compliance of the sub-options and the Full Solution with the WFD	The Gate 2 WFD assessment has identified that all the source sub-options are potentially non-compliant with the WFD due to the requirements for further evidence and assessment.	NWT-G02-006-003: Water Framework Directive (WFD) Compliance Assessment	Groundwater and river flow modelling. River geomorphology and physical habitat surveys. Fish, macroinvertebrate and macrophytes surveys. Assessment of water dependent designated sites. Update of WFD compliance assessment for Gate 3.
13	Compliance of the sub-options and the Full Solution with the Habitats Regulations	The appropriate assessments presented in the informal HRA for Gate 2 indicate a low risk that any of the sub-options will adversely affect the integrity of any European sites, alone or in combination, but there is some residual uncertainty over this conclusion, and further evidence and assessment is required during Gate 3.  Sites to be considered further include Manchester Mosses SAC (includes Astley and Bedford Mosses SSSI, Holcroft Moss SSSI, and Risley Moss SSSI), Rostherne Mere Ramsar, Midland Meres and Mosses Phase 1 Ramsar, Martin Mere SPA and Ramsar, Ribble and Alt Estuaries SPA and Ramsar, Sefton Coast SAC, and Mersey Estuary SPA and Ramsar.	NWT-G02-006-004: Informal Habitats Regulation Assessment (HRA)	Groundwater and river flow modelling. River geomorphology physical habitat surveys. Fish, macroinvertebrate and macrophytes surveys. Assessment of water dependent designated sites. Update of appropriate assessments for Gate 3.





No.	Uncertainty/ Data Gap	Description	Further Information	How this will be addressed in Gate 3
14	Validation of BNG and NC assessment data	The biodiversity net gain and natural capital assessments for Gate 2 are based on GIS data which requires validation through site survey. Riverine habitats should also be incorporated into the assessments.	NWT-G02-006-006 Biodiversity Net Gain (BNG) and Natural Capital (NC) Assessment	River geomorphology and physical habitat surveys.
15	Other Ecology Receptors	<p>The Gate 2 ecology assessments have focussed on aquatic groups, for which data are readily available and are mostly likely to be directly affected by the sub-options (i.e., aquatic invertebrates, aquatic macrophytes, fish and statutory designated sites).</p> <p>The Gate 2 ecology assessments have not considered legally protected species, priority habitats, priority or other notable species (that don't fall within the categories listed above), or non-statutory designated sites.</p>	<p>NWT-G02-006-002: Assessment of Sub-Options Involving Surface Water Abstractions</p> <p>NWT-G02-006-004: Informal Habitats Regulation Assessment (HRA)</p>	Other ecology receptor surveys.





## 6.4 Forward Plan

- 6.4.1 The focus of the Gate 2 environmental assessments has been to establish the feasibility of the NWT SRO by understanding what the key environmental risks are, and to begin work to understand these risks and how they might be mitigated. The assessments have not identified any “red flags” to indicate that the sub-options are unfeasible, but there remain key risks and uncertainties, and further evidence is needed to demonstrate that the sub-options will be compliant with environmental regulations.
- 6.4.2 During Gate 2 UU will undertake surveys, modelling, and assessment to support the regulatory requirements for planning applications (including Environmental Impact Assessments (EIA) where required) and abstraction licence applications. RAPID’s Gate 3 will coincide with the permitting applications, and there will also be a Gate 3 checkpoint in December 2023 when UU will demonstrate progress in this work. **Table 6.1** has identified the key data gaps and uncertainties that remain at Gate 2 (i.e. those linked to the impact of abstractions on the water environment and aquatic biodiversity), and how these will be addressed in Gate 3. The following sections provide a summary of each of the work packages listed in the final column of **Table 6.1**, with more detail presented in the Environment Monitoring & Assessment Plan included as **Appendix C**.
- 6.4.3 In the closing stages of Gate 2 and early stages of Gate 3 method statements will be prepared for each of the activities identified in this Forward Plan, which will enable methods, locations, timings and frequency/durations of the surveys, and the scope and methods for modelling and other desk-based assessments be agreed with the NAU. In addition, all proposed survey locations are being assessed for land access constraints. The exact number and locations of surveys may change as result of these activities, along with the emerging results of ongoing assessments during Gate 3.

### Groundwater Balance Calculations

- 6.4.4 It is recognised that groundwater models are the best tool for understanding the impacts of groundwater abstractions, but these complex tools take time to prepare and use (see the following section). Because of this UU will undertake an update of the Environment Agency’s groundwater resource availability assessments in late Gate 2/early Gate 3 to provide more confidence in the feasibility of the groundwater sub-options before the groundwater models are available. At the time of writing (November 2022) this is underway and is planned to be complete by the end of 2022. The calculations will comprise:
- Preparation of a method statement and agreement of this with the Environment Agency;
  - Consideration of the recharge to drift and shallow aquifers in addition to recharge to the main sandstone aquifer;
  - Definition of the most appropriate Recent Actual abstraction period;
  - Use of the best and most recent data available to inform the calculations; and



- Application of the revised average Available Groundwater Resource (AGR) calculation for the GWMU and GW Body balances, in line with current guidance.

## Groundwater Modelling

- 6.4.5 UU will use the Environment Agency's Lower Mersey Basin and East Cheshire Regional Groundwater Models to assess the impact of the groundwater sub-options on aquifer water balances, surface water courses, GWDTE and the potential for saline intrusion. The groundwater models are available for use but are out of date and require updating with more recent data and modelling techniques to make them suitable for use.
- 6.4.6 UU has begun the initial first phase of groundwater modelling by commissioning a scoping study to develop an implementation plan for the model updates. The scoping study will:
- Define the purpose of the groundwater models and their intended applications;
  - Identify any revisions or expansions required to the conceptual models;
  - Define the data necessary for the model update, both existing data sets and new data to be collected;
  - Recommend changes to modelling codes and mesh designs (i.e. the spatial discretisation of the model), including if a routed runoff and recharge model is required;
  - Consider expanding or combining the two models; and
  - Recommend the model run period (i.e., the historical period it represents) and how future climate trends will be represented.
- 6.4.7 The scoping study is in progress at the time of writing (November 2022) and is anticipated to finish by the end of 2022. This will be followed by the model update, which is anticipated to be complete in June 2023, but depends upon the scope of the update agreed through the scoping study.
- 6.4.8 Once the model updates are complete the models will be used to assess the NWT sub-options (planned to be complete by September 2023). A range of scenarios will be run to assess the spatial and temporal impact of additional groundwater abstraction at the proposed sources on groundwater levels, river flows, SSSI/GWDTEs, the water balance and risks of saline intrusion. The hydrogeological conceptualisation of the groundwater sub-options established during Gate 2 will be tested and refined during the modelling, as described in the following section. A second phase of modelling will be undertaken after the Gate 3 Checkpoint (December 2023) to support the abstraction licence application process.
- 6.4.9 All phases of the groundwater modelling work will be undertaken collaboratively with the Environment Agency, and at the present time it is anticipated that the Environment Agency will be responsible for the update of the East Cheshire model.



## Hydrogeological Conceptualisation

- 6.4.10 The hydrogeological conceptualisation of the groundwater sub-options established during Gate 2 will be tested and refined during the groundwater modelling, in particular the understanding of:
- The spatial pattern of groundwater-surface water interaction across the area, including areas where rivers may lose and gain baseflow;
  - The lined - or unlined - nature of the canals that cross the area to determine whether these are likely to leak to the aquifer or receive inflows of groundwater, and what component of the water balance this represents;
  - The hydraulic behaviour of fault zones as barriers to groundwater flow, and where faults may influence flow accretion and control the spatial extent of any abstraction impacts;
  - The influence of the nature of the superficial deposits on groundwater levels in the Sandstone aquifer and interaction between the sandstone and the overlying deposits;
  - The risks posed by saline intrusion, both from the coast and from the upconing of saline water from depth;
  - The importance of any areas of sandstone excluded from the Environment Agency GWMU area to the aquifer water balance;
  - The boundaries of the sandstone aquifer and lateral flow across these, in particular the Carboniferous Coal Measures and the Mercia Mudstone Group.
- 6.4.11 The regional conceptual models will be supplemented by the development of a local conceptual model for each groundwater sub-option (or group of sub-options as appropriate). The purpose of the hydrogeological conceptual model for each sub-option is to synthesise the data and modelling results for each sub-option into an understanding of the aquifer and abstraction and how it is linked to surface water features. This will be used in combination with the modelling results to inform the assessment of impacts of the groundwater sub-options. In reality the regional and local conceptual models will be developed in parallel and in an iterative manner.

## Pumping Tests

- 6.4.12 UU is commissioning investigative works, refurbishment, and short-term pumping tests (step tests) of the existing boreholes that make up the NWT options to establish what improvements are needed to the infrastructure (e.g., where new pumps and headworks are needed, if borehole cleaning or relining is required) and to enable water quality sampling to be undertaken. This will begin in November 2022 and continue into spring 2023.
- 6.4.13 The groundwater model scoping study (complete by the end of 2022) will establish if and where longer-term pumping tests (constant rate tests) are required or would be beneficial to inform the ongoing groundwater modelling and hydrogeological conceptualisation of the groundwater sub-options. Where this is recommended a scope of work will be developed to detail the format of the tests. The constant rate tests would be begun



following the completion of the initial investigative works, refurbishment and short-term pumping tests described above (i.e., summer 2023).

- 6.4.14 Where sources are already licensed and the constant rate tests remain within the licence constraints, no pumping test consent would be formally required, but we would engage with the Environment Agency to agree the scope of the tests. For unlicensed sources, where replacement boreholes are required, or if new monitoring boreholes are needed, a formal consent to construct and/or test the boreholes would be required. Testing of such boreholes would occur later in Gate 3 once the boreholes are constructed.
- 6.4.15 The results of the pumping tests would be used to inform the groundwater model calibration and the hydrogeological conceptualisation, and ultimately to support abstraction licence applications or variations where required.

## River Flow Modelling

- 6.4.16 The assessment of surface water sub-options during Gate 2 quantified the impact of the proposed abstractions on historical gauged flows. During Gate 3 rainfall runoff modelling will be undertaken to allow the assessment of flow impacts on actual and naturalised flows, under a range of climatic conditions, and different abstraction scenarios.
- 6.4.17 Rainfall runoff models will be developed for the catchments of the Rivers Irwell, Roch, Bollin, Tame, and Ribble. The intention is to use the GR6J rainfall-runoff modelling software, to align with UU's companywide approach to rainfall runoff modelling (e.g., that used to inform water resource planning and reservoir modelling).
- 6.4.18 The relationship between the distributed groundwater models and the lumped surface water models will be considered to ensure an appropriate level of consistency between the two. This will include:
- Considering overlaps in catchment extents between the two types of models. The Irwell GR6J model extent is likely to coincide approximately with the upper boundary of the Lower Mersey groundwater model, so may be able to be used as onflow for the groundwater model. Parts of the Bollin catchment may be included in both the East Cheshire groundwater model and the rainfall-runoff model, so as a minimum, a consistency check of the resulting flows will be carried out between the two;
  - Several data sources and data processing steps required for the GR6J modelling are similar to those likely to be required as part of the groundwater model updates (e.g., collection and processing of climate, abstraction and discharge data, naturalisation of gauged river flows etc) so the two workstreams will work closely together to minimise duplication of effort and maintain consistency between the two modelling approaches as far as possible.
- 6.4.19 The first phase of the rainfall runoff modelling work will be the writing of a method statement which will be agreed between UU and the NAU in early 2023. This will consider both the approaches to be used for model construction and calibration, and the scenarios (i.e., abstraction patterns and climate change scenarios) to be used for assessment of the NWT SRO. Phase 2 will comprise data collection, quality assurance, processing and model development, calibration, and validation. Phase 3 will be an initial round of assessment of the NWT river sub-options to identify any "red flag" impacts and provide flow impact



assessments to inform other assessments such as the river water quality modelling. This will be complete in summer 2023. A fourth phase of river flow modelling will be undertaken in 2024 (after the Gate 3 checkpoint) to support abstraction licence applications.

- 6.4.20 In addition to catchment scale rainfall runoff modelling, more localised hydraulic modelling of specific river reaches may also be required to determine the impact any reduction in flow may have on velocity and depth. This will be targeted to locations with identified sensitive habitats with greater proportional impacts on flow, and at river barriers. The need for hydraulic modelling will be determined later in Gate 3 following the results of Phase 3 of the rainfall-runoff modelling and the fish barrier surveys.

### Engagement on Water Availability Status

- 6.4.21 A key consideration in the feasibility of the sub-options, particularly with regards to licensing is the Environment Agency's water availability assessments. Data on water availability has been gathered from three sources during Gate 2:
- 2013 ALS published on the [www.gov.uk](http://www.gov.uk) website;
  - Updated summary water availability status for the sub-options provided by the Environment Agency in January, March, and May 2022; and
  - Draft updated 2021 ALS for the Upper Mersey provided by the Environment Agency in July 2022.
- 6.4.22 Specific further discussions will be required to understand the implications of the results of the updated groundwater balance calculations being undertaken in Autumn 2022, and once results of the groundwater modelling and river flow modelling are available in 2023 to agree updated water availability assessments, but it is anticipated that engagement with the Environment Agency on water availability status will be an ongoing dialogue throughout Gate 3.

### River Water Quality Modelling

- 6.4.23 In Gate 3 modelling of water quality on river reaches which will be impacted by reduced flows as a result of surface water and/or groundwater sub-options will be undertaken. The purpose of the modelling is to establish the impacts of reduced dilution on both continuous WwTW discharges and intermitted CSO discharges, as well as general water quality and WFD status, and also the potential for the sub-options to impact the planned improvements at UU's wastewater assets which will be delivered during AMP8. The modelling will consider the impacts of the sub-options individually, but also cumulative impacts of multiple options which could impact on the River Mersey and Manchester Ship Canal.
- 6.4.24 The Environment Agency's SAGIS SIMCAT model for the North West River Basin District will be used to identify the impact of reduced flows in rivers on the dilution of the concentrations of nutrients (phosphorous and nitrogen) and sanitary parameters (BOD, DO, ammonia) at the point of wastewater treatment works (WwTW) discharges. For chemical parameters (specific pollutants and priority substances) where required the



SIMCAT models will need to be calibrated using available Chemicals Investigations Programme (CIP) data collected by UU upstream and downstream of their assets. This will be carried out where the status of the river reach (or downstream reaches) is already at less than good status, or where the observed concentrations suggests that there is a risk of deterioration to less than good.

- 6.4.25 UUs ICM models for the relevant river reaches will be used to understand the impact on water quality from CSO spill events. Using flow data profiled from historical datasets and the proposed abstraction rates for high flows and low flows, the models will be used to predict the impact on water quality specifically for nutrients and sanitary parameters on downstream reaches. CSO discharges may be more likely to cause Q90 WFD threshold (during lower flows) to be crossed and could also impact the compliance with Fundamental Intermittent Standards (FIS) and 99%ile standards.
- 6.4.26 At the time of writing (November 2022) a method statement is in preparation and will shortly be issued to the NAU for review and agreement. An initial phase of modelling using existing tools will be undertaken in early 2023, initially to identify any “red flags” which would prevent option progression, and then to inform option design, development of mitigation measures, and start to provide the evidence base for environmental appraisals.
- 6.4.27 This will be followed by a second phase of modelling after the Gate 3 checkpoint (December 2023) which will contribute to the evidence base required to support abstraction licence application environmental appraisals and including finalised option designs and utilisation, results of the groundwater modelling, further data gathering etc.
- 6.4.28 UU is not proposing to undertake additional water quality sampling during Gate 3 based on the quality and availability of existing datasets, and because water quality impacts from the NWT SRO are limited to the effects of reduced dilution, not for example due to the introduction of new discharges or water transfers. This position will be kept under review during Gate 3.

### River Geomorphology, Physical Habitat, Spot Flow and Bed Elevation Surveys

- 6.4.29 Geomorphology and physical habitat surveys are required to inform the assessment of potential impact to fish and other species’ habitats within flow deprived reaches. This will comprise two stages, firstly a drone survey for comprehensive coverage of the likely impacted reaches, and to target locations for MoRPH (**M**odular **R**iver **P**hysical) surveys, and secondly the MoRPH surveys themselves.
- 6.4.30 MoRPH is a river habitat survey tool which records both the physical habitat and hydromorphological functions within rivers and streams<sup>53</sup>. The approach provides for the recording of physical form, vegetation and habitat types, and the presence of invasive plants.
- 6.4.31 A first phase will be undertaken in late spring/early summer 2023 (to coincide with optimal vegetation growth for the survey). This will include the drone survey and MoRPH surveys covering reaches 100 m upstream and 500 m downstream of each surface water

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<sup>53</sup> See: <https://www.hlsnewforest.org.uk/projects/surveys-and-monitoring/monitoring-wetland-restorations/modular-river-physical-survey-morph/> accessed (20/06/22)



abstraction point (**Table C.4**), and the macroinvertebrate sampling sites (**Table C.8**). The drone surveys will be used to target survey locations within other sensitive reaches downstream of the river abstractions (**Table C.5**), and sensitive reaches with a high likelihood of being impacted by reduced baseflows due to the groundwater sub-options (see **Table C.6**). A second phase will be undertaken in late spring/early summer 2024 to cover any additional reaches identified to be impacted by baseflow reductions after the completion of the groundwater modelling.

- 6.4.32 In addition, bed level surveys and spot flow surveys will be undertaken to help develop an improved understanding of the connectivity of surface water bodies to the underlying regional sandstone aquifer, and the magnitude of impacts of flows in upstream ungauged catchments. This will inform the calibration of the groundwater models and build confidence in the model outputs.
- 6.4.33 Streams likely to be targeted for surveys include the Bollin, Dean, Ditton Brook, Alt, Downholland Brook, Spittle Brook, and Glaze. While some surveys were undertaken as part of the original groundwater model development in the early 2000s, this will be fully reviewed as part of the Groundwater Model Scoping Study in Autumn 2022 so that any gaps in knowledge can be filled. Surveys will begin in early 2023 to feed into the groundwater model updates.

## Fish Population Surveys

- 6.4.34 Fish surveys are required to determine the species present within affected river catchments, from which the relevant sensitivities to habitat change can be understood. This will enable targeted assessments of potential impacts on relevant habitat features. On this basis, eDNA surveys are proposed because they provide greater coverage than electro-fishing, and will provide an overview of all species present, including any migratory species which may not be present in the reach at the time of survey. eDNA surveys are also beneficial for large rivers that cannot be effectively comprehensively surveyed by electro-fishing.
- 6.4.35 eDNA surveys would be undertaken in late summer 2023 to time with migratory species. If required, this would be followed up with further targeted surveys in 2024. For the surface water sub-options, the surveys would be undertaken in the same reaches as the MoRPH surveys (within a reach 100 m upstream and 500 m downstream of each abstraction point see previous section including **Table C.4**). For the groundwater sub-options the location of surveys will be determined following the initial results of the groundwater modelling and hydrogeological conceptualisation.
- 6.4.36 Targeted juvenile fish surveys would also be carried out in early summer 2023 to assess downstream egg/larval drift, and to assess the value of marginal habitat in the vicinity of proposed abstraction sites. Juvenile seine netting within marginal habitats will be undertaken in late summer 2023 to determine the value of the habitats. The locations for these surveys will be determined by the geomorphology and habitat surveys.
- 6.4.37 It is acknowledged that the Environment Agency have raised concerns over the use of eDNA surveys. All fish survey locations, frequencies and methods will be agreed with the NAU before sampling takes place.



## Fish Barrier Surveys

- 6.4.38 Surveys of potential barriers to fish passage (e.g. weirs) downstream of the surface water abstraction locations and in reaches that may be affected by reductions in baseflow due to groundwater abstractions will be undertaken. This will comprise a rapid fish passage assessment, using the SNIFFER (2010) and ZSL (2028) methodology. Where fish pass structures are present additional information will be collected on fish pass design to ensure any reductions in river flows do not affect the efficacy of these facilities and to ensure compliance with the Salmon and Freshwater Fisheries Act 1975 (as amended).
- 6.4.39 48 potential barriers have been identified through a review of Google Earth imagery as listed in **Table C.7**, all of which will be included in the fish barrier surveys. These will take place at times of low flow in summer 2023.
- 6.4.40 Depending on the outcome of these assessments, hydraulic modelling of some barriers may be required, to determine the impact any reduction in flow may have on passability of the barrier. For more detail on hydraulic modelling see the River Flow Modelling section above.

## Assessment of Impacts on Migratory Species

- 6.4.41 Further desk study and literature review will be undertaken in early 2023 to consider potential impacts of the sub-options on salmonid migration and other migratory species (e.g. smelt) will be undertaken, particularly in relation to the Ribble Estuary. Depending on the results of the desk study, further assessment of temperature impacts may be required, for sensitive reaches in rivers with migratory salmonids.

## Macroinvertebrate Surveys

- 6.4.42 Surveys will be undertaken to ensure a representative, current macroinvertebrate baseline dataset is available to inform the assessment of the sub-options. This will begin in autumn 2022 with surveys at approximately 35 locations (see **Table C.8**) downstream of surface water abstraction locations, and on reaches likely to be impacted by groundwater abstractions. These sites are all existing Environment Agency sampling locations.
- 6.4.43 Two years of seasonal (autumn, spring and summer) surveys are planned from autumn 2022 to summer 2024. Additional sampling locations may be added (or removed) in 2023 based on the findings of other ongoing assessments (e.g., habitat surveys) and regulator feedback. For example, an additional sample location will be added on the River Tame, closer to the proposed abstraction location (for sub-option WR144) than the existing Environment Agency sampling sites, and an additional location will be added on the River Irwell on the long reach between the two Environment Agency sampling sites.
- 6.4.44 Surveys will be undertaken using the standard Environment Agency method<sup>54</sup> (3-minute active kick sampling, 1 minute hand search), although air lift sampling may be required at some downstream locations on the major rivers).

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<sup>54</sup> UKTAG (2008) UKTAG River assessment methods benthic invertebrate fauna: River Invertebrate Classification Tool (RICT)



## Macrophyte and Phyto-benthos Surveys

- 6.4.45 Given the limited existing sample locations and paucity of available macrophyte data for most sub-options, further monitoring will be undertaken. Surveys will be undertaken at existing locations sampled by the Environment Agency (**Table C.9**), plus additional sampling points where the Environment Agency sites are a significant distance from the abstraction location (notably on the Rivers Irwell and Tame). The locations for these surveys (and possible identification of additional sites) will be informed by the geomorphology and habitat surveys. The objective is, wherever possible, to have a minimum of two sample sites downstream of each abstraction location (except where the abstraction is close to the bottom of the catchment, e.g. on the Ribble and Bollin), ensuring the locations are representative of the river in the vicinity of the abstraction locations.
- 6.4.46 The standard survey approach adopted will be the LEAFPACs survey (WFD UKTAG, 2014), as used by the Environment Agency for macrophyte surveys to inform Water Framework Directive classification. The LEAFPACs methods requires the calculation of several indices, and in order to obtain the data with which to calculate the observed values for each of the indices, a 100 m stretch of the river will be sampled at the identified sample point. A single round of surveys is planned for summer 2023, with follow up surveys in summer 2024 if required.
- 6.4.47 Phyto-benthos data may be of benefit, alongside macrophyte data, to support characterisation of river reaches and their sensitivity to a range of pressures. This will be subject to further discussion with the Environment Agency. It is currently assumed that phyto-benthos sampling would be of benefit in WFD water bodies that are classified for the phyto-benthos sub-element, at existing Environment Agency sample locations (see **Table C.10**. Spring and autumn samples will be collected in 2023, using the recommended UKTAG<sup>55</sup> methodology.

## Assessment of Water Dependent Designated Sites & Other Ecological Receptors

- 6.4.48 The appropriate assessments presented in the informal HRA for Gate 2 indicate a low risk that any of the sub-options will adversely affect the integrity of any European sites, alone or in combination, but there is uncertainty over this conclusion, and further evidence and assessment is required during Gate 3 to rule out all reasonable scientific doubt.
- 6.4.49 The surveys and assessments described in this Forward Plan will all contribute to the evidence base for the formal HRAs required to support permitting applications. Where these activities cannot rule out a pathway for effects, the scope of any further investigations (such as discussions with site wardens, reviewing water level management plans, reviewing existing ecological data, or site-specific surveys or modelling) will be discussed and agreed with Natural England and the Environment Agency before implementation in Gate 3.
- 6.4.50 Further consideration of non-European designated sites will be required in Gate 3. These include the SSSIs listed in rows 6 and 7 in **Table 6.1**) and non-statutory designated sites. These will be initially considered through the other activities listed in this Forward Plan

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<sup>55</sup> UKTAG (2014) UKTAG River assessment method Macrophytes and Phytobenthos



(e.g. groundwater modelling, hydrogeological conceptualisation, river flow modelling, desk based reviews) and where impact pathways cannot be discounted, followed by site specific survey and assessment, the scope of which will be determined and agreed later in Gate 3 once the initial results of other assessments are available.

- 6.4.51 The Gate 2 ecology assessments have focussed on aquatic groups, for which data are readily available and are mostly likely to be directly affected by sub-options (i.e., aquatic invertebrates, aquatic macrophytes, fish, statutory designated sites). Early in Gate 3 a desk study review will be carried out to cover a wider range of ecological receptors beyond those considered at Gate 2, including:
- Non-statutory designated biodiversity sites;
  - Legally protected species, Species of Principal Importance for the Conservation of Biodiversity in England, and/or other notable species; and
  - Habitats of Principal Importance for the Conservation of Biodiversity, or other notable habitats.
- 6.4.52 This will consider potential hydrological connectivity to the sub-options, sensitivity of the species, habitats or sites, and linkages to European and other statutory designated sites. The outcomes of the desk study will inform additional survey and assessment requirements to be undertaken later in Gate 3.

### Gate 3 Regulatory Assessments

- 6.4.53 Assessments such as HRA, WFD, INNS, and NC and BNG assessments will not be prepared specifically for Gate 3 or for the NWT SRO as a whole as they have been for Gates 1 and 2. Rather these assessments will be prepared where required to support individual sub-option abstraction licence and planning permission applications. Individual assessments will be prepared for each sub-option in the confirmed Full Solution, but each assessment will consider the other sub-options as part of the in-combination assessments. The assessments will build on the informal assessments undertaken during Gate 2 (and presented in the WFD Compliance Assessment Technical Appendix (NWT-G02-006-003), Informal HRA Technical Appendix (NWT-G02-006-004), INNS Assessment (NWT-G02-006-005), and BNG and NC Assessment (NWT-G02-006-006)).
- 6.4.54 Several of the NWT groundwater sub-options do not require a new or varied abstraction licence, as they will continue to operate under their current licence conditions. For these sub-options formal assessments of the impacts of operational abstraction will not be required for permitting purposes (e.g. there is no statutory requirement for a HRA). However, because these sub-options will involve increasing abstraction rates compared to recent abstraction, informal assessments will be undertaken during Gate 3 to ensure that for example there will be no significant negative effects on the conservation objectives or integrity of European sites, and no deterioration of WFD status or introduction impediments to improvements in WFD status.
- 6.4.55 In Gate 3, what is currently the NWT Environment Workstream will focus on the potential operational impacts of the supply sub-options. It will undertake the assessments required to support abstraction licence applications and to demonstrate that there will be no environmental deterioration because of increased abstraction from already licenced



sources. The assessment of potential environmental impacts arising from construction of the sub-options (e.g., pipelines, new WTW etc), and the assessments required to support planning applications (e.g., EIA) will be considered as part of the NWT Planning Workstream. UU will ensure close working between the two workstreams to ensure a holistic approach to environmental assessment and coordinated engagement with the NAU.

- 6.4.56 Throughout Gate 3, and specifically at the Gate 3 checkpoint (in December 2023) updates on progress with the formal and informal assessments, and the investigations that inform them, will be provided to the NAU and RAPID, focussing on the key data gaps and uncertainties outlined in **Table 6.1**, and progress with addressing these.



# Figures



# Appendix A

## Thresholds of Significance



IEA Topic	Effect	Description
1. Population (socio-economics)	Major/Significant Positive	The option would provide an additional design capacity of $\geq 25$ MI/d. The option would result in a significant increase in construction jobs (capital spend of $\geq \pounds 25$ m). The option would provide new, and/or significantly enhances existing, recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	Moderate Positive	The option would provide an additional design capacity of 5MI/d to $< 25$ MI/d. The option would result in a moderate increase in construction jobs (capital spend $\pounds 5$ m to $< \pounds 25$ m). The option would have a moderate positive effect on existing, recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	Minor Positive	The option would provide an additional design capacity of 1MI/d to $< 5$ MI/d. The option would result in a minor increase in construction jobs (capital spend $\pounds 1$ m to $< \pounds 5$ m). The option would have a minor positive effect on existing, recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	Negligible	The option would result in no/negligible effects. The option would provide an additional design capacity of $< 1$ MI/d.
	Minor Negative	It is not expected that any options will have a negative effect on employment opportunities, the economy or design capacity. The option would result in a minor disruption on built assets and infrastructure, including transport. The option would reduce the availability and quality of existing recreational facilities and/or tourism within the operational area.
	Moderate Negative	It is not expected that any options will have a negative effect on employment opportunities, the economy or design capacity. The option would result in a moderate disruption on built assets and infrastructure, including transport. The option would result in the permanent removal of existing recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	Major/Significant Negative	It is not expected that any options will have a negative effect on employment opportunities, the economy or design capacity. The option would result in a major disruption on built assets and infrastructure, including transport. The option would result in the removal of existing recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	Uncertain	From the level of information available the effect that the option would have on this topic is uncertain
2. Health	Major/Significant Positive	The option would lead to a major increase in design capacity ( $\geq 25$ MI/d) of drinking water, would have a sustained positive effect on the health of local communities and would ensure that surface water and bathing water quality is maintained within statutory limits.
	Moderate Positive	The option would lead to a moderate increase in design capacity (5MI/d to $< 25$ MI/d) of drinking water, would have a positive effect on the health of local communities and would ensure that surface water and bathing water quality is maintained within statutory limits.
	Minor Positive	The option would lead to a minor increase in design capacity (1MI/d to $< 5$ MI/d) of drinking water, would have a temporary positive effect on the health of local communities and would ensure that surface water and bathing water quality is maintained within statutory limits.





	Neutral	The option would not result in any effects on human health and existing recreational facilities and/or tourism.
	Negligible	The option would result in no/negligible effects.
	Moderate Negative	The option would have a moderate long-term negative effect on human health (e.g., noise or air quality).
	Major/Significant Negative	The option would have a significant long-term effect on human health (e.g., noise or air quality).
	Uncertain	From the level of information available the effect that the option would have on this topic is uncertain
3. Biodiversity, flora and fauna	Major/Significant Positive	<p>The option would result in a major enhancement on the quality of designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat quality and availability.</p> <p>The option would result in a major increase in the population of, or habitats for, a priority species.</p> <p>Effects could be caused by beneficial changes in water flows/water quality, or large amounts of creation or enhancement of habitat, promoting a major increase in ecosystem structure and function.</p> <p>The option would lead to a major increase in natural capital/ecosystem resilience and enhancement (as measured by the NCA).</p> <p>The option would lead to a biodiversity net gain of greater than 10% (as measured by the BNG assessment).</p> <p>The option would result in a major reduction or management of INNS.</p>
	Moderate Positive	<p>The option would result in a moderate enhancement on the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat creation and enhancement measures.</p> <p>The option would result in a moderate increase in the population of, or habitats for, a priority species.</p> <p>Effects could be caused by beneficial changes in water flows/water quality, or moderate amounts of creation or enhancement of habitat, promoting a moderate increase in ecosystem structure and function.</p> <p>The option would lead to a moderate increase in natural capital/ecosystem resilience and enhancement (as measured by the NCA).</p> <p>The option would lead to a biodiversity net gain of 10% (as measured by the BNG assessment).</p> <p>The option would result in a moderate reduction or management of INNS.</p>
	Minor Positive	<p>The option would result in a minor enhancement of the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat creation and enhancement measures.</p> <p>The option would result in a minor increase in the population of, or habitats for, a priority species.</p> <p>Effects could be caused by beneficial changes in water flows/water quality, or small amounts of creation or enhancement of habitat, promoting a minor increase in ecosystem structure and function.</p> <p>The option would lead to a minor increase in natural capital/ecosystem resilience and enhancement (as measured by the NCA).</p>





		The option would lead to a biodiversity net gain of less than 10% (as measured by the BNG assessment). The option would result in a minor reduction or management of INNS.
	Negligible	The option would result in no/negligible effects.
	Minor Negative	The option would result in a minor negative effect on the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat loss or degradation. The option would result in a minor decrease in the population of, or habitats for, a priority species. Effects could be caused by detrimental changes in flows/water quality, or small losses or degradation of habitat leading to a minor loss of ecosystem structure and function. The option would lead to a minor decrease in natural capital/ecosystem resilience (as measured by the NCA). The option would lead to a biodiversity net loss of less than 10% (as measured by the BNG assessment). The option would result in a minor increase or spread of INNS.
	Moderate Negative	The option would result in a moderate negative effect on the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat loss or degradation. The option would result in a moderate decrease in the population of, or habitats for, a priority species. Effects could be caused by detrimental changes in flows/water quality, or moderate loss or degradation of habitat leading to a moderate loss of ecosystem structure and function. The option would lead to a moderate decrease in natural capital/ecosystem resilience (as measured by the NCA). The option would lead to a biodiversity net loss of 10% (as measured by the BNG assessment). The options would result in a moderate increase or spread of INNS.
	Major/Significant Negative	The option would result in a major negative effect on the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat loss or degradation. The option would result in a major decrease in the population of, or habitats for, a priority species. Effects could be caused by detrimental changes in flows/water quality, or large losses or degradation of habitat leading to a major loss of ecosystem structure and function. The option would lead to a major decrease in natural capital/ecosystem resilience (as measured by the NCA). The option would lead to a biodiversity net loss of greater than 10% (as measured by the BNG assessment). The option would result in a major increase or spread of INNS.
	Uncertain	From the level of information available the effect that the option would have on this topic is uncertain
4. Land use, geology, geomorphology and soils	Major/Significant Positive	The option would result in a major enhancement on the quality of soils as a result of remediation. implementation of catchment approaches, or other measures.
	Moderate Positive	The option would result in a moderate enhancement on the quality of soils as a result of remediation, implementation of catchment approaches, or other measures.





	Minor Positive	The option would be located on a brownfield site and has no effect on soils or existing land use. The option results in the remediation of contaminated land.
	Negligible	The option would result in no/negligible effects.
	Minor Negative	The option would not be located on a brownfield site and/or results in a minor loss of best and most versatile agricultural land or is in conflict with existing land use. The option would result in land contamination. The option would result in a minor negative effect on a site designated for their geological interest
	Moderate Negative	The option would result in a moderate loss of best and most versatile agricultural land or is in substantial conflict with existing land use. The option would result in land contamination. The option would result in a moderate negative effect on a site designated for their geological interest The option would be partially overlying mineral resources leading to partial mineral sterilisation.
	Major/Significant Negative	The option would result in a major loss of best and most versatile agricultural land or is in substantial conflict with existing land use. The option would result in land contamination. The option would result in a major negative effect on a site designated for their geological interest The option would be directly overlying mineral resources leading to mineral sterilisation.
	Uncertain	From the level of information available the effect that the option would have on this topic is uncertain
5. Water	Major/Significant Positive	The option would result in major reduction in the demand for water. The option would result in addressing failure of WFD Good Ecological Status / Good Ecological Potential.
	Moderate Positive	The option achieves savings through demand management and does not require abstraction to achieve yield. The option would result in moderate reduction in demand for water. The option would contribute to addressing failure of WFD Good Ecological Status / Good Ecological Potential.
	Minor Positive	The option achieves savings through demand management and does not require abstraction to achieve yield. The option would result in minor reduction in the demand for water. The option would contribute to a minor improvement in surface/coastal water quality or in groundwater quality.
	Negligible	The option would result in no/negligible effects.
	Minor Negative	The option would result in minor short-term decreases in river flows, wetted width, depth, and velocity over small distances. The option would result in minor decreases in groundwater levels. The option would result in minor increases in demand for water.





		<p>The option would have a minor effect on river and/or coastal water quality and lead to short term or intermittent effects on receptors (e.g., designated habitats, protected species or recreational users of rivers and the coastline) that could not be avoided but could be mitigated.</p> <p>The option would result in minor decreases in groundwater quality.</p>
	Moderate Negative	<p>The option would result in medium-term, moderate decreases in river flows, wetted width, depth, and velocity over moderate distances.</p> <p>The option would result in moderate decreases in groundwater levels.</p> <p>The option would result in moderate increases in demand for water.</p> <p>The option would have a moderate effect on river and/or coastal water quality and lead to long term or continuous effects on receptors (e.g., designated habitats, protected species or recreational users of rivers and the coastline) that could not reasonably be mitigated.</p> <p>The option would result in the likely deterioration of WFD classification.</p> <p>The option would result in moderate decreases in groundwater quality.</p>
	Major/Significant Negative	<p>The option would result in major decreases in river flows over the long-term affecting significant stretches of river.</p> <p>The option would result in major decreases in groundwater levels.</p> <p>The option would result in major increases in demand for water.</p> <p>The option would have a major effect on river and/or coastal water quality and lead to long term or continuous effects on receptors (e.g., designated habitats, protected species or recreational users of rivers and the coastline) that could not reasonably be mitigated.</p> <p>The option results in the deterioration of WFD classification.</p> <p>The option would result in major decreases in groundwater quality.</p>
	Uncertain	From the level of information available the effect that the option would have on this topic is uncertain
6. Flood risk.	Major/Significant Positive	The option would result in a major improvement to flood risk.
	Moderate Positive	The option would result in a moderate improvement to flood risk.
	Minor Positive	The option would involve the construction of above-ground water supply infrastructure which help alleviate flooding in the catchment.
	Negligible	The option would result in no/negligible effects.
	Minor Negative	<p>The option would involve the construction of above-ground water supply infrastructure which would be wholly or partially located within Flood Zone 2.</p> <p>The option would have the potential to have a minor increase in the risks to flooding to people and property, now or in the future.</p>





	Moderate Negative	The option would involve the construction of above-ground water supply infrastructure which would be partially (but < 40% by area) located within Flood Zone 3 and/or site is at medium risk of surface water flooding. The option would have the potential to have a moderate increase in the risks to flooding to people and property, now or in the future.
	Major/Significant Negative	The option would involve the construction of above-ground water supply infrastructure which would be wholly or partially ( $\geq 40\%$ of the site) within flood zone 3a or 3b and/or site is at high risk of surface water flooding. The option would have the potential to have a major increase in the risks to flooding to people and property, now or in the future.
	Uncertain	From the level of information available the effect that the option would have on this topic is uncertain
7. Noise and vibration	Major/Significant Positive	The option would result in a major reduction in the disturbance and nuisance experienced by receptors from noise and vibration.
	Moderate Positive	The option would result in a moderate reduction in the disturbance and nuisance experienced by receptors from noise and vibration.
	Minor Positive	The option would result in a minor reduction in the disturbance and nuisance experienced by receptors from noise and vibration.
	Negligible	The option would result in no/negligible effects.
	Minor Negative	The option would result in a minor increase in the disturbance and nuisance experienced by receptors from noise and vibration.
	Moderate Negative	The option would result in a moderate increase in the disturbance and nuisance experienced by receptors from noise and vibration.
	Major/Significant Negative	The option would result in a major increase in the disturbance and nuisance experienced by receptors from noise and vibration.
	Uncertain	From the level of information available the effect that the option would have on this topic is uncertain
8. Air quality.	Major/Significant Positive	The option would result in a major enhancement of the air quality within one or more AQMAs





	Moderate Positive	The option would result in a moderate enhancement of the air quality within one or more AQMAs
	Minor Positive	The option would result in an enhancement of the air quality
	Negligible	The option would result in no/negligible effects.
	Minor Negative	The option would result in a decrease of the air quality
	Moderate Negative	The option would result in a decrease of the air quality within one or more AQMAs
	Major/Significant Negative	The option would result in a major decrease in the air quality within one or more AQMAs
	Uncertain	From the level of information available the effect that the option would have on this topic is uncertain
9. Climate change (including greenhouse gas emissions and resilience).	Major/Significant Positive	The option would reduce operational carbon emissions by more than 1,000 tonnes CO <sub>2</sub> e/year e.g., it would provide new infrastructure/assets that maximise the use of renewable energy sources. The option would result in a major increase in carbon sequestration. The option would have a major positive effect on increasing the resilience/decreasing the vulnerability to climate change effects.
	Moderate Positive	The option will reduce operational carbon emissions by between 100 and <1,000 tonnes CO <sub>2</sub> e/year. The option will result in a moderate increase in carbon sequestration. The option would have a moderate positive effect on increasing the resilience/decreasing the vulnerability to climate change effects.
	Minor Positive	The option will reduce operational carbon emissions by less than 100 tonnes CO <sub>2</sub> e/year. The option would have a minor positive effect on increasing the resilience/decreasing the vulnerability to climate change effects.
	Negligible	The option would result in no/negligible effects.





	Minor Negative	The construction of the option would use of materials with a minor amount of embodied carbon (100 to <1,000 tonnes CO2e). The option would result in a minor or temporary increase in operational carbon emissions (100 to <500 tonnes CO2e). The option would have a minor negative effect on resilience/decreasing vulnerability to climate change effects.
	Moderate Negative	The construction of the option would use of materials with a moderate amount of embodied carbon (1,000 to 7,500 tonnes CO2e). The option would result in a moderate increase in operational carbon emissions (500-2,000 tonnes CO2e). The option will result in a moderate release of previously sequestered carbon. The option would have a moderate negative effect on resilience/decreasing vulnerability to climate change effects.
	Major/Significant Negative	The construction of the option would use of materials with a major amount of embodied carbon (>7,500 tonnes CO2e). The option would result in major or long term increases in operational carbon emissions (>2,000 tonnes CO2e). The option would result in a major release of previously sequestered carbon. The option would have a major negative effect on resilience/decreasing vulnerability to climate change effects.
	Uncertain	From the level of information available the effect that the option would have on this topic is uncertain
10. Traffic and transport	Major/Significant Positive	The option would result in a major reduction in the number of movements arising from construction or operational traffic.
	Moderate Positive	The option would result in a moderate reduction in the number of movements arising from construction or operational traffic.
	Minor Positive	The option would result in a minor reduction in the number of movements arising from construction or operational traffic.
	Negligible	The option would result in no/negligible effects.
	Minor Negative	The option would result in a minor increase in the number of movements arising from construction or operational traffic e.g. vehicle movements of 1000 to < 7,750, per annum assuming that this is an equivalent to 5 to <35 per day (so an average max of 5 per hour)
	Moderate Negative	The option would result in a moderate increase in the number of movements arising from construction or operational traffic e.g. vehicle movements of 7,750 to <15,500 per annum assuming that this is an equivalent to 35 to <70 per day (so an average max of 10 per hour)
	Major/Significant Negative	The option would result in a major increase in the number of movements arising from construction or operational traffic e.g. vehicle movements > 15,500 per annum, assuming that this is an equivalent of ≥ 70 per day.





	Uncertain	From the level of information available the effect that the option would have on this topic is uncertain
11. Resource and waste management.	Major/Significant Positive	The option would make extensive reuse of existing built assets and infrastructure. The option will re-use or recycle substantial quantities of waste materials and any new infrastructure will incorporate substantial sustainable design measures and materials.
	Moderate Positive	The option would make reuse of existing built assets and infrastructure. The option would re-use or recycle moderate quantities of waste materials and any new infrastructure would incorporate some sustainable design measures and materials.
	Minor Positive	The option would re-use or recycle limited quantities of waste materials and any new infrastructure would incorporate limited sustainable design measures and materials.
	Negligible	The option would result in no/negligible effects and quantities of concrete < 100 tonnes.
	Minor Negative	The option would require new infrastructure requiring quantities of concrete of between 100 to <1,000 tonnes. The option would have limited opportunities for the re-use or recycling of waste materials. There would be limited opportunities for sustainable design or the use of sustainable materials.
	Moderate Negative	The option would require new infrastructure requiring quantities of concrete 1,000 to <15,000 tonnes. The option would have limited opportunities for the re-use or recycling of waste materials.
	Major/Significant Negative	The option would require significant new infrastructure that cannot be provided through the re-use or recycling of waste materials. The new infrastructure would require significant quantities of concrete $\geq$ 15,000 tonnes There are no opportunities for sustainable design or the use of sustainable materials.
	Uncertain	From the level of information available the effect that the option would have on this topic is uncertain
12. Historic environment.	Major/Significant Positive	The option will result in enhancements to designated heritage assets and/or their setting, fully realising the significance and value of the asset, such as: Securing repairs or improvements to heritage assets, especially those identified in the Historic England Buildings/Monuments at Risk Register; Improving interpretation and public access to important heritage assets.
	Moderate Positive	The option will result in enhancements to designated heritage assets and/or their setting. Improving interpretation and public access to important heritage assets.
	Minor Positive	The option will result in enhancements to non-designated heritage assets and/or their setting.





	Negligible	The option would result in no/negligible effects.
	Minor Negative	The option will result in the loss of significance of undesignated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected. There will be limited damage to known, undesignated archaeology important sites with a consequent loss of significance only partly mitigated by archaeological investigation
	Moderate Negative	The option will result in the loss of significance of undesignated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected. The option will diminish of significance of designated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected.
	Major/Significant Negative	The option would diminish the significance of designated heritage assets and/or their setting such as: <ul style="list-style-type: none"> <li>Demolition or further deterioration in the condition of designated heritage assets especially those identified in the Historic England Buildings/Monuments at Risk Register;</li> <li>Loss of public access to important heritage assets and lack of appropriate interpretation.</li> </ul> There would be major damage to known, designated archaeological sites/remains or geologically important sites with a consequent loss of significance only partly mitigated by archaeological investigation.
	Uncertain	From the level of information available the effect that the option would have on this topic is uncertain
13. Landscape and visual.	Major/Significant Positive	The option results in new, above ground infrastructure that significantly enhances the local landscape, townscape or seascape.
	Moderate Positive	The option results in new, above ground infrastructure that has a moderate positive effect on the local landscape, townscape or seascape
	Minor Positive	The option results in new, above ground infrastructure that has a minor positive effect on the local landscape, townscape or seascape.
	Negligible	The option would result in no/negligible effects.
	Minor Negative	The option results in new, above ground infrastructure that has a minor negative effect on the local landscape, townscape or seascape.
	Moderate Negative	The option would have a moderate negative effect on a designated landscape or feature (i.e. significant visually intrusive infrastructure) whose effects could not be reasonably mitigated. The option results in new, above ground infrastructure that has a moderate negative effect on the local landscape, townscape or seascape.





	Major/Significant Negative	The option would have a negative effect on a designated landscape or feature (i.e. significant visually intrusive infrastructure) whose effects could not be reasonably mitigated. The option results in new, above ground infrastructure that has a major negative effect on the local landscape, townscape or seascape.
	Uncertain	From the level of information available the effect that the option would have on this topic is uncertain





# Appendix B

## Sub-Option Environmental Appraisal Tables



## Option STTA4: Vyrnwy Aqueduct Enabling Works

Topic	Overall Appraisal of Effects	Appraisal Comments
Population (socio-economics)	<b>Construction Effect</b>	[✕]
	Minor negative effect	
	Major positive effect	
Health	<b>Operational Effect</b>	
	Major positive effect	
	<b>Construction Effect</b>	[✕]
Biodiversity, flora and fauna	Minor negative effect	
	<b>Operational Effect</b>	
	Major positive effect	



Topic	Overall Appraisal of Effects	Appraisal Comments
	Negligible effect	
<b>Land use, geology, geomorphology and soils</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Negligible effect	[<img alt="document icon" data-bbox="265 275 285 295"]
<b>Water (hydrology, groundwater, water quality)</b>	<b>Construction Effect</b> Negligible effect  <b>Operational Effect</b> Negligible effect	[<img alt="document icon" data-bbox="265 455 285 475"]
<b>Flood risk</b>	<b>Construction Effect</b> Negligible effect  <b>Operational Effect</b> Negligible effect	[<img alt="document icon" data-bbox="265 615 285 635"]
<b>Noise and vibration</b>	<b>Construction Effect</b> Minor negative effect	[<img alt="document icon" data-bbox="265 775 285 795"]



Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Negligible effect	
<b>Air quality</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[<img alt="document icon" data-bbox="265 315 282 332"]
<b>Climate change (including greenhouse gas emissions and resilience)</b>	<b>Construction Effect</b> Major negative effect  <b>Operational Effect</b> Minor negative effect  Major positive effect	[<img alt="document icon" data-bbox="265 495 282 512"]
<b>Traffic and transport</b>	<b>Construction Effect</b> Minor negative effect	[<img alt="document icon" data-bbox="265 755 282 772"]



Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Negligible effect	
<b>Resource use and waste management</b>	<b>Construction Effect</b> Major negative effect  Minor positive effect  <b>Operational Effect</b> Minor negative effect	[✕]
<b>Historic environment</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Landscape and visual</b>	<b>Construction Effect</b> Minor negative effect	[✕]



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Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Minor negative effect	



### Option STT041b: [✕]

Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Population (socio-economics)</b>	<b>Construction Effect</b> Moderate negative effect  Major positive effect  <b>Operational Effect</b> Moderate negative effect  Major positive effect	[✕]
<b>Health</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Major positive effect	[✕]
<b>Biodiversity, flora and fauna</b>	<b>Construction Effect</b> Moderate negative effect	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Moderate negative effect	
<b>Land use, geology, geomorphology and soils</b>	<b>Construction Effect</b> Minor negative effect	[✕]
	<b>Operational Effect</b> Negligible effect	
<b>Water (hydrology, groundwater, water quality)</b>	<b>Construction Effect</b> Negligible effect	[✕]
	<b>Operational Effect</b> Moderate negative effect	
<b>Flood risk</b>	<b>Construction Effect</b> Moderate negative effect	[✕]
	<b>Operational Effect</b>	



Topic	Overall Appraisal of Effects	Appraisal Comments
	Minor negative effect	
<b>Noise and vibration</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Negligible effect	[<img alt="document icon" data-bbox="265 298 282 312"]
<b>Air quality</b>	<b>Construction Effect</b> Major negative effect  <b>Operational Effect</b> Moderate negative effect	[<img alt="document icon" data-bbox="265 478 282 492"]
<b>Climate change (including greenhouse gas emissions and resilience)</b>	<b>Construction Effect</b> Major negative effect  <b>Operational Effect</b> Major negative effect	[<img alt="document icon" data-bbox="265 678 282 692"]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Moderate positive effect	
<b>Traffic and transport</b>	<b>Construction Effect</b> Major negative effect  <b>Operational Effect</b> Moderate negative effect	[<img alt="document icon" data-bbox="265 298 282 312"]
<b>Resource use and waste management</b>	<b>Construction Effect</b> Major negative effect  <b>Operational Effect</b> Major negative effect	[<img alt="document icon" data-bbox="265 498 282 512"]
<b>Historic environment</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Minor negative effect	[<img alt="document icon" data-bbox="265 698 282 712"]



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Topic	Overall Appraisal of Effects	Appraisal Comments
Landscape and visual	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Minor negative effect	[X]



Option WR015: [X]

Topic	Overall Appraisal of Effects	Appraisal Comments
Population (socio-economics)	<b>Construction Effect</b> Moderate negative effect  Major positive effect  <b>Operational Effect</b> Major positive effect	[X]
Health	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Major positive effect	[X]
Biodiversity, flora and fauna	<b>Construction Effect</b>	[X]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Moderate negative effect	
	<b>Operational Effect</b> Moderate negative effect	
<b>Land use, geology, geomorphology and soils</b>	<b>Construction Effect</b> Minor negative effect	[X]
	<b>Operational Effect</b> Negligible effect	
<b>Water (hydrology, groundwater, water quality)</b>	<b>Construction Effect</b> Negligible effect	[X]
	<b>Operational Effect</b> Moderate negative effect	



Topic	Overall Appraisal of Effects	Appraisal Comments
Flood risk	<b>Construction Effect</b> Moderate negative effect	[X]
	<b>Operational Effect</b> Minor negative effect	
Noise and vibration	<b>Construction Effect</b> Moderate negative effect	[X]
	<b>Operational Effect</b> Negligible effect	
Air quality	<b>Construction Effect</b> Major negative effect	[X]
	<b>Operational Effect</b>	



Topic	Overall Appraisal of Effects	Appraisal Comments
	Negligible effect	
<b>Climate change (including greenhouse gas emissions and resilience)</b>	<b>Construction Effect</b> Major negative effect <b>Operational Effect</b> Major negative effect  Moderate positive effect	[X]
<b>Traffic and transport</b>	<b>Construction Effect</b> Major negative effect <b>Operational Effect</b> Negligible effect	[X]
<b>Resource use and waste management</b>	<b>Construction Effect</b>	[X]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Major negative effect  <b>Operational Effect</b> Moderate negative effect	
<b>Historic environment</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Moderate negative effect	[X]
<b>Landscape and visual</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b>	[X]



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Topic	Overall Appraisal of Effects	Appraisal Comments
	Moderate negative effect	



**Option WR049d:** [🔗]

Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Population (socio-economics)</b>	<b>Construction Effect</b>	[🔗]
	Moderate negative effect	
	Major positive effect	
	<b>Operational Effect</b>	
	Major positive effect	
	Minor negative effect	
<b>Health</b>	<b>Construction Effect</b>	[🔗]
	Minor negative effect	
	<b>Operational Effect</b>	
	Major positive effect	
	Minor negative effect	



Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Biodiversity, flora and fauna</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Moderate negative effect	[✕]
<b>Land use, geology, geomorphology and soils</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Water (hydrology, groundwater, water quality)</b>	<b>Construction Effect</b> Negligible effect  <b>Operational Effect</b> Moderate negative effect	[✕]
<b>Flood risk</b>	<b>Construction Effect</b> Moderate negative effect	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Minor negative effect	
<b>Noise and vibration</b>	<b>Construction Effect</b> Minor negative effect	[✕]
	<b>Operational Effect</b> Negligible effect	
<b>Air quality</b>	<b>Construction Effect</b> Major negative effect	[✕]
	<b>Operational Effect</b> Moderate negative effect	
<b>Climate change (including greenhouse gas emissions and resilience)</b>	<b>Construction Effect</b> Major negative effect	[✕]
	<b>Operational Effect</b>	



Topic	Overall Appraisal of Effects	Appraisal Comments
	Major negative effect Moderate positive effect	
<b>Traffic and transport</b>	<b>Construction Effect</b> Major negative effect <b>Operational Effect</b> Moderate negative effect	[✕]
<b>Resource use and waste management</b>	<b>Construction Effect</b> Major negative effect <b>Operational Effect</b> Moderate negative effect	[✕]
<b>Historic environment</b>	<b>Construction Effect</b> Minor negative effect	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Minor negative effect	
<b>Landscape and visual</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Minor negative effect	[✕]



Option WR076: [X]

Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Population (socio-economics)</b>	<b>Construction Effect</b> Moderate negative effect  Major positive effect  <b>Operational Effect</b> Major positive effect	[X]
<b>Health</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Major positive effect	[X]
<b>Biodiversity, flora and fauna</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b>	[X]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Moderate negative effect	
<b>Land use, geology, geomorphology and soils</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Neutral effect	[<img alt="document icon" data-bbox="265 298 282 312"]
<b>Water (hydrology, groundwater, water quality)</b>	<b>Construction Effect</b> Neutral effect  <b>Operational Effect</b> Moderate negative effect	[<img alt="document icon" data-bbox="265 478 282 492"]
<b>Flood risk</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Moderate negative effect	[<img alt="document icon" data-bbox="265 658 282 672"]



Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Noise and vibration</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Air quality</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Climate change (including greenhouse gas emissions and resilience)</b>	<b>Construction Effect</b> Major negative effect  <b>Operational Effect</b> Major negative effect  Moderate positive effect	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Traffic and transport</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Resource use and waste management</b>	<b>Construction Effect</b> Major negative effect  <b>Operational Effect</b> Moderate negative effect	[✕]
<b>Historic environment</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Minor negative effect	[✕]
<b>Landscape and visual</b>	<b>Construction Effect</b>	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Minor negative effect  <b>Operational Effect</b> Minor negative effect	



Option WR102b: [redacted]

Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Population (socio-economics)</b>	<b>Construction Effect</b> Minor negative effect  Major positive effect  <b>Operational Effect</b> Major positive effect	[redacted]
<b>Health</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Major positive effect	[redacted]
<b>Biodiversity, flora and fauna</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b>	[redacted]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Moderate negative effect	
<b>Land use, geology, geomorphology and soils</b>	<b>Construction Effect</b> Minor negative effect  Minor positive effect  <b>Operational Effect</b> Negligible effect	[<img alt="document icon" data-bbox="265 298 282 312"]
<b>Water (hydrology, groundwater, water quality)</b>	<b>Construction Effect</b> Negligible effect  <b>Operational Effect</b> Moderate negative effect	[<img alt="document icon" data-bbox="265 538 282 552"]
<b>Flood risk</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b>	[<img alt="document icon" data-bbox="265 718 282 732"]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Minor negative effect	
<b>Noise and vibration</b>	<b>Construction Effect</b> Moderate negative effect <b>Operational Effect</b> Negligible effect	[<img alt="document icon" data-bbox="265 295 285 315"]
<b>Air quality</b>	<b>Construction Effect</b> Minor negative effect <b>Operational Effect</b> Negligible effect	[<img alt="document icon" data-bbox="265 475 285 495"]
<b>Climate change (including greenhouse gas emissions and resilience)</b>	<b>Construction Effect</b> Major negative effect <b>Operational Effect</b> Major negative effect	[<img alt="document icon" data-bbox="265 655 285 675"]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Moderate positive effect	
<b>Traffic and transport</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[⌂]
<b>Resource use and waste management</b>	<b>Construction Effect</b> Major negative effect  Minor positive effect  <b>Operational Effect</b> Moderate negative effect	[⌂]
<b>Historic environment</b>	<b>Construction Effect</b> Negligible effect  <b>Operational Effect</b> Negligible effect	[⌂]



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Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Landscape and visual</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Minor negative effect	[X]



Option WR105a: [REDACTED]

Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Population (socio-economics)</b>	<b>Construction Effect</b> Minor negative effect  Moderate positive effect  <b>Operational Effect</b> Moderate positive effect	[REDACTED]
<b>Health</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Moderate positive effect	[REDACTED]
<b>Biodiversity, flora and fauna</b>	<b>Construction Effect</b> Minor negative effect	[REDACTED]



Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Moderate negative effect	
<b>Land use, geology, geomorphology and soils</b>	<b>Construction Effect</b> Moderate negative effect	[X]
	<b>Operational Effect</b> Negligible effect	
<b>Water (hydrology, groundwater, water quality)</b>	<b>Construction Effect</b> Negligible effect	[X]
	<b>Operational Effect</b> Moderate negative effect	
<b>Flood risk</b>	<b>Construction Effect</b> Moderate negative effect	[X]
	<b>Operational Effect</b>	



Topic	Overall Appraisal of Effects	Appraisal Comments
	Moderate negative effect	
<b>Noise and vibration</b>	<b>Construction Effect</b> Minor negative effect <b>Operational Effect</b> Negligible effect	[🔍]
<b>Air quality</b>	<b>Construction Effect</b> Minor negative effect <b>Operational Effect</b> Negligible effect	[🔍]
<b>Climate change (including greenhouse gas emissions and resilience)</b>	<b>Construction Effect</b> Moderate negative effect <b>Operational Effect</b> Moderate negative effect	[🔍]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Minor positive effect	
<b>Traffic and transport</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[<img alt="document icon" data-bbox="265 298 282 312"]
<b>Resource use and waste management</b>	<b>Construction Effect</b> Major negative effect  <b>Operational Effect</b> Major negative effect	[<img alt="document icon" data-bbox="265 478 282 492"]
<b>Historic environment</b>	<b>Construction Effect</b> Minor effect  <b>Operational Effect</b> Minor negative effect	[<img alt="document icon" data-bbox="265 678 282 692"]



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Topic	Overall Appraisal of Effects	Appraisal Comments
Landscape and visual	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Minor negative effect	[X]



**Option WR106b:** [✕]

<b>Topic</b>	<b>Overall Appraisal of Effects</b>	<b>Appraisal Comments</b>
<b>Population (socio-economics)</b>	<b>Construction Effect</b> Minor negative effect  Major positive effect  <b>Operational Effect</b> Moderate positive effect	[✕]
<b>Health</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Moderate positive effect	[✕]
<b>Biodiversity, flora and fauna</b>	<b>Construction Effect</b> Moderate negative effect	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Minor negative effect	
<b>Land use, geology, geomorphology and soils</b>	<b>Construction Effect</b> Minor negative effect  Minor positive effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Water (hydrology, groundwater, water quality)</b>	<b>Construction Effect</b> Negligible effect  <b>Operational Effect</b> Moderate negative effect	[✕]
<b>Flood risk</b>	<b>Construction Effect</b> Negligible effect  <b>Operational Effect</b>	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
		Negligible effect
Noise and vibration	<b>Construction Effect</b>	[<img alt="document icon" data-bbox="265 275 285 295"]
	Minor negative effect	
	<b>Operational Effect</b>	
	Negligible effect	
Air quality	<b>Construction Effect</b>	[<img alt="document icon" data-bbox="265 455 285 475"]
	Minor negative effect	
	<b>Operational Effect</b>	
	Negligible effect	
Climate change (including greenhouse gas emissions and resilience)	<b>Construction Effect</b>	[<img alt="document icon" data-bbox="265 635 285 655"]
	Major negative effect	
	<b>Operational Effect</b>	
	Moderate negative effect	
	Moderate positive effect	



Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Traffic and transport</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Resource use and waste management</b>	<b>Construction Effect</b> Major negative effect  <b>Operational Effect</b> Moderate negative effect	[✕]
<b>Historic environment</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Landscape and visual</b>	<b>Construction Effect</b> Minor negative effect	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Minor negative effect	

**Option WR107a2:** [✕]

Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Population (socio-economics)</b>	<b>Construction Effect</b> Minor negative effect  Moderate positive effect  <b>Operational Effect</b> Moderate positive effect	[✕]
<b>Health</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b>	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Moderate positive effect	
<b>Biodiversity, flora and fauna</b>	<b>Construction Effect</b> Minor negative effect <b>Operational Effect</b> Moderate negative effect	[<img alt="document icon" data-bbox="265 298 282 312"]
<b>Land use, geology, geomorphology and soils</b>	<b>Construction Effect</b> Minor negative effect <b>Operational Effect</b> Negligible effect	[<img alt="document icon" data-bbox="265 498 282 512"]
<b>Water (hydrology, groundwater, water quality)</b>	<b>Construction Effect</b> Negligible effect <b>Operational Effect</b> Moderate negative effect	[<img alt="document icon" data-bbox="265 678 282 692"]



Topic	Overall Appraisal of Effects	Appraisal Comments
Flood risk	<b>Construction Effect</b> Negligible effect  <b>Operational Effect</b> Negligible effect	[🔗]
Noise and vibration	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[🔗]
Air quality	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[🔗]
Climate change (including greenhouse gas emissions and resilience)	<b>Construction Effect</b> Moderate negative effect	[🔗]



Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Moderate negative effect  Moderate positive effect	
<b>Traffic and transport</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Resource use and waste management</b>	<b>Construction Effect</b> Major negative effect  <b>Operational Effect</b> Minor negative effect	[✕]
<b>Historic environment</b>	<b>Construction Effect</b> Minor negative effect effect	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
Landscape and visual	<b>Operational Effect</b> Negligible effect	[X]
	<b>Construction Effect</b> Minor negative effect	
	<b>Operational Effect</b> Minor negative effect	



**Option WR107b:** [✕]

Topic	Overall Appraisal of Effects	Appraisal Comments
Population (socio-economics)	<b>Construction Effect</b> Moderate negative effect  Major positive effect  <b>Operational Effect</b> Moderate positive effect	[✕]
Health	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Moderate positive effect  Minor negative effect	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Biodiversity, flora and fauna</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Moderate negative effect	[X]
<b>Land use, geology, geomorphology and soils</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[X]
<b>Water (hydrology, groundwater, water quality)</b>	<b>Construction Effect</b> Negligible effect  <b>Operational Effect</b> Moderate negative effect	[X]
<b>Flood risk</b>	<b>Construction Effect</b>	[X]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Moderate negative effect  <b>Operational Effect</b> Minor negative effect	
<b>Noise and vibration</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Minor negative effect	[✕]
<b>Air quality</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Moderate negative effect	[✕]
<b>Climate change (including greenhouse gas)</b>	<b>Construction Effect</b> Major negative effect	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
emissions and resilience)	<b>Operational Effect</b> Moderate negative effect  Moderate positive effect	
Traffic and transport	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Moderate negative effect	[X]
Resource use and waste management	<b>Construction Effect</b> Major negative effect  <b>Operational Effect</b> Moderate negative effect	[X]
Historic environment	<b>Construction Effect</b> Negligible effect	[X]



Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Negligible effect	
<b>Landscape and visual</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[✕]



Option WR111: [X]

Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Population (socio-economics)</b>	<b>Construction Effect</b> Minor negative effect  Moderate positive effect  <b>Operational Effect</b> Moderate positive effect	[X]
<b>Health</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Moderate positive effect	[X]
<b>Biodiversity, flora and fauna</b>	<b>Construction Effect</b> Moderate negative effect	[X]



Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Moderate negative effect	
<b>Land use, geology, geomorphology and soils</b>	<b>Construction Effect</b> Negligible effect <b>Operational Effect</b> Negligible Effect	[X]
<b>Water (hydrology, groundwater, water quality)</b>	<b>Construction Effect</b> Negligible effect <b>Operational Effect</b> Moderate negative effect	[X]
<b>Flood risk</b>	<b>Construction Effect</b> Negligible effect <b>Operational Effect</b> Negligible effect	[X]
<b>Noise and vibration</b>	<b>Construction Effect</b>	[X]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Minor negative effect <b>Operational Effect</b> Negligible effect	
<b>Air quality</b>	<b>Construction Effect</b> Minor negative effect <b>Operational Effect</b> Negligible effect	[✕]
<b>Climate change (including greenhouse gas emissions and resilience)</b>	<b>Construction Effect</b> Moderate negative effect <b>Operational Effect</b> Moderate negative effect  Moderate positive effect	[✕]
<b>Traffic and transport</b>	<b>Construction Effect</b>	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Minor negative effect  <b>Operational Effect</b> Negligible effect	
<b>Resource use and waste management</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Minor negative effect	[✕]
<b>Historic environment</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Landscape and visual</b>	<b>Construction Effect</b> Minor negative effect	[✕]



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Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Minor negative effect	



Option WR113: [X]

Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Population (socio-economics)</b>	<b>Construction Effect</b> Minor negative effect  Moderate positive effect  <b>Operational Effect</b> Minor positive effect	[X]
<b>Health</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Minor positive effect	[X]
<b>Biodiversity, flora and fauna</b>	<b>Construction Effect</b> Moderate negative effect	[X]



Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Moderate negative effect	
<b>Land use, geology, geomorphology and soils</b>	<b>Construction Effect</b> Minor negative effect	[<img alt="document icon" data-bbox="265 338 282 355"]
	<b>Operational Effect</b> Negligible effect	
<b>Water (hydrology, groundwater, water quality)</b>	<b>Construction Effect</b> Negligible effect	[<img alt="document icon" data-bbox="265 518 282 535"]
	<b>Operational Effect</b> Moderate negative effect	
<b>Flood risk</b>	<b>Construction Effect</b> Negligible effect	[<img alt="document icon" data-bbox="265 698 282 715"]
	<b>Operational Effect</b> Negligible effect	



Topic	Overall Appraisal of Effects	Appraisal Comments
Noise and vibration	<b>Construction Effect</b> Minor negative effect	[X]
	<b>Operational Effect</b> Negligible effect	
Air quality	<b>Construction Effect</b> Minor negative effect	[X]
	<b>Operational Effect</b> Negligible effect	
Climate change (including greenhouse gas emissions and resilience)	<b>Construction Effect</b> Moderate negative effect	[X]
	<b>Operational Effect</b> Moderate negative effect	
	Minor positive effect	



Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Traffic and transport</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Resource use and waste management</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Minor negative effect	[✕]
<b>Historic environment</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Landscape and visual</b>	<b>Construction Effect</b> Minor negative effect	[✕]



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Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Negligible effect	

**Option WR144:** [⌂]

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Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Population (socio-economics)</b>	<b>Construction Effect</b> Negligible effect  Moderate positive effect  <b>Operational Effect</b> Moderate positive effect	[⌂]
<b>Health</b>	<b>Construction Effect</b> Minor negative effect	[⌂]



Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Moderate positive effect	
<b>Biodiversity, flora and fauna</b>	<b>Construction Effect</b> Moderate negative effect	[<img alt="document icon" data-bbox="265 338 282 355"]
	<b>Operational Effect</b> Moderate negative effect	
<b>Land use, geology, geomorphology and soils</b>	<b>Construction Effect</b> Negligible effect	[<img alt="document icon" data-bbox="265 538 282 555"]
	<b>Operational Effect</b> Negligible effect	
<b>Water (hydrology, groundwater, water quality)</b>	<b>Construction Effect</b> Negligible effect	[<img alt="document icon" data-bbox="265 718 282 735"]
	<b>Operational Effect</b> Moderate effect	



Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Flood risk</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Minor negative effect	[✕]
<b>Noise and vibration</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Air quality</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Climate change (including greenhouse gas)</b>	<b>Construction Effect</b> Moderate negative effect	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
emissions and resilience)	<b>Operational Effect</b> Moderate negative effect  Minor positive effect	
Traffic and transport	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[✕]
Resource use and waste management	<b>Construction Effect</b> Major negative effect  <b>Operational Effect</b> Minor negative effect	[✕]
Historic environment	<b>Construction Effect</b> Minor negative effect	[✕]



Topic	Overall Appraisal of Effects	Appraisal Comments
	<b>Operational Effect</b> Negligible effect	
<b>Landscape and visual</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[✕]



**Option WR149:** [🔗]

Topic	Overall Appraisal of Effects	Appraisal Comments
<b>Population (socio-economics)</b>	<b>Construction Effect</b> Moderate negative effect  Major positive effect  <b>Operational Effect</b> Moderate positive effect	[🔗]
<b>Health</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Moderate positive effect	[🔗]
<b>Biodiversity, flora and fauna</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b>	[🔗]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Moderate negative effect	
<b>Land use, geology, geomorphology and soils</b>	<b>Construction Effect</b> Negligible positive effect  <b>Operational Effect</b> Negligible effect.	[<img alt="document icon"/>
<b>Water (hydrology, groundwater, water quality)</b>	<b>Construction Effect</b> Negligible effect  <b>Operational Effect</b> Moderate negative effect	[<img alt="document icon"/>
<b>Flood risk</b>	<b>Construction Effect</b> Moderate negative effect  <b>Operational Effect</b> Negligible effect	[<img alt="document icon"/>
<b>Noise and vibration</b>	<b>Construction Effect</b>	[<img alt="document icon"/>



Topic	Overall Appraisal of Effects	Appraisal Comments
	Minor negative effect  <b>Operational Effect</b> Negligible effect	
<b>Air quality</b>	<b>Construction Effect</b> Minor negative effect  <b>Operational Effect</b> Negligible effect	[⌕]
<b>Climate change (including greenhouse gas emissions and resilience)</b>	<b>Construction Effect</b> Major negative effect  <b>Operational Effect</b> Major negative effect  Moderate positive effect	[⌕]
<b>Traffic and transport</b>	<b>Construction Effect</b>	[⌕]



Topic	Overall Appraisal of Effects	Appraisal Comments
	Minor negative effect  <b>Operational Effect</b> Negligible effect	
<b>Resource use and waste management</b>	<b>Construction Effect</b> Major negative effect  Minor positive effect  <b>Operational Effect</b> Moderate negative effect	[✕]
<b>Historic environment</b>	<b>Construction Effect</b> Negligible effect  <b>Operational Effect</b> Negligible effect	[✕]
<b>Landscape and visual</b>	<b>Construction Effect</b>	[✕]



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Topic	Overall Appraisal of Effects	Appraisal Comments
	Minor negative effect	
	<b>Operational Effect</b> Negligible effect	



# **Appendix C**

## **Gate 3 Environment Monitoring & Assessment Plan**



This appendix should be read alongside the Forward Plan presented in **Section 6.4**. The tables presented in this appendix provide more details on the work activities described in **Section 6.4**, detailing which work activities relate to which sub-option (**Table C.1**), and summary programme of activities for Gate 3 (**Table C.2**). Lists of survey locations for each sub-option are provided in **Tables C.3 to C.9**. As noted in **Section 6.4** method statements will be prepared for each of the activities, which will enable methods, locations, timings and frequency/durations of the surveys, and the scope and methods for modelling and other desk-based assessments be agreed with the NAU.



Table C.2 Forward Plan Sub-Option Matrix

	WR015 [X]	WR049d [X]	WR076 [X]	WR102b [X]	WR105a1 [X]	WR106b [X]	WR107a2 [X]	WR107b [X]	WR111 [X]	WR113 [X]	WR144 [X]	WR149 [X]	STT041b [X]	STTA4 [X]
<b>GW Balance Calculations</b>				✓	✓	✓	✓	✓	✓	✓		✓		
<b>GW Modelling</b>				✓	✓	✓	✓	✓	✓	✓		✓		
<b>Hydrogeological Conceptualisation</b>				✓	✓	✓	✓	✓	✓	✓		✓		
<b>Pumping Tests</b>				?	?	?	?	?	?	?		?		
<b>River Flow Modelling</b>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b>Water Availability Engagement</b>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b>Geomorphology &amp; Physical Habitat Surveys</b>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b>Spot flow and bed elevation surveys</b>				✓	✓	✓	✓	✓	✓	✓		✓		
<b>Assessment of Water Dependent Designated</b>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓



	WR015 [X]	WR049d [X]	WR076 [X]	WR102b [X]	WR105a1 [X]	WR106b [X]	WR107a2 [X]	WR107b [X]	WR111 [X]	WR113 [X]	WR144 [X]	WR149 [X]	STT041b [X]	STTA4 [X]
<b>Sites &amp; Other Ecological Receptors</b>														
<b>River Water Quality Modelling</b>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b>Fish Population Surveys</b>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b>Fish Barrier Surveys</b>	✓		✓		✓			✓	✓	✓	✓	✓	✓	
<b>Assessment of Impacts on Migratory Species</b>	?	✓	?	?	?	?	?	?	?	?	?	?	?	?
<b>Macroinvertebrate Surveys</b>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b>Macrophyte Surveys</b>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b>Phytobenthos</b>		✓					✓	✓	✓	✓	✓	✓		
<b>Gate 3 Regulatory Assessments</b>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

## Notes:

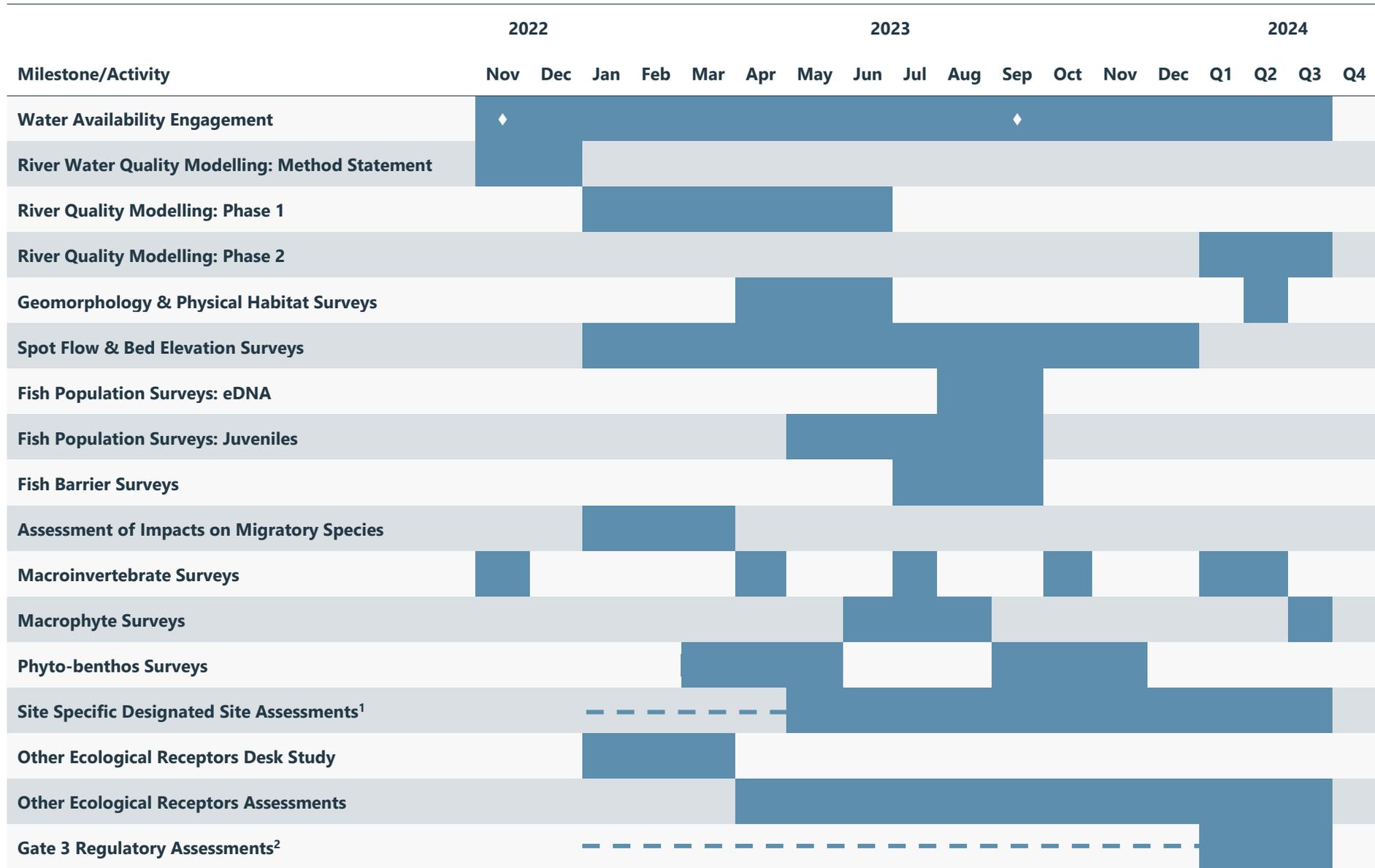
Question marks indicate that the work package may be undertaken for the sub-option, depending on the outcomes of other preceding Gate 3 assessments.

Additional assessments not listed in this table will be undertaken for all options where required to inform planning applications, including EIA where relevant (e.g. terrestrial ecology, landscape assessments etc).



Table C.3 Summary Gate 3 Environment Workstream Programme

Milestone/Activity	2022				2023								2024					
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4
Gate 3 Checkpoint																		♦
Earliest Gate 3																		♦
GW Balance Calculations		█																
GW Modelling Phase 1: Scoping Study		█																
GW Modelling Phase 2: Update			█	█	█	█	█	█										
GW Modelling Phase 3: Assessment									█	█								
GW Modelling Phase 4: Assessment																█	█	
Hydrogeological Conceptualisation			█	█	█	█	█	█	█	█	█	█	█					
Pumping Tests: Step Tests		█	█	█	█													
Pumping Tests: Constant Rate Tests								█	█	█	█	█	█	█				
River Flow Modelling: Phase 1 Method Statement		█	█															
River Flow Modelling: Phase 2 Model Development				█	█	█												
River Flow Modelling: Phase 3 Initial Assessment								█	█	█	█							
River Flow Modelling: Phase 4 Full Assessment																█	█	
Hydraulic Modelling												█	█	█				





Milestone/Activity	2022			2023							2024							
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Q1	Q2	Q3	Q4
<b>Preparation of Gate 3 Submission, Abstraction Licence (and Planning) Applications<sup>3</sup></b>																		

Notes:

1. Impacts on European and national and local water dependent designated sites will initially be considered as part of other activities (e.g. groundwater and river flow modelling) before site specific survey and assessments begin where required.
2. All the assessments and surveys listed in this table and described in the Forward Plan will support and inform the Gate 3 Regulatory Requirements, but the formal assessments will start to be prepared after the Gate 3 Checkpoint.
3. The supporting assessments and material for the Gate 3 Submission, abstraction licence and planning applications will be developed and prepared throughout Gate 3, with the final preparation of the submission documents occurring in Quarter Four 2024.



Table C.4 Proposed Physical Habitat Survey Locations: Abstraction Points

Sub-Option ID	100 m U/S of Abstraction Point (NGR)	500 m D/S of Abstraction Point (NGR)	River
WR015 & STT041b [X]	[X]	[X]	Irwell
STT041b [X]	[X]	[X]	Roch
WR076	[X]	[X]	Bollin
WR049d	[X]	[X]	Ribble
WR144	[X]	[X]	Tame

Table C.5 Proposed Physical Habitat Survey Locations: Sensitive Reaches Downstream of River Abstraction Points – Candidate Sites

Sub-Option ID	Centre Point of Reach (NGR)	River
STT041b	[X]	Roch
WR015	[X]	Irwell





Table C.6 Proposed Physical Habitat Survey Locations: Sensitive Reaches Associated with Groundwater Abstractions – Candidate Sites

Sub-Option ID	Centre Point of Reach (NGR)	River
WR102b	[X]	Netherley / Ditton Brook
WR102b	[X]	Netherley / Ditton Brook
WR102b	[X]	Netherley / Ditton Brook
WR102b	[X]	Mill / Dog Clog Brook
WR102b	[X]	Mill / Dog Clog Brook
WR102b	[X]	Prescot / Logwood Mill / Ochre Brook
WR102b	[X]	Prescot / Logwood Mill / Ochre Brook
WR102b	[X]	Prescot / Logwood Mill / Ochre Brook
WR102b	[X]	Prescot / Logwood Mill / Ochre Brook
WR102b	[X]	Mill / Dog Clog Brook
WR102b	[X]	Prescot / Logwood Mill / Ochre Brook
WR102b	[X]	Prescot / Logwood Mill / Ochre Brook
WR105a	[X]	Bradley Brook
WR105a	[X]	Bradley Brook
WR106b	[X]	Keckwick Brook
WR106b	[X]	Keckwick Brook
WR106b	[X]	Keckwick Brook
WR106b	[X]	Keckwick Brook
WR107a2	[X]	Cunscough Brook
WR107a2	[X]	Cunscough Brook
WR107b	[X]	Knowsley Brook
WR107b	[X]	Alt







Sub-Option ID	Feature	Site	NGR	River
STT041b	Weir	Blackford Bridge	[X]	Roch
WR015	Weir	Adelphi weir	[X]	Irwell
WR015	Weir	Charlestown	[X]	Irwell
WR015	Weir	Ringley Weir	[X]	Irwell
WR076	Weir	Heatley Mill	[X]	Bollin
WR105a	Dam	Lymm Dam	[X]	Bradley Brook
WR105a	Weir	Lymm Lower Dam	[X]	Bradley Brook
WR105a	Weir	Lymm Slitten Mill	[X]	Bradley Brook
WR107b	Weir	Scarisbrick Hall School	[X]	Eas Brook
WR107b	Weir	Scarisbrick Hall School	[X]	Eas Brook
WR107b	Unknown	Birkdale	[X]	Boundary Brook
WR107b	Unknown	Kew	[X]	Boundary Brook
WR107b	Unknown	Crossens	[X]	Three Pool's Waterway
WR107b	Sluice	Crossens pumping station	[X]	Three Pool's Waterway
WR107b	Weir	NRFA Alt at Kirby	[X]	Alt
WR107b	Weir	Aintree	[X]	Alt
WR107b	Unknown	Hightown	[X]	Alt
WR111	Weir	Deanwater Hotel, Woodford	[X]	Dean
WR111	Weir	Handforth	[X]	Dean
WR111	Weir	Stanneylands Gauge	[X]	Dean
WR113	Weir	Cartmel Close, Tytherington	[X]	Bollin
WR113	Weir	Riverside Park, Tytherington	[X]	Bollin
WR113	Weir	Northmead, Dale Brow	[X]	Bollin
WR113	Weir	Willow Way, Dale Brow	[X]	Bollin
WR113	Weir	Bollin Grove, Prestbury	[X]	Bollin
WR113	Weir	Prestbury Park US	[X]	Bollin
WR113	Weir	Prestbury Park Mid	[X]	Bollin
WR113	Weir	Prestbury Park DS	[X]	Bollin



Sub-Option ID	Feature	Site	NGR	River
WR113	Weir	Wilmslow Park East	[X]	Bollin
WR113	Weir	Wilmslow Park West	[X]	Bollin
WR113	Weir	Wilmslow Gauge	[X]	Bollin
WR144	Weir	Caroline Bridge, Stalybridge	[X]	Tame
WR144	Weir	Victoria Bridge, Stalybridge	[X]	Tame
WR144	Weir	Copley	[X]	Tame
WR144	Weir	Souracre	[X]	Tame
WR144	Weir	Blackrock, Mossley	[X]	Tame
WR144	Weir	Blackrock, Mossley	[X]	Tame
WR144	Weir	Scout Mill, Mossley	[X]	Tame
WR144	Weir	Mossley Beach	[X]	Tame
WR144	Weir	Woodend Mills	[X]	Tame
WR144	Weir	Woodend Mills	[X]	Tame
WR144	Weir	Roaches, Mossley	[X]	Tame
WR149	Weir	Glazebury	[X]	Pennington Brook
WR149	Weir	A572 Bridge, Leigh	[X]	Pennington Brook

## Notes:

No downstream barriers have been identified for options WR102b, WR106b, WR107a2 and WR049D.

Table C.8 Macroinvertebrate Sampling Locations for Autumn 2022 Survey

Sub-Option ID	EA Site ID	River	NGR
WR102b	67486	Dog Clog Brook	[X]
WR102b	66759	Ditton Brook (Prescott Brook)	[X]
WR102b	156235	Ditton Brook	[X]
WR102b	67485	Netherley Brook	[X]
WR102b	65637	Ditton Brook	[X]
WR105a	65947	Bradley (Sow) Brook	[X]
WR105a	66487	Bradley (Sow) Brook	[X]
WR106b	65773	Keckwick Brook	[X]



Sub-Option ID	EA Site ID	River	NGR
WR107a2	65532	Cunscough Brook	[X]
WR107a2	66833	Sudell Brook	[X]
WR107a2	68076	Downholland Brook	[X]
WR107a2	64885	Alt	[X]
WR107b	65644	Knowsley Brook	[X]
WR107b	68078	Knowsley Brook	[X]
WR107b	65616	Alt	[X]
WR107b	67587	Alt	[X]
WR111	67161	Dean	[X]
WR111	66508	Dean	[X]
WR111	67973	Dean	[X]
WR113	68454	Bollin	[X]
WR113	67170	Bollin	[X]
WR113	67770	Bollin	[X]
WR149	64098	Pennington Brook	[X]
WR149	178485	Glaze Brook	[X]
WR149	68340	Glaze Brook	[X]
WR149	68354	Carr Brook	[X]
WR149	64843	Spittle Brook	[X]
STT041b	69398	River Roch	[X]
STT041b	68703	River Irwell	[X]
WR015	67275	River Irwell	[X]
WR015	69675	Irwell / Manchester Ship Canal (Irk to conf with Upper Mersey)	[X]
WR049d	64957	River Ribble	[X]
WR076	69696	River Bollin	[X]
WR144	66918	Tame (North West)	[X]
WR144	66794	Tame (North West)	[X]



Table C.9 Proposed Macrophyte Sampling Locations

Sub-Option ID	EA Site ID	River	NGR
STT041b	68703	Irwell	[X]
STT041b	69398	Roch	[X]
WR015	161146	Irwell	[X]
WR015	67275	River Irwell	[X]
WR015	69675	Irwell / Manchester Ship Canal (Irk to conf with Upper Mersey)	[X]
WR049d	64957	Ribble	[X]
WR076	69696	Bollin	[X]
WR102b	65637	Ditton Brook	[X]
WR105a	65947	Bradley (Sow) Brook	[X]
WR105a	66487	Bradley (Sow) Brook	[X]
WR106b	65773	Keckwick Brook	[X]
WR107a2	202736	Cheshire Lines	[X]
WR107a2	65532	Cunscough Brook	[X]
WR107a2	66833	Sudell Brook	[X]
WR107a2	68076	Downholland Brook	[X]
WR107a2	64885	Alt	[X]
WR107b	68078	Knowsley Brook	[X]
WR111	67973	Dean	[X]
WR113	68454	Bollin	[X]
WR113	155727	Bollin	[X]
WR144	66794	Tame	[X]
WR144	97263	Tame	[X]
WR144	66918	Tame (North West)	[X]
WR144	66794	Tame (North West)	[X]
WR149	67357	Pennington Brook	[X]
WR149	65572	Pennington Brook	[X]
WR149	64843	Spittle Brook	[X]



Table C.10 Proposed Phyto-Benthos Sampling Locations

Sub-Option ID	EA Site ID	WFD Water Body	NGR
<b>WR049d/WR107b</b>	64957	Ribble	[X]
<b>WR107a2</b>	68076	Downholland Brook	[X]
<b>WR107a2</b>	65532	Downholland (Lydiate/Cheshire Lines) Brook	[X]
<b>WR111/WR113</b>	68454	Bollin (source to Dean)	[X]
<b>WR111/WR113</b>	155727	Bollin (source to Dean)	[X]
<b>WR111/WR113</b>	153806	Bollin (source to Dean)	[X]
<b>WR149</b>	68321	Hey/Bordsane Brook	[X]
<b>WR144</b>	66794	Tame (Swineshaw Brook to Mersey)	[X]

wood.