United Utilities Water

Habitats Regulations Assessment of the Water Resource Management Plan 2024

Information to support an assessment under Regulation 63 of the *Conservation of Habitats and Species Regulations 2017*

February 2024

Report for

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Doc Ref. 806845-WOOD-ZZ-XX-RP-OE-00006_S3_P8a

https://wsponline-my.sharepoint.com/personal/mike_frost_wsp_com/documents/projects/wrw/jan 2024/806845-wood-zz-xx-rp-oe-00006_s3_p8a [uu wrmp hra - feb 24 update tc].docx

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Document revisions

No.	Details	Date
1	Draft for UUW Review	17/08/21
2	Draft for UUW Review	26/09/21
3	Draft for UUW Review	27/09/21
4	Issued for consultee review	29/09/21
5	Draft Final for UUW Review	02/06/23
6a	Publication (unredacted)	20/06/23
7a	Draft for UU	05/02/24
8b	Updated Final (redacted)	12/02/24

Contents

1. Introduction

Water Resource Management Plans set out how water supply-demand balances and water supply security will be maintained over the next 25 years and beyond. These plans are subject to the provisions of the *Conservation of Habitats and Species Regulations 2017* (as amended).

1.1 United Utilities Water's Water Resources Management Plan 2024

1.1.1 The Water Act 2003 requires that all water companies in England Wales prepare and maintain Water Resources Management Plans (WRMPs). These plans set out how public water supply (PWS) will be maintained over a minimum of 25 years in a way that is economically, socially and environmentally sustainable. The WRMPs must be revised every five years.

1.1.2 United Utilities Water (UUW) is currently finalising its Water Resources Management Plan 2024 (WRMP24). Once approved, the WRMP24 will set out a long-term, best value and sustainable plan for water supplies in the North West. The WRMP24 plans for an adequate supply to meet demand from 2025 to 2050 and beyond, and a supply system that is resilient to drought. WRMPs are reviewed on a rolling five-year basis, with UUW's most recent plan being published in 2019.

1.1.3 As part of the preparation of WRMP24, UUW published its Draft Water Resources Management Plan 2024 (Draft WRMP24) for consultation between the 7th December 2022 and 15th March 2023, following submission to Defra. The Draft WRMP24 set out UUW's proposals to ensure continued delivery of a secure and reliable supply of water from 2025 to 2050, looking beyond out to the year 2100.

1.1.4 Taking into account the responses received to the consultation on the Draft WRMP24 from regulators, stakeholders and the public, further engagement and environmental assessment, UUW has selected its preferred plan for WRMP24. A Revised Draft Water Resources Management Plan 2024 (Revised Draft WRMP24 or rdWRMP24) was prepared and submitted to the Secretary of State for review and approval (21 June 2023).

1.1.5 The Secretary of State has subsequently requested further information on the Revised Draft WRMP (December 2023)[1], which is being provided by UUW alongside updated environmental reports.

1.1.6 UUW's WRMP24 has been developed within a regional water resources planning framework covering all or part of the operational areas of Dŵr Cymru Welsh Water (DCWW), Hafren Dyfrdwy (HD), Severn Trent Water (STW), South Staffordshire Water (SSW) and United Utilities Water (UUW)[2] that is managed by Water Resources West (WRW). WRW is currently preparing a Regional Plan[3] for the period 2025 to 2085 that will address long-term regional and inter-regional, multi-sectoral water resources management pressures and will draw on water resource options from the member water

[1] Letter from Defra Deputy Director – Water Sector Delivery to UU (no reference) dated December 2023.

[2] Hafren Dyfrdwy operates in mid-Wales and borders the WRW Regional Plan area; no Hafren Dyfrdwy water resources zones are included in the regional plan and so Hafren Dyfrdwy is an associate rather than core member of WRW.

[3] EA (2020) *Water Resources National Framework: Appendix 2: Regional planning*.

companies' WRMP24s, as well as the Strategic Resource Options (SROs) being taken forward by the companies.

1.2 Habitats Regulations Assessment

1.2.1 Water company WRMPs are subject to the provisions of the *Conservation of Habitats and Species Regulations 2017* (as amended) (the 'Habitats Regulations')[4].

1.2.2 Regulations 63 and 64 transposed the provisions of Articles 6(3) and 6(4) of Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive') as they related to plans or projects in England Wales.

1.2.3 Regulation 63 states that if a plan or project is "*(a) is likely to have a significant effect on a European site*[5] *or a European offshore marine site*[6] *(either alone or in combination with other plans or projects); and (b) is not directly connected with or necessary to the management of the site*" then the competent authority must "…*make an appropriate assessment of the implications for the site in view of that site's conservation objectives*" before the giving consent or authorisation. The plan or project can only be given effect if it can be concluded (following an 'appropriate assessment') that it "…*will not adversely affect the integrity*" of a site, unless the provisions of Regulation 64 are met.

1.2.4 This assessment process is known as Habitats Regulations Assessment (HRA)[7]. An HRA determines whether there will be any 'likely significant effects' (LSE) on any European site as a result of a plan's implementation (either on its own or 'in combination' with other plans or projects)[8] and, if so, whether there will be any 'adverse effects on site integrity'[9].

1.3 This Report

1.3.1 UUW has a statutory duty to prepare a WRMP and is therefore the Competent Authority for the HRA of that plan. UUW has appointed WSP Environment & Infrastructure UK Ltd

[4] The 2017 Regulations have been amended by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 to reflect the UK's exit from the EU, although these largely carried forward the provisions and terminology of the 2017 Regulations and do not fundamentally alter their interpretation. This report therefore primarily refers to the 2017 Regulations and (where appropriate for clarity) the relevant provisions of the Habitats Directive.

[5] As noted, the 2019 amendment to the Habitats Regulations largely carried forward the provisions and terminology of the 2017 Regulations, and so the term 'European site' is currently retained and for all practical purposes the definition is essentially unchanged. European sites are therefore: any Special Area of Conservation (SAC) from the point at which the European Commission and the UK Government agreed the site as a 'Site of Community Importance' (SCI) (if this was before 31 Jan 2020); any classified Special Protection Area (SPA); and any candidate SAC (cSAC). However, the term is also commonly used when referring to potential SPAs (pSPAs), to which the provisions of Article 4(4) of Directive 2009/147/EC (the 'new wild birds directive') are applied; and to possible SACs (pSACs) and listed Ramsar Sites, to which the provisions of the Habitats Regulations are applied a matter of Government policy (NPPF para. 187; TAN5 para. 5.1.3) when considering development proposals that may affect them. "European site" is therefore used in this document in its broadest sense, as an umbrella term for all of the above designated sites. Note, it is likely that this term will be supplanted at some point in the future although an appropriate UK-wide alternative has not yet been agreed (e.g. the NPPF in England has adopted the term 'Habitats sites' to refer collectively to those sites defined by Regulation 8; the *Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019* does not offer a direct alternative to "European site" but uses the term 'National Site Network' in place of 'Natura 2000').

[6] 'European offshore marine sites' are defined by Regulation 18 of The Conservation of Offshore Marine Habitats and Species Regulations 2017; these regulations cover waters (and hence sites) over 12 nautical miles from the coast.

[7] The term 'Appropriate Assessment' has been historically used to describe the process of assessment; however, the process is more typically referred to as 'Habitats Regulations Assessment' (HRA), with the term 'Appropriate Assessment' limited to a specific stage within the process.

[8] Also referred to as the 'test of significance'.

[9] Also referred to as the 'integrity test'.

(formerly Wood Group UK Limited) and Ricardo Energy and Environment (Ricardo) to assist with its assessment of WRMP24 against Regulations 63 and (if required) 64.

1.3.2 As noted, the Secretary of State has requested further information on the rdWRMP24 which is being provided by UUW. **This updated HRA report accompanies UUW's "*Further information in support of Statement of Response*" document that has been submitted to Defra, and summarises the current assessment of UUW's preferred options against the requirements of the Habitats Regulations, with consultee comments on the rdWRMP24 and its HRA addressed as appropriate**.

1.3.3 The report is structured as follows:

- **Section 2** provides a brief summary of the WRMP and the preferred options;
- **Section 3** sets out the approach to HRA of WRMP24, including the key issues for these strategic plans (**Section 3**);
- **Section 4** documents the 'screening' of the preferred options;
- **Sections 5 – 8** provide 'appropriate assessments' for those European sites where significant effects could not be excluded, including option-specific 'in combination' assessments;
- **Section 9** summarises the plan-level 'in combination' assessment;
- **Section 10** summarises the assessment for the demand-side options; and
- **Section 11** sets out the proposed conclusion of the HRA of UUW's WRMP24 (assuming that the adopted version of the WRMP reflects the submitted WRMP, and subject to any additional data gathering that may be required to resolve residual uncertainties).

1.3.4 The report necessarily focuses on the assessment of the preferred options; the iterative HRA-related processes used to inform the development of the plan (including the feasible options assessments) are documented separately for clarity. In addition, the assessment is of the WRMP only and not the WRW Regional Plan (although it will contribute to the HRA of the Regional Plan).

1.3.5 Note that the HRA draws on the environmental data and assessments undertaken within other assessments, particularly in relation to operational effects and the hydrological zone of influence. These include:

- the Water Framework Directive (WFD) assessment
- NWT SRO Gate 2: Assessment of options involving groundwater abstractions
- NWT SRO Gate 2: Assessment of options involving surface water abstractions

1.3.6 This HRA report should therefore be read in conjunction with these reports.

2. UUW's WRMP24

The WRMP process identifies potential deficits between the water available for supply and the projected demand. UUW has identified three 'supply-side' options and 33 'demand-side' options to resolve predicted deficits in its supply area.

2.1 Water Resources Planning

2.1.1 The WRMP process establishes supply and demand balances for each Water Resource Zone[10] (WRZ) operated by the water company, identifying potential deficits between the water available for supply and the projected demand. Each supply-demand balance calculation is structured around a consistent central set of planning assumptions and is used to identify WRZs in deficit over the plan period. Options are then proposed to resolve these deficits.

2.1.2 The supply-demand balance calculations are based on deployable output (DO) and demand forecasts. The estimation of DO is based on:

- abstraction volumes allowed under current statutory licences, as impacted by actual source yield;
- any future reductions in abstraction expected under environmental improvement regimes; and
- predicted future demand for water based on government data for population and housing growth plans (including Local Plans) and information on major infrastructure schemes likely to have high water demand.

2.1.3 It should be noted that various licence review arrangements and protocols are implemented at the start of each WRMP cycle, which take account of the Environment Agency's or Natural Resources Wales' requirements through the Water Industry National Environment Programme (WINEP) and National Environment Programme (NEP) respectively. This review process (and WINEP) is undertaken in conjunction with Natural England, which identifies protected sites (including European sites) to the EA where it believes abstraction-related issues are affecting the achievement of favourable conservation status.

2.1.4 This review is important to the development of the supply/DO forecast at the start of the WRMP process, and is consequently reflected in Section 5.4 ('Developing Your Supply Forecast') of the Water Resource Planning Guideline (2020 draft and 2023 published versions) which outlines the requirements for sustainable abstraction taking into account existing statutory requirements and environmental destination.

[10] Section 4.4. of the Water Resources Planning Guideline (WRPG) defines a water resource zone as "*an area within which the abstraction and distribution of water to meet demand is largely self-contained (with the exception of agreed bulk transfers)*".

2.1.5 Demand forecasts are completed in accordance with the *Water Resources Planning Guideline*[11]) and consider (*inter alia*):

- Estimates of baseline demand from:
  - household customers;
  - non-household customers;
  - water leaks;
  - any other losses or uses of water such as water taken unbilled.
- Future demands which will be subject to many influences, including:
- housing development and population changes, including changes in occupancy;
- the impact of prolonged high demand;
- changes in water use behaviour and distribution of demand (in both household and non-household users);
- metering and smart metering;
- changes in government policy and expectations, for example water efficiency standards in new homes and water labelling;
- changing water efficiency and sustainable water use practices;
- changing design standards of devices that use water such as more efficient washing machines;
- changes in technology and practices for leakage detection and repair;
- a changing climate;
- weather patterns;
- potential changes in demand from the energy sector as it moves to low *carbo*n technology.

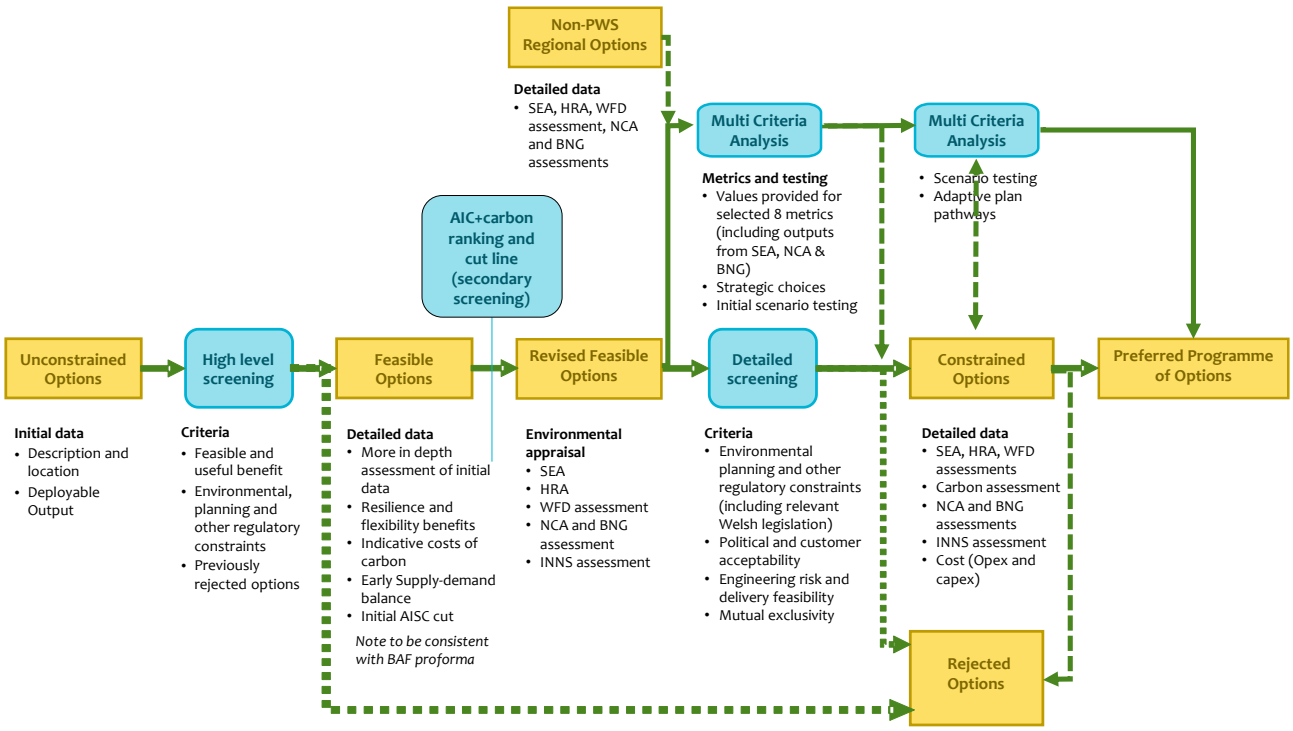
2.1.6 The supply forecast informs the supply-demand balance calculations for the planning period, which is in effect the 'predicted future baseline' for water resources in a supply area. The water company then develops 'options' for resolving any predicted deficits in the supply-demand balance, which are then tested against various metrics to determine the 'preferred plan'. Note that all references to WRMP 'options' in the WRPG are made in the commonly-accepted sense, i.e. explicit interventions proposed by the WRMP to increase water supply or reduce consumption (e.g. Section 1.1), not a broad 'catch all' for ongoing water company operations such as those existing abstractions that will form part of the 'predicted future baseline'.

2.1.7 The WRMP process initially identifies as many potential deficit solutions as possible (the 'unconstrained list' of options) irrespective of cost or technical merit. These are then refined to identify '**feasible options**' and subsequently the '**preferred options**' for meeting any supply-demand deficits. All zones with deficits are subject to a decision-making process using a Multi-Criteria Analysis (MCA), and other methods where appropriate, to identify a preferred plan (comprising 'preferred options') to address the supply demand deficit. The decision-making method factors in multiple costs and benefits

[11] UK Government (2022). Water resources planning guideline [online.]. Available at: https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline. [Accessed April 2022].

and considers the interaction between zones to establish a best value plan for the region (and individual company). This staged filtering process allows various assessments, including HRA, to inform the plan development (see **Figure 2.1**).

Figure 2.1 Environmental assessments into option and plan development



2.1.8 WRMP options are typically characterised as **supply-side** (measures that increase supply, such as new abstractions) or **demand-side** (measures which reduce consumption post-treatment, such as metering or leakage detection and reduction). HRAs generally focus on supply-side options[12] and their potential effects; these options would typically involve one or more of the following:

- development of new surface or groundwater sources, or desalination of sea water ('new water');
- modification of an existing licence to alter the operational and network regimes (e.g. additional abstraction; changes in timing of abstractions; etc);
- use of 'spare water' from existing licensed sources through operational adjustments or capital works (e.g. new treatment facilities);
- re-instatement of existing, mothballed sources (with or without current licences);
- capital works to the distribution network (e.g. to improve resilience);
- transferring water from adjacent water companies or third-parties with a supply / demand surplus; or

[12] 'Demand management' options (i.e. options designed to reduce treated water use such as metering or provision of water butts) are generally considered unlikely to have any significant or adverse effects on any European sites (see Section 3.2).

- Strategic Resource Options[13] involving multiple companies and sources.

2.2 UUW's WRMP24

2.2.1 UUW supplies water to ~7.3 million customers in the north-west of England. The supply area includes three PWS WRZs[14]:

- Carlisle WRZ;
- North Eden WRZ;
- Strategic WRZ.

2.2.2 As part of the WRMP development process, UUW initially identified feasible supply-side and demand-side options to resolve deficits, improve network resilience and make water available for transfer. These options were subject to a staged filtering process (which included a high-level consideration of the HRA-related risks associated with each option) designed to establish the best-value plan for UUW taking into account the regional plan requirements.

2.2.3 UUW's proposed best-value plan is focussed on delivering three strategic choices:

- Achieve government targets to halve leakage and reduce customer consumption to 110 litres per person per day by 2050.
- Support national planning by developing large-scale water transfers that are adaptable and flexible to the changing needs of other regions.
- In line with customer preferences, improve the level of service for temporary use bans (TUBs), halving the expected frequency of occurrence to 1 in 40 years (5% annual chance). Concurrently, UUW will improve the frequency of implementing drought orders and drought permits to 1 in 50 years (2% annual chance).

2.2.4 UUW's demand forecast shows a very small increase of around 0.7% across the 25-year planning horizon, excluding the impacts of demand management programmes, and so the leakage reduction and water efficiency measures and TUBs measures will increase resilience in the supply.

2.2.5 Following consultation on the Draft WRMP24, UUW has reviewed its best value plan for WRMP24 and as a result, the preferred plan contained in the Draft WRMP24 has been modified. In particular, the number of supply options which now make up the preferred plan for the Revised Draft WRMP24 has significantly reduced owing to, in particular, decreased water transfer needs (following the final regional planning reconciliation round).

2.2.6 The Draft WRMP24 included a total of 168 Ml/d of exports to STW and Water Resources South East (WRSE) from UUW's SRZ, starting with a 75 Ml/d transfer in 2031. Seven supply options were included in preferred plan to support these transfers. Transfers to WRSE are no longer selected in the preferred plan, linked to WRSE companies lowering their demand projections following consultation feedback. As a consequence of these changes there are fewer supply options in the Revised Draft WRMP24 preferred plan. When combined with updates to the demand management measures, this also means

[13] There are six Strategic Resource Options (SROs) being taken forward by the companies (the Severn Thames transfer, Grand Union Canal transfer, Minworth Effluent Reuse, Severn Trent Sources, [redacted] Source, United Utilities Sources).

[14] A fourth WRZ, Barepot WRZ, supplies non-potable water to an industrial customer only.

that improving UUW's level of service for temporary use bans (TUBs) is no longer reliant on the dual-purposing of water transfer support options.

2.2.7 The revised draft WRMP24 therefore proposes:

- Three supply options to provide 22Ml/d of additional resource.
- 33 customer, distribution and production options to provide some 282Ml/d.

2.2.8 These options are summarised in **Table 2.1** and **Tables 2.2 – 2.5**. The WRMP24 also assumes delivery of an environmental destination scenario by 2050. This scenario will continue to take shape over time.

2.2.9 Further to comments received from regulators on the Draft WRMP24, the revised draft plan now also includes drought permit options taken from UUW's Drought Plan.

Supply-side options

2.2.10 The three preferred portfolio supply-side options (including intended yield and approximate year by which the option would be required) are summarised in **Table 2.1**.

2.2.11 UUW has also identified four 'reserve options' that might be used if one or more of the preferred options is shown (through project level HRA) to have unavoidable adverse effects on a European site; these are identified and discussed separately in **Appendix D** for clarity.

Table 2.1 Preferred portfolio supply-side options

Option Ref	Option Name	Summary	Yield (Ml/d)	Year selected
WR107a2	GWE_Aughton Park a2	[redacted]	10	2030
WR111	GWE_Woodford	[redacted]	9	2030
WR113	GWE_Tytherington	[redacted]	3	2030

Demand-side options

2.2.12 The demand side options are summarised in **Tables 2.2 – 2.4**. Whilst their application and requirements are slightly different in each WRZ, they essentially comprise the following generic option types:

- Physical amendments to the network:

- District Metered Area (DMA) optimisation (reducing the size of DMAs through network interventions to improve the detection of smaller leaks);
- Flow regulators (installation of flow restrictors and pressure reducing valves);
- In-pipe repairs and lining technologies (typically non-invasive);
- Mains rehabilitation/renewal/replacement (typically invasive);
- Permanent network sensors (installation of acoustic loggers within assets);
- Pressure management (reduces leakages);
- Enhanced metering of households (smart meters);
- Upgrade existing household meters to smart meters;
- Non-household (NHH) smart meters;
- Upstream tile optimisation (installation of larger meters 'upstream' in the supply network to improve monitoring of network losses).

- Water efficiency support:
  - Free water efficiency audits for households;
  - Free water efficiency devices (internal or external) for households;
  - Government intervention (water labelling, standards);
  - Non-household water efficiency programmes;
  - Rainwater harvesting and water reuse (new builds).

2.2.13 It is assumed that these will be employed at various times across the planning period.

2.2.14 It should be noted that the '**demand side**' measures are not geographically specific at the WRMP level, and could be applied anywhere within UUW's network. Location-specific information on the measures is not available without specific investigations, which would form part of the package (for example, the location and severity of most leakages is not known).

Table 2.2 Preferred demand-side options – Strategic WRZ

Option Ref	Option Name	Year
WR502c	LEA-SRZ5_Permanent network sensors	2035
WR510	LEA-SRZ15_In-pipe repairs and lining technologies	2026
WR658c	WSD-SRZ10_Free water efficiency devices (inside/internal)	2026
WR661c	WUA-SRZ15_Free water efficiency visits (households)	2026
WR677c	WUA-SRZ10_Non-household water efficiency programme	2026
WR694f	WSA-SRZ15_Government intervention (e.g. water labelling)	2026
WR659c	WER-SRZ15_Free water efficiency devices (outside/external)	2026
WR516h1	LEA-SRZ10_Mains rehabilitation/renewal/replacement	2026

Option Ref	Option Name	Year
WR516h2	LEA-SRZ25_Mains rehabilitation/renewal/replacement	2037
WR511g	LEA-SRZ5_Pressure management	2049
WR520c	LEA-SRZ5_DMA optimisation	2030
WR524d	LEA-SRZ10_Upstream tile optimisation	2027
WR619c	EMT-SRZ10_Replace existing household meters with smart meters	2026
WR603e	EMT-SRZ15_Enhanced metering of households on single supplies (smart meters)	2026
WR615c	EMT-SRZ5_Replace existing non-household meters with smart meters	2026

Table 2.3 Preferred demand-side options – Carlisle WRZ

Option Ref	Option Name	Year
WR619a	EMT-CRZ10_Replace existing household meters with smart meters	2026
WR658a	WSD-CRZ10_Free water efficiency devices (inside/internal)	2026
WR661a	WUA-CRZ15_Free water efficiency visits (households)	2028
WR677a	WUA-CRZ10_Non-household water efficiency programme	2026
WR685a	WER-CRZ5_Rainwater harvesting and water reuse (new builds)	2026
WR694d	WSA-CRZ15_Government intervention (e.g. water labelling)	2026
WR659a	WER-CRZ15_Free water efficiency devices (outside/external)	2048
WR669b	ISD-CRZ15_Flow regulators	2026
WR516a1	LEA-CRZ15_Mains rehabilitation/renewal/replacement	2038
WR502a	LEA-CRZ10_Permanent network sensors	2029
WR511a	LEA-CRZ5_Pressure management	2026
WR520a	LEA-CRZ5_DMA optimisation	2027
WR603a	EMT-CRZ5_Enhanced metering of households on single supplies (smart meters)	2026
WR615a	EMT-CRZ5_Replace existing non-household meters with smart meters	2026

Table 2.4 Preferred demand-side options – North Eden WRZ

Option Ref	Option Name	Year
WR603b	EMT-NERZ5_Enhanced metering of households on single supplies (smart meters)	2026
WR694e	WSA-NERZ15_Government intervention (e.g. water labelling)	2026

Option Ref	Option Name	Year
WR619b	EMT-NERZ10_Replace existing household meters with smart meters	2026
WR615b	EMT-NERZ5_Replace existing non-household meters with smart meters	2026

Drought Plan options

2.2.15 The options in the 2022 Drought Plan[15] are listed in **Table 2.5**. It should be noted that the HRA of the Drought Plan[16] concluded that it would have no likely significant effects, alone or in combination, on any European sites (i.e. all options were screened out).

Table 2.5 Options in the 2022 Drought Plan

Option	Resource Zone	Option Type	Summary
	CRZ	Supply side	
	SRZ	Drought permit	
	SRZ	Drought permit	
	SRZ	Drought permit	
	SRZ	Drought permit	
	SRZ	Drought permit	
	SRZ	Drought permit	
	SRZ	Drought permit	
	SRZ	Drought permit	
	SRZ	Drought permit	
	SRZ	Drought permit	

[15] https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/final-drought-plan-2022/final-drought-plan-2022.pdf

[16] https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/water-resources/uu-revised-draft-dp-hra-_300721.pdf

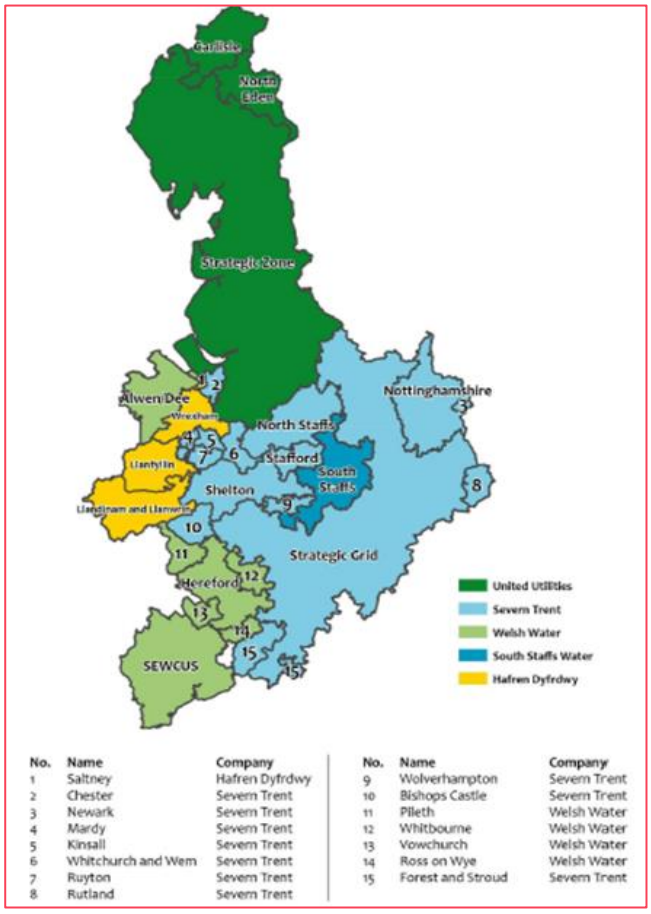
Option	Resource Zone	Option Type	Summary
[redacted]	SRZ	Drought permit	[redacted]
	NERZ	Drought permit	
	NERZ	Drought permit	
	NERZ	Drought permit	
Drought publicity	All zones	Demand side	Increased water efficiency messages via increased customer communications
Enhanced leakage detection and repair	All zones	Demand side	Enhanced leakage detection and repair activities targeted to appropriate areas and where greatest savings can be achieved.
Campaign for voluntary water use restraint	All zones	Demand side	Voluntary water use restrictions (applying to the general use of a hosepipe for domestic purposes) and statutory water use restrictions as set out in Section 76 of the Water Industry Act 1991 (as amended by Section 36 of the Flood and Water Management Act 2010)
Temporary Use Ban (TUB)	All zones	Demand side	Implemented when “experiencing, or may experience, a serious shortage of water for distribution”. Due to the level of connectivity a TUB would be applied across each of the WRZs rather than locally.
Ordinary Drought Order (Non-Essential Use Ban)	All zones	Demand side	Drought order to ban non-essential uses of water (as set out in the Drought Direction 2016)
Pressure management	All zones	Demand side	Reducing the pressure in certain parts of UU’s water network to help reduce demand.
Drought publicity	All zones	Demand side	Increased water efficiency messages via increased customer communications

CRZ – Carlisle Resource Zone
SRZ – Strategic Resource Zone
NERZ – North Eden Resource Zone

2.3 Relationship with the WRW Regional Plan and SROs

Regional Plan

2.3.1 The Water Resources West (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[17], Severn Trent Water (STW), South Staffordshire Water (SSW) and UUW (see figure to right).



No.	Name	Company
1	Saltney	Hafren Dyfrdwy
2	Chester	Severn Trent
3	Newark	Severn Trent
4	Mardy	Severn Trent
5	Kinsall	Severn Trent
6	Whitchurch and Wem	Severn Trent
7	Ruyton	Severn Trent
8	Rutland	Severn Trent
9	Wolverhampton	Severn Trent
10	Bishops Castle	Severn Trent
11	Pileth	Welsh Water
12	Whitbourne	Welsh Water
13	Vowchurch	Welsh Water
14	Ross on Wye	Welsh Water
15	Forest and Stroud	Severn Trent

2.3.2 These five companies, like all water companies in England Wales, are required[18] to prepare, maintain and publish a WRMP.

2.3.3 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.

2.3.4 Each water company is leading development of the WRMP and relevant aspects of the regional plan in the parts of their area included with WRW as a single piece of work. This has necessitated a high degree of integration and fostered greater collaboration between companies and stakeholders.

2.3.5 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 Strategic Resource Options[19] (SROs) being taken forward by the companies.

[17] At 1st July 2018, Hafren Dyfrdwy combined the water service area of Dee Valley Water and Severn Trent lying in Wales.

[18] Section 37 and 37A of Water Industry Act 1991, as amended by the Water Act 2003 and the Water Act 2014.

[19] The Strategic Water Resource Options (SROs) programme has been initiated by Ofwat to provide at least 1500Ml/d of water to areas of England facing a water deficit. The SRO Programme includes 17 schemes which will be funded and assessed during AMP7 to determine the right portfolio of projects to be selected by Regional Plans ready for implementation in AMP8. Schemes are evaluated at a series of decision points (Gates).

2.3.6 In March 2020, WRW published its Initial Resource Position[20]. This identified that by 2050, an estimated 166 million litres per day of additional water would be needed for public water supplies, and in the region of an additional 41 million litres per day needed for other abstractors. In an update[21] (published in February 2021) to its resource position, WRW noted that the need maybe greater than previously estimated. WRW published its Emerging Regional Plan[22] in January 2022. This updated the forecast, taking into account a commitment to achieve a 50% reduction in leakage from the public water supply network by 2050 and a per capita consumption reduction to 110 litres/person/day. The updated WRW forecast identified that 215Ml/d of new water would be needed to meet public supply demand by 2031 and that an additional 63Ml/d would be needed by 2050, for non-public water supply sectors.

2.3.7 On 14th November 2022, WRW published its Draft Regional Plan[23] for consultation which closed on 20th February 2023. The Draft Regional Plan identified that by 2050, the WRW region would need an additional 221 Ml/d to meet public water supply needs and 97 Ml/d to meet the needs of other sectors. To meet this demand, whilst also reflecting the needs of other regions, WRW's draft best value plan included:

- action to reduce daily water demand by over 900 million litres across the whole region. This included the Government introducing water labelling to save 280 Ml/d;
- STW delivering a large number of supply options to offset abstraction reduction for environmental improvement;
- UUW developing new water resources in the North West to support water transfers and provide benefit to customers in the North West, by reducing the frequency of temporary use bans (hosepipe bans);
- DCWW upgrading the network in South-East Wales and recovering losses from a water treatment works; and
- a range of options to take water resources towards WRW's environmental destination. This includes improving water quality and improving habitats.

2.3.8 Following the close of consultation on the Draft Regional Plan in February 2023, WRW has in conjunction with other regional groups completed a further round of supply demand reconciliation, reflecting post consultation changes and is now producing its Final Regional Plan for publication in Autumn 2023.

2.3.9 The final regional planning reconciliation round reconciled three pathways related to water trading:

- **Preferred pathway**: Includes Minworth Reuse SRO raw water flow augmentation to support the Grand Union Canal (GUC) Transfer SRO, selected from 2031 (50 Ml/d in 2031 increasing to 100 in 2040) – note, Minworth Reuse SRO and GUC SRO are options in the STW WRMP.

[20] WRW (2020) *Initial Resource Position, March 2020*. Available from https://waterresourceswest.co.uk/s/WRW-Initial-Resource-Position.pdf [Accessed August 2022].

[21] WRW (2021) *Update on our Resource Position, February 2021*. Available from https://waterresourceswest.co.uk/s/WRW-Update-on-Resource-Position-February-2021-web.pdf [Accessed March 2022].

[22] WRW (2022) Emerging Regional Plan, January 2022. Available from: https://static1.squarespace.com/static/5e67889204d86850e1fdcece/t/61e5a4e237970d62de92fa10/1642439906757/WRW+Emerging+Regional+Plan+Executive+Summary.pdf

[23] WRW (2022) Draft Regional Plan. Available from https://static1.squarespace.com/static/5e67889204d86850e1fdcece/t/6374bcc4bc2d9e543adfc90a/1668594894637/Draft+Regional+Plan+v1.1.pdf [Accessed May 2023].

- **WRSE higher demand scenario**: GUC with Minworth support selected from 2031 (50 Ml/d in 2031 increasing to 100 in 2040); Severn Thames Transfer (STT) SRO (500 Ml/d pipeline with support) selected from 2050.
- **WRSE no SESRO (South East Strategic Reservoir Option) scenario**: GUC with Minworth support selected from 2031 (50 Ml/d in 2031 increasing to 100 in 2040); STT SRO (500 Ml/d pipeline with support) selected from 2039.

2.3.10 UUW's Revised Draft WRMP24 preferred plan is consistent with the reconciled regional preferred pathway.

Strategic Resource Options

2.3.11 Two SROs are associated to some extent with the UUW supply area, the North-West Transfer (NWT) SRO and the Severn-Thames Transfer (STT) SRO.

2.3.12 Currently, UUW's Revised Draft WRMP24 is consistent with the reconciled regional preferred pathway. Under this pathway the NWT SRO only requires the three supply-side options that are in the Revised Draft WRMP24 (i.e. this version of the NWT SRO is essentially the same as the Revised Draft WRMP24), and the STT SRO is not deployed.

2.3.13 However, under the 'WRSE higher demand' and 'No SESRO' scenarios, additional water from [redacted] would be transferred to the Water Resources South East (WRSE) region via the STT SRO, requiring further sources of supply (from the constrained list of UUW WRMP24 options) to maintain supply resilience to UUW customers; the 'WRSE higher demand' and 'No SESRO' scenarios would require an additional four or five supply-side options respectively (i.e. seven or eight options in total). In these scenarios the NWT SRO would comprise two principal components:

- new sources to offset water transferred out of region from [redacted] as part of the STT SRO; and
- enabling works on the [redacted] to allow treated water from regional UU sources to be transferred by pumping into the [redacted] to maintain customer supplies (for transfer volumes greater than 75Ml/d).

2.3.14 It should be noted that there remains considerable uncertainty over the 'WRSE higher demand' and 'WRSE no SESRO' scenarios as these are dependent on confirmation from other water companies (who are managing future uncertainties relating to demand, climate change and environmental destination) and the reliability or acceptability of other large-scale options.

2.3.15 Importantly, decisions relating to implementation of these scenarios are also external to UUW's own decision making, including RAPID's gated decision-making process in respect of STT. Currently, STT is not part of any other water company revised draft WRMP24 preferred plan and so the NWT SRO scenario is fundamentally the same as the revised draft WRMP24 (i.e. three options).

2.3.16 Consequently, the NWT SRO as it might be delivered under 'WRSE higher demand' and 'WRSE no SESRO' scenarios is dependent on selection of STT in future planning cycles by other water companies and is a not a 'plan' or 'programme' that can be meaningfully assessed for in combination effects at this point (since substantial components of the assessment would be speculative, and the additional SRO options would not be required until 2043 at the earliest).

2.3.17 Note that the NWT SRO is currently being assessed as part of RAPID's gated process for SROs; this includes environmental compliance. The environmental compliance assessments, and the supporting investigations, are ongoing with the outcomes available

to inform the RAPID Gate 3 submission in 2024. In particular, **groundwater models for the Lower Mersey Basin and East Cheshire groundwater bodies are being developed and although initial outputs from these have been produced (Feb 2024), the models are still being tested and refined to ensure that they are robust. In consequence, a further update of the HRA to reflect the model outputs may be required once these are verified**; however, it should be noted that the emerging model data and preliminary outputs do not conflict with the conclusions of the HRA report.

3. Approach to HRA

The nature of the WRMP (a long-term strategic plan with specific projects) presents challenges for a 'strategic' or plan-level HRA and it is therefore important to understand how the WRMP is developed and hence how it might consequently affect European sites.

3.1 Key Guidance

3.1.1 The key guidance document for HRA of WRMPs is **UKWIR (2021). *Environmental Assessment Guidance for Water Resources Management Plans and Drought Plans*. UK Water Industry Research Limited, London**.

3.1.2 Other relevant guidance and case-practice includes:

- Regulators' Alliance for Progressing Infrastructure Development (2022). Strategic regional water resource solutions guidance for Gate 2.
- Defra (2021). *Policy paper: Changes to the Habitats Regulations 2017* [online]. Available at: https://www.gov.uk/government/publications/changes-to-the-habitats-regulations-2017/changes-to-the-habitats-regulations-2017 [Accessed March 2021].
- UK Government (2019). *Appropriate assessment: Guidance on the use of Habitats Regulations Assessment* [online]. Available at: https://www.gov.uk/guidance/appropriate-assessment [Accessed March 2021].
- Tyldesley, D. & Chapman, C. (2021). *The Habitats Regulations Assessment Handbook* [online]. DTA Publications Limited. Available at: https://www.dtapublications.co.uk/handbook/. [Accessed March 2021].
- UK Government (2023). Water resources planning guideline [online]. Available at: https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline [Accessed April 2023].
- Natural England (2020). *Guidance on how to use Natural England's Conservation Advice Packages in Environmental Assessments*. Natural England, Peterborough.
- European Commission (2018). *Managing Natura 2000 sites - The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*. European Union, 1-86.
- Defra (2012). *The Habitats and Wild Birds Directives in England its seas: Core guidance for developers, regulators & land/marine managers* [online]. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/82706/habitats-simplify-guide-draft-20121211.pdf. [Accessed March 2021].
- PINS Note 05/2018: *Consideration of avoidance and reduction measures in Habitats Regulations Assessment: People over* Wind, Peter Sweetman v Coillte Teoranta. [withdrawn].
- SNH (2019). SNH Guidance Note: *The handling of mitigation in Habitats Regulations Appraisal – the People Over Wind CJEU judgement* [online]. Scottish Natural Heritage. Available at: https://www.nature.scot/sites/default/files/2019-08/Guidance%20Note%20-%20The%20handling%20of%20mitigation%20in%20Habitats%20Regulations%20App

raisal%20-%20the%20People%20Over%20Wind%20CJEU%20judgement.pdf. [Accessed March 2021].

3.2 Application of HRA of WRMPs

Process Overview

3.2.1 European Commission guidance[24] and established case-practice suggests a four-stage process for addressing Articles 6(3) and 6(4), and hence Regulations 63 and 64 (see **Box 1**), although not all stages will necessarily be required:

Box 1 – Stages of HRA

Stage 1 – Screening or 'Test of significance'

This stage identifies the likely effects of a project or plan on a European site, either alone or 'in combination' with other projects or plans, and considers whether these effects are likely to be significant. The 'screening' test or 'test of significance' is a low bar, intended as a trigger rather than a threshold test: a plan should be considered 'likely' to have an effect if the competent authority is unable (on the basis of objective information) to exclude the possibility that the plan or project could have significant effects on any European site, either alone or in combination with other plans or projects; an effect will be 'significant' simply if it could undermine the site's conservation objectives. Note that mitigation measures should not be taken into account at the 'screening' stage, in accordance with the People over Wind (Court of Justice of the European Union (ECJ) Case C-323/17); this reinforces the idea of screening as a 'low bar' and makes 'appropriate assessments' more common.

Stage 2 – Appropriate Assessment (including the 'Integrity test')

An 'appropriate assessment' (if required) involves a closer examination of the plan or project where the effects on relevant European sites are significant or uncertain, to determine whether any sites will be subject to 'adverse effects on integrity' if the plan or project is given effect. The scope of any 'appropriate assessment' stage is not set, and the assessments will not be extremely detailed in every case (particularly if mitigation is clearly available, achievable, and likely to be effective). The assessments must be 'appropriate' to the effects and proposal being considered, and sufficient to ensure that there is no reasonable doubt that adverse effects on site integrity will not occur (or sufficient for those effects to be appropriately quantified should Stages 3 and 4 be required).

Stage 3 – Assessment of Alternative Solutions

Where adverse effects remain after the inclusion of mitigation, Stage 3 examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of European sites. A plan or project that has adverse effects on the integrity of a European site cannot be permitted if alternative solutions are available, except for imperative reasons of overriding public interest (IROPI; see Stage 4).

Stage 4 – Assessment Where No Alternative Solutions Exist and Where Adverse Impacts Remain

This stage assesses compensatory measures where it is deemed that there are no alternatives that have no or lesser adverse effects on European sites, and the project or plan should proceed for imperative reasons of overriding public interest (IROPI). The EC guidance does not deal with the assessment of IROPI, although the IROPI need to be sufficient to override the adverse effects on European site integrity, taking into account the compensatory measures that can be secured (which must ensure the overall coherence of the 'national site network'.

[24] *Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (EC 2002).

3.2.2 The stages in Box 1 (if required) are used to ensure compliance with the Habitats Regulations and so principally reflect the stepwise legislative tests applied to the final, submitted project or plan; **there is no statutory requirement for HRA (or its specific stages) to be completed for draft plans or similar developmental stages**.

3.2.3 Consequently there is flexibility for the HRA process to be run in a manner that provides maximum benefit for plan-development and sound decision-making, whilst still ultimately meeting the legislative tests.

3.2.4 In practice, HRAs of WRMPs usually have two functional components: they informally guide each water company as it considers which water resource options will be included in the published plan; and subsequently provide a formal assessment of the published WRMP against Regulation 63. A degree of separation between these functions is therefore sometimes necessary, and the rigid application of the stages in Box 1 to the emerging or interim stages of strategic plans[25] is not always appropriate, reducing the clarity and usefulness of the HRA as a plan-shaping process for both plan-makers and consultees. For WRMPs this is especially true for the assessment of the emerging feasible options and the application of the 'People over Wind' (PoW)[26] case.

3.2.5 Therefore, whilst the principles of HRA have been applied to the emerging WRMP and the feasible options **the specific tests associated with Regulation 63 are applied to the preferred programme of options only**. The overarching HRA *process* for the WRMP has therefore included the following key steps:

- An initial **'risk review' of the supply-side**[27] **feasible options**, to assist UUW's selection of constrained options (i.e. 'HRA as a process'). The review of the feasible options applied the normal principles and practices associated with 'HRA screening' but also took account of the deliverability of the options including potential mitigation opportunities[28] (for clarity, this review process is not documented in this report since the scope of some options has changed in response to the review).
- The **assessment of the preferred programme of options** against the provisions of Regulation 63, comprising formal 'screening' and an 'appropriate assessment' designed to meet the legislative tests (this report).

[25] Particularly those (such as WRMPs) where the guideline HRA stages do not map easily on to the agreed or statutory stages in the plan development process.

[26] *People Over Wind and Sweetman v Coillte Teoranta* (C-323/17)

[27] Demand-side options designed to reduce treated water use (such as metering, provision of water butts or leakage reduction options) are not systematically reviewed at this stage as they are invariably generic and geographically unspecified activities or groups of actions that cannot negatively affect any European sites (or be meaningfully assessed at the strategy level). Since they will form part of the adopted WRMP they are formally subject to Regulation 63 as part of the final HRA, but this is typically a simple screening exercise or 'down-the-line' deferral, depending on the nature of the option.

[28] Applying a PoW-compliant 'screening' assessment to the feasible options would have little value for plan-development since mitigation opportunities, including effective and well-established measures for marginal effects, would be ignored. All options with 'likely significant effects' would therefore be treated equally, with no distinction between options that would (from an HRA perspective) be easily achievable in practice and those that would be extremely challenging or impossible. The review of the feasible options is not therefore intended to be, or replicate, a formal and fully compliant 'HRA screening' or be a 'draft HRA' or similar. It takes a broad view of the 'HRA-related risk' associated with an option that captures both the risk to UUW and the delivery of the WRMP within the statutory timescales (for example, the data collection required to definitively demonstrate that an option is acceptable might not be achievable in the time available for delivery of the WRMP) and the risks of the option to European site integrity (i.e. where adverse effects would appear to be an unavoidable outcome of the option as presented). The terminology intentionally reflects a typical RAG risk assessment to provide clarity for UUW and to avoid the perception of premature assessment conclusions.

Key Challenges and Assumptions

3.2.6 The fundamental nature of the WRMP (a long-term strategic plan with specific projects) presents a number of distinct challenges for a 'strategic' or plan-level HRA and it is therefore important to understand how the WRMP is developed, its objectives, and hence how it might consequently affect European sites.

Uncertainty and plan-level mitigation

3.2.7 HRAs of plans and strategies typically have to deal with a degree of uncertainty; very often, it is not possible to provide a detailed assessment of the effects of a proposal as many aspects simply cannot be fully defined at the strategy-level in the planning hierarchy. This is particularly true for options that will only be required over longer-term planning horizons, which are inevitably less defined than options that are required in the near term.

3.2.8 Where the available information is fundamentally insufficient to complete a meaningful appropriate assessment, then case-practice (both for WRMPs and strategic plans in general) suggests some assessment may be deferred 'down the line' to a lower planning tier provided that certain criteria are met.

3.2.9 This is usually only appropriate where there is sufficient certainty that the proposal can (with the implementation of established scheme-level measures that are known to be effective) avoid adverse effects on the integrity of European sites; and/or if appropriate investigation schemes are identified to resolve the uncertainty and commitments are made within the plan to not pursue an option if adverse effects are identified through these investigations.

3.2.10 Case-practice in WRMP HRAs[29] and the WRPG indicates that it may be acceptable to include Preferred Programme options with residual uncertainties provided that:

- there is sufficient flexibility within the terms of the WRMP to ensure adverse effects can be avoided at the project level (e.g. the plan does not dictate specific pipeline routes or yields that cannot be deviated from); and/or
- the option is not required within the first five years of the plan period, so allowing time for additional investigations to be completed; and
- the uncertainty that this creates is mitigated at the plan-level by the inclusion of alternative options which:
  - will meet the required demand / deficit should the Preferred Programme option prove to have an unavoidable risk of adverse effects on the European sites in question; **and**
  - will not themselves have any adverse effect on any European sites.

3.2.11 Note, this is not intended to provide a mechanism for the inclusion of options where there appears to be no reasonable way of avoiding adverse effects. It should be noted that this flexibility is perhaps desirable in any case, since it is possible that a 'no adverse effect' option might be subsequently proven to have adverse effects when brought to the design stage. This approach allows for the WRMP to be compliant with the Habitats Regulations, since certainty over outcomes for the plan as a whole is provided.

3.2.12 However, it is important to note that some uncertainties will remain (particularly with regard to 'in combination' effects) and for some options it will only be possible to fully

[29] For example, in relation to UU's WRMP14.

assess any potential effects at the pre-project planning stage, when certain specific details are known; for example: construction techniques; site specific survey information; the precise timing of implementation; or the status of other projects that may operate 'in combination'. In addition, it may be several years before an option is employed, during which time other factors may alter the baseline or the likely effects of the option.

WRMP development parameters and relevance to HRA

3.2.13 The modelling underpinning the WRMP development and option selection process incorporates several assumptions that influence and are relevant to the scope of the HRA.

Existing Consents

3.2.14 Regulation 9 of the Habitats Regulations requires that "…*a competent authority, in exercising any of its functions, must have regard to the requirements of the Directives so far as they may be affected by the exercise of those functions*".

3.2.15 For existing abstraction licences and their consideration in WRMPs, the requirements of Reg. 9 are met by the Environment Agency, Natural Resources Wales and the water companies through the licence review arrangements and protocols that are implemented at the start of each WRMP cycle, which also take account of the Environment Agency's or Natural Resources Wales' requirements through the Water Industry National Environment Programme (WINEP) and National Environment Programme (NEP) respectively. This review process (and WINEP) is undertaken in conjunction with Natural England, which identifies protected sites (including European sites) to the EA where it believes abstraction-related issues are affecting the achievement of favourable conservation status.

3.2.16 This review is important to the development of the supply forecast at the start of the WRMP process and is consequently reflected in Section 5.4 ('*Developing Your Supply Forecast*') of the Water Resource Planning Guideline (2020 draft and 2023 published versions) which outlines the requirements for sustainable abstraction taking into account existing statutory requirements and environmental destination. Any required licence amendments are factored into the supply-deficit calculations, and the EA or NRW will have confirmed those licences that are considered valid for the planning period when the WRMP modelling is undertaken.

3.2.17 The supply forecast informs the supply-demand balance calculations for the planning period, which is in effect the 'predicted future baseline' for water resources in a supply area. The water company then develops 'options'[30] for resolving any predicted deficits in the supply-demand balance, which are then tested against various metrics to determine the 'preferred plan'.

3.2.18 Consideration of the existing consenting regime in relation to European sites is noted in the WRPG (2020 draft and 2023 published versions) solely in relation to the development of the supply forecast (Section 5.4), and not in those sections of the guidance that explicitly consider the application of HRA to the WRMP; and whilst the 2023 guidelines refer to "*Your plan, including any options within it…*" in relation to the Habitats Regulations, all references to HRA (as both a process and legislative test) are explicitly and/or implicitly linked to the options identified by the WRMP. Consequently, the WRMP HRA addresses Regulation 63 of the Habitats Regulations and necessarily focuses on the assessment of the additional effects that the WRMP introduces over the predicted future

[30] Note that all references to WRMP 'options' in the WRPG are made in the commonly-accepted sense, i.e. explicit interventions proposed by the WRMP to increase water supply or reduce consumption (e.g. Section 1.1), not a broad 'catch all' for ongoing water company operations such as those existing abstractions that will form part of the 'predicted future baseline'.

baseline (i.e. the supply forecast determined at the start of the WRMP process that takes account of the agreed sustainability reductions and any that are reasonably anticipated).

3.2.19 Therefore, the HRA of the WRMP is necessarily a forward looking assessment of the specific options (feasible and preferred) proposed by the WRMP to resolve deficits; it does not (and cannot) re-litigate the existing licences agreed for the planning period (and hence the WRMP supply-demand baseline) since there has to be a starting point / basis for the WRMP (i.e. the modelling / optioneering process cannot start with the assumption that no current consents are reliable; and the HRA of the WRMP does not and cannot determine the licensing baseline from which the supply-demand balance is calculated).

3.2.20 In some instances, when considering water that may be available from existing sources, consultees have indicated that consideration of 'recent actual' abstraction is more appropriate than the currently licenced maximum, particularly for waterbodies that are considered 'over-licensed'; it is understood that these licences have been identified to UUW during the plan-development process and factored into the supply-demand balance calculations.

Regional Growth

3.2.21 The WRMP supply-demand balance modelling takes account of predicted local and regional growth when identifying risk areas and potential solutions, based (*inter alia*) on Local Plans and population growth models. Likewise, the modelling accounts for climate change. 'In combination' effects with population growth that may be related to land-use plans are therefore inherently considered and accounted for as part of the WRMP option development process (i.e. an option that does not account for local growth is not a solution) and this can be relied on by the HRA; the HRA considers the potential for 'in combination' effects with specific proposals within Local Plans (and similar), such as major site allocations, but does not (and cannot) attempt to model an alternative 'population growth' scenario to somehow test against specific options.

In combination effects with SROs

3.2.22 With regard to schemes involving multiple water companies (particularly some SROs) the assessment will necessarily focus on those European sites directly exposed to the activities proposed and managed by UUW, rather than sites that will only be affected by those scheme elements proposed and managed by other water companies; i.e. when undertaking the 'in combination' assessment of a scheme that appears in multiple plans the effects from source/donor will be considered distinct from supply/beneficiary.

3.2.23 For example, the source/donor plan will only consider the implications of the abstraction, etc on relevant European sites and water bodies within its catchment (and downstream catchments where relevant), and the supply/beneficiary plan would consider any implications on European sites / water bodies from the application of the supplied water within its catchment/s[31]. This approach is intended to ensure unnecessary duplication is avoided, and pragmatism will be applied to address indirect, downstream effects and effects on functional habitat.

3.2.24 In addition, as noted in **Section 2.3**, there remains considerable uncertainty whether the 'WRSE higher demand' or 'WRSE no SESRO' scenarios will be required proceed, as it is dependent on confirmation from other water companies and the reliability or acceptability of other large-scale options. Importantly, decisions relating to implementation of the

[31] Note: for the Severn Thames transfer we would expect the in-combination assessment of impacts on the Severn to feature in both WRW and WRSEs plans. This is due to the complex interaction of releases and abstractions particular to this scheme.

scenarios are also external to UUW's own decision making, including RAPID's gated decision-making process in respect of STT.

3.2.25 Currently, STT is not part of any other water company revised draft WRMP24 preferred plan and so the NWT SRO scenario is fundamentally the same as the revised draft WRMP24 (i.e. three options).

3.2.26 Consequently, the NWT SRO as it might be delivered under 'WRSE higher demand' and 'WRSE no SESRO' scenarios is dependent on selection of STT in future planning cycles by other water companies and is a not a 'plan' or 'programme' that can be meaningfully assessed for in combination effects at this point (since substantial components of the assessment would be speculative, and the additional SRO options would not be required until 2043 at the earliest). Note that any such in combination effects will be addressed by the forthcoming SRO Gate 3 investigations (this includes additional groundwater modelling, water quality, ecological and hydrological monitoring and fish pass assessments) and in future WRMP cycles.

3.3 HRA of the Preferred Options

Geographical Scope

3.3.1 'Arbitrary' buffers are not generally appropriate for HRA. However, as distance is a strong determinant of the scale and likelihood of effects, the application of a suitably precautionary study area (based on a thorough understanding of both the options and European site interest features) has some important advantages due to the number of options and the benefits of a consistent approach:

- using buffers allows the systematic identification of European sites using GIS, so minimising the risk of sites or features being overlooked;
- it ensures that sites for which there are no reasonable impact pathways can be quickly and transparently excluded from any further screening or assessment; and
- when assessing multiple options it provides a consistent point of reference for consultees following the assessment process, and the 'screening' can therefore focus on the assessment of effects, rather than on explaining why certain sites may or may not have been considered in relation to a particular option.

3.3.2 Professional experience and case-practice relating to typical water industry schemes demonstrates that environmental changes associated with construction in terrestrial environments are rarely notable more than 2 km from a source, and the UKWIR (2021) guidance includes accepted 'zones of influence' for certain aspects (for example, noise impacts would almost never be significant over 1km from the source). Operational effects can extend further, depending on the scale and nature of the option, and so an intentionally precautionary overarching assessment scope has been used as a starting point for the assessment; this includes:

- All European sites that are within 20km of any operational facilities or new infrastructure required to deliver each option (including temporary infrastructure)). This is an intentionally large buffer that can also reliably capture the vast majority of possible interactions with 'mobile species' in terrestrial environments.
- All European sites that are downstream of any operational facilities or new infrastructure required to deliver each option (including temporary infrastructure)), or upstream sites that support migratory fish (no distance thresholds). This reflects the potential for hydrological impacts to operate over greater distances, and to address the potential for catchment-scale in combination effects from operation.

3.3.3 These parameters are used as a starting point for identifying potentially exposed sites. It is not a 'hard buffer' and in some instances it may be appropriate to consider more distant sites[32]; however, unless otherwise noted, sites over 20km from the options that are not hydrologically linked and which do not support wide-ranging mobile species are typically considered sufficiently remote such that any environmental changes will be effectively nil, and so there will be 'no effects' on sites beyond this distance (and so no possibility of 'in combination' effects).

3.3.4 The European sites and interest features considered potentially exposed to the outcomes of the WRMP are listed in **Appendix A**.

Data Collection

European site data collection and conservation objectives

3.3.5 The screening and appropriate assessment stages take account of the baseline condition of the European sites and their interest features[33], including (where reported) data on

- the site boundaries and the boundaries of the component SSSIs;
- the conservation objectives;
- information on the attributes of the European sites that contribute to and define their integrity;
- the condition, vulnerabilities and sensitivities of the sites and their interest features, including known pressures and threats;
- the approximate locations of the interest features within each site (if reported); and
- designated or non-designated 'functional habitats' (if identified).

3.3.6 These data were derived from:

- the most recent JNCC-hosted GIS datasets;
- the Standard Data forms for SACs and SPAs and Information Sheets for Ramsar sites;
- Article 12 and 17 reporting;
- the published site Conservation Objectives;
- Supplementary Advice to the conservation objectives (SACO) where available[34];

[32] For example, where an option is likely to directly affect the marine environment (e.g. through desalination schemes) and so potentially result in environmental changes that could coincide with areas used by wide-ranging marine species; however, wide-ranging marine / marine dependent species associated with marine sites that are not directly connected to the hydrological zone of influence are not typically considered to be both sensitive and exposed to the effects of the options.

[33] The interest features are taken to be the qualifying features; and other within-site features that may be relevant to site integrity, particularly 'typical species' (for SACs) and within-site supporting habitats for SPAs. 'Functional land' would not usually be considered an interest feature of the site (although it may be important to the integrity of some interest features).

[34] NE has published '*Supplementary advice on conserving and restoring site features*' for most European sites in England which describe in more detail the range of ecological attributes which are most likely to contribute to a site's overall integrity, and the targets each qualifying feature needs to achieve in order for the site's conservation objectives to be met.

- Site Improvement Plans (SIPs);
- Core Management Plans (Wales); and
- the supporting Site of Special Scientific Interest's favourable condition tables where relevant and where no SACOs applicable to the features are available.

3.3.7 Note:

- For SPAs, the qualifying features are taken as those identified on the most recent JNCC datasets and citations where these post-date the 2nd SPA Review (i.e. it will be assumed that any amendments suggested by the SPA review have been made) unless otherwise identified to us by NE or NRW; any site-specific issues relating to the SPA Review can be addressed in the screening and appropriate assessment of the preferred options (see below).
- The conservation objectives for Ramsar sites are taken to be the same as for the corresponding SACs / SPAs (where sites overlap); SSSI Definition of Favourable Condition Tables (FCTs) will be used for those features not covered by SAC/SPA designations.

3.3.8 Where possible the site data are used to identify other features that may be relevant to site integrity, particularly '**typical species**' (for SACs), within-site **supporting habitats**, and designated or non-designated '**functional habitats**'.

3.3.9 A '**typical species**' is broadly described by EC guidance as being any species (or community of species) which is particularly *chara*cteristic of, confined to, and/or dependent upon the qualifying Annex I habitat feature at a particular site. This may include those species which:

- are critical to the composition or structure of an Annex I habitat (e.g. constant species identified by the National Vegetation Classification (NVC) community classification);
- exert a critical positive influence on the Annex I habitat's structure or function (e.g. a bioturbator (mixer of soil/sediment), grazer, surface borer or predator);
- are consistently associated with, and dependent upon, the Annex I habitat feature for specific ecological needs (e.g. feeding, sheltering), completion of life-cycle stages (e.g. egg-laying) and/or during certain seasons/times; or
- are particularly distinctive or representative of the Annex I habitat feature at a particular site.

3.3.10 Within-site **supporting habitats** are those which support the population(s) of the qualifying species and which are therefore critical to the integrity of the feature.

3.3.11 '**Functional habitats**' are generally taken to be habitats or features outside a European site boundary that are important or critical to the functional integrity of the site habitats and / or its interest features. These might include, for example:

- 'buffer' areas around a site (e.g. dense scrub areas preventing public access; areas of land that reduce the effects of agricultural run-off; etc.);
- specific features or habitats relied on by mobile species during their lifecycle (e.g. high-tide roosts for waders; significant maternity colonies for bats known to hibernate within an SAC; areas that are critical for foraging or migration; etc).

3.3.12 **Conservation Objectives** benchmark Favourable Conservation Status (FCS) for each feature. Guidance[35] from the UK Statutory Nature Conservation Bodies (SNCBs) provides a broad characterisation of FCS, stating that it "*relates to the long-term distribution and abundance of the populations of species in their natural range, and for habitats to the long-term natural distribution, structure and functions as well as the long-term survival of its typical species in their natural range. It describes a situation in which individual habitats and species are maintaining themselves at all relevant geographical scales and with good prospects to continue to do so in the future*".

3.3.13 The conservation objectives for European sites in England have been revised by Natural England in recent years to improve the consistency of assessment and reporting. As a result, the high-level conservation objectives for all sites are effectively the same:

3.3.14 For SACs in England:

- *With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features'...), and subject to natural change; ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring* [as applicable to each site];
  - *The extent and distribution of the qualifying natural habitats;*
  - *The extent and distribution of the habitats of qualifying species;*
  - *The structure and function (including typical species) of the qualifying natural habitats;*
  - *The structure and function of the habitats of qualifying species;*
  - *The supporting processes on which the qualifying natural habitats rely;*
  - *The supporting processes on which the habitats of qualifying species rely;*
  - *The populations of qualifying species; and,*
  - *The distribution of qualifying species within the site*.

3.3.15 For SPAs in England:

- *With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features'...), and subject to natural change; ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:*
  - *The extent and distribution of the habitats of the qualifying features;*
  - *The structure and function of the habitats of the qualifying features;*
  - *The supporting processes on which the habitats of the qualifying features rely;*
  - *The population of each of the qualifying features; and*
  - *The distribution of the qualifying features within the site*.

3.3.16 NE has published '*Supplementary advice on conserving and restoring site features*' for most sites, which describe in more detail the range of ecological attributes which are most

[35] JNCC (2018). *Favourable Conservation Status: UK Statutory Nature Conservation Bodies Common Statement* [online]. Available at: https://data.jncc.gov.uk/data/b9c7f55f-ed9d-4d3c-b484-c21758cec4fe/FCS18-InterAgency-Statement.pdf. [Accessed March 2022].

likely to contribute to a site's overall integrity, and the minimum targets each qualifying feature needs to achieve in order to meet the site's conservation objectives. These are considered at the screening and appropriate assessment stages, as necessary.

3.3.17 In Wales, the Regulation 37 advice and Core Management Plans for the SACs and SPAs set out conservation objectives that benchmark Favourable Conservation Status (FCS) for each feature. For the Welsh European sites the conservation objectives comprise a 'vision' for the feature (the key component of the objective) and (where relevant) performance indicators by which the objectives may be measured. These are used and referred to as necessary within the assessment but are not generally reproduced in this report.

3.3.18 The conservation objectives for Ramsar sites are taken to be the same as for the corresponding SACs / SPAs (where sites overlap); where Ramsar sites do not coincide with an SAC or SPA, or where the Ramsar features are not ecologically coincident with SAC or SPA features, the conservation objectives and definitions of favourable condition for the underlying SSSIs are used.

3.3.19 **The conservation objectives are considered at both screening and appropriate assessment stages, but are not explicitly reproduced in this report** as (a) they are freely available online and (b) the narrative nature of many of the conservation objectives can be challenging to co-opt in a clear and concise manner; the assessments therefore focus on the key conservation objectives that might be undermined by an option, rather than attempting to exhaustively document the assessment of an option against all conservation objectives for all features. Information on the sensitivities of the interest features also informs the assessment.

Water resources baseline data

3.3.20 Information on the water resources baseline in the region is drawn from other assessment reports (e.g. the WFD), UUW (e.g. groundwater (GW) and surface water (SW) abstraction locations, source operational parameters, WRZ operation, emergency or drought plan operations) and the EA (Public Water Supply (PWS) and other GW/ SW abstractions, C Catchment Abstraction Management Strategy (CAMS) or Abstraction Licensing Strategy (ALS) documentation).

3.3.21 Note, unless otherwise stated by the EA during the options development process, it is assumed that the relevant CAMS / ALS documents are correct and reliable, and that there is 'water available' where this is confirmed by the CAMS / ALS (or independently by the EA).

Option data

3.3.22 Information on the preferred options is provided by UUW. This includes an outline of how the option will function, including the intended outcomes (design yields/capacities); and the scheme delivery requirements, including the type and indicative location of any permanent or temporary infrastructure.

3.3.23 It should be noted that the location of some scheme aspects cannot always be established at the WRMP level: whilst some elements may be clear (for example, new plant will often be located within or close to existing water company assets) the exact routes of pipelines (etc.) cannot be finalised at this stage. In most instances an indicative design route is provided for option costing purposes, which has been informed by the feasible options review process at the stage (i.e. in most cases direct impacts on designated sites would be avoided if possible). However, it should be recognised that the options are not fixed proposals for delivery that cannot be deviated from, and there will be

many aspects (particularly relating to construction) that cannot be defined at the strategy level ahead of scheme-specific investigations (e.g. the location of any temporary enabling works; precise locations for additional materials storage; etc.)).

Preferred Options Assessment

Overview

3.3.24 For each option (or group of options, as appropriate), the assessment comprises:

- a 'screening' to identify those options that cannot have significant effects due to the fundamental nature of the option (this might include, for example, options that are designed to reduce demand but which do not involve any direct physical changes, such as education programmes to reduce water use);
- a 'screening' of European sites within the study area to identify those sites and features where there will self-evidently be 'no effect', 'no likely significant effects', or positive effects due to the option[36], and those where significant effects are likely or uncertain; and
- an 'appropriate assessment' of any European sites where significant effects cannot be excluded (this may include 'down-the-line' deferral of some options in accordance with established HRA practice, where appropriate).

3.3.25 As noted, the conservation objectives are considered at both screening and appropriate assessment stages, but are not explicitly reproduced in this report.

General Assumptions

3.3.26 Most environmental changes associated with construction and operation will have an inherent range over which they naturally attenuate[37], and many interest features will have little or no sensitivity to the likely magnitude of the environmental changes expected as the result of an option. Broad or universal assumptions that can be robustly applied to the assessments of the individual options or interest features are set out in **Appendix B**.

3.3.27 In addition:

- It is assumed that all normal licensing, consenting and management procedures will be employed at option delivery and throughout operation, and that established best-practice avoidance and mitigation measures will be employed throughout scheme design and construction to safeguard environmental receptors, including European site interest features. The HRA will not therefore assess speculative or hypothetical effects based on assumptions of non-compliance (e.g. accidental spillages of treatment chemicals from a new WTW).
- Guidance from the EA suggests that significant direct effects on groundwater dependent terrestrial ecosystems (GWDTEs) from drawdown associated with abstraction are unlikely for European sites over 5 km from the abstraction (*National EA guidance: Habitats Directive Stage 2 Review: Water Resources Authorisations – Practical Advice for Agency Water Resources Staff*).

[36] Note, for options with 'no effects' or positive effects there is no possibility of 'in combination' effects.

[37] For example, construction noise will almost invariably be indistinguishable from background levels over 600m from the source due to natural attenuation alone; several studies have demonstrated that visual disturbance of wading birds by construction plant or personnel is inconsequential over ~500m.

Screening

3.3.28 The screening identifies possible effects on European sites based on:

- the anticipated operation of each option and predicted hydrological zone of influence;
- the anticipated scope of any construction or enabling works required for each option;
- the European site interest features and their sensitivities; and
- the exposure of the site or features to the likely effects of the option (i.e. presence of reasonable impact pathways, taking into account species mobility and the likelihood of functional habitats being affected[38]).

3.3.29 The screening therefore identifies:

- those European sites where significant effects are considered likely as the result of an option;
- those European sites where significant effects are considered uncertain as the result of an option;
- those European sites where significant effects were considered unlikely (alone) as the result of an option (but where in combination effects might still be possible); and
- those options that will have no effects on any European sites due to their nature or location (and hence no possibility of 'in combination' effects).

3.3.30 The 'low-bar' principle is used for the screening of the preferred options[39]; in general, unless the possibility of significant effects can be simply and self-evidently excluded then an 'appropriate assessment' is completed (rather than a more detailed 'secondary screening' or similar). This applies to the options alone and in combination (i.e. unless it is evident that there will be 'no effects' from any options the possibility of 'in combination' effects is not excluded and these are taken forward to 'appropriate assessment'). This approach simplifies the overall assessment and ensures procedural clarity.

3.3.31 The 'low bar' approach is consistent with the 'People Over Wind'[40] case law, which requires that mitigation not be considered at screening. Historically, HRAs of plans typically assumed that established best-practice avoidance and mitigation measures (see **Appendix C**) would be employed at the project level to safeguard environmental receptors, including European site interest features, and accounted for this at the screening stage. However, it is arguable that an assumption such as this, albeit in relation to a lower-tier project that would itself be subject to HRA, might constitute an 'avoidance measure' that the WRMP is effectively relying on to ensure that significant effects do not occur.

3.3.32 In this instance, therefore, mitigation measures (including the established best-practice avoidance and mitigation measures noted in **Appendix C**) are not taken into account at screening, but are instead introduced at the 'appropriate assessment' stage (if required).

[38] With regard to functional habitat, it should be noted that field investigations would not be undertaken for a plan-level assessment except in very exceptional circumstances, and so specific areas of 'functional habitat' may not be identifiable for assessment at the plan level unless explicitly noted in the site documentation.

[39] The low-bar nature of the screening test is characterised in case-law (*C-258/11 - Sweetman and Others*) as '*should we bother to check?*' – i.e. is a closer examination of possible effects required (i.e. appropriate assessment) or can effects self-evidently be excluded as nil or entirely nugatory?

[40] Case *C 323/17 Court of Justice of the European Union: People Over Wind*

Appropriate Assessments

3.3.33 The ‘appropriate assessments’ are an extension of the assessment processes undertaken at the screening stage, with significant effects (or areas of uncertainty) examined to determine whether there will be any adverse effects on the integrity of any European sites taking into account the conservation objectives.

3.3.34 The presentation of the assessments depends on the nature of the options and European sites that might be exposed to effects. In this case the assessments are ‘European site led’ (i.e. each assessment section relates to a specific European site), rather than being ‘option by option’; this tends to simplify the ‘in combination’ assessment and minimises repetition of information relating to the interest features / sensitivities (etc.) of the sites).

3.3.35 Shared evidence applicable to multiple sites or features (for example, in relation to birds and construction noise) are provided in appendices to reduce repetition.

3.3.36 The appropriate assessments are ‘appropriate’ to the nature of the WRMP as a strategic plan, the option under consideration, and the scale and likelihood of any effects; for example, exhaustive examination of feature sensitivities and possible effect pathways is not undertaken for options that would have previously been ‘screened out with mitigation’ if there is a high degree of confidence in the mitigation measures. The assessments include inter-option ‘in combination’ assessments.

3.4 Plan-Level In Combination Assessments

3.4.1 HRA requires that the effects of other projects, plans or programmes be considered for effects on European sites ‘in combination’ with the WRMP. There is limited guidance on the precise scope of ‘in combination’ assessments for strategies, particularly with respect to the levels within the planning hierarchy at which ‘in combination’ effects should be considered, although guidance is provided by the ACWG.

3.4.2 Broadly, it is considered that the UUW WRMP could have the following in combination effects:

- Within-plan effects, i.e. separate options within the WRMP affecting the same European site(s); these are addressed as part of the Option assessment process outlined above.
- Between-plan abstraction effects, i.e. effects with other abstractions, in association with or driven by other plans (for example, other water company WRMPs);
- Other between-plan effects, i.e. 'in combination' with non-abstraction activities promoted by other plans – for example, with flood risk management plans.
- Between-project effects, i.e. effects of a specific option with other specific projects and developments.

3.4.3 In undertaking the ‘in combination’ assessment it is important to note the following:

- The WRMP development process explicitly accounts for land-use plans, growth forecasts and population projections when determining future treatment and water management requirements.
- The detailed examination of non-water company consents for ‘in combination’ effects can only be undertaken by the EA or NRW through their permitting procedures.
- Likely water resource demands of known major projects are also taken into account during the development of the WRMPs, unless otherwise noted.

3.4.4 Therefore:

- It is considered that (for the HRA) potential 'in combination' effects in respect of water-resource demands associated with known plans or projects will not occur since these demands are explicitly considered when developing the WRMP and its associated and related plans (including the SROs). The main exception to this is other water company WRMPs, which are developed concurrently.
- With regard to other strategic plans, the list of plans included within the SEA of the emerging UUW WRMP is used as the basis for a high-level 'in combination' assessment. The SEA is used to provide information on themes, policies and objectives of the 'in combination' plans, with the plans themselves examined in more detail as necessary. Plans are obtained from the SEA datasets or internet sources where possible.
- With regard to projects:
  - The WRMP development process explicitly accounts for the water-resource demands of known major projects (e.g. power station decommissioning; large-scale housing development) during its development, and so these 'in combination' effects are not considered in detail.
  - Potential 'in combination' effects between individual options and Nationally Significant Infrastructure Projects (NSIPs) identified by The Planning Inspectorate, and other known major projects, are assessed.
  - It is not possible to produce a definitive list of minor existing or anticipated planning applications within the zone of influence of each proposed option to review possible local 'in combination' effects. The nature of the WRMP and the timescales over which it operates ensure that generating a list of local planning applications at this stage would be of very little value, and this aspect can only be meaningfully undertaken at the scheme-level.

4. Preferred Options Screening

The ‘screening’ adopts a low-bar approach; in general, unless the possibility of significant effects can be simply and self-evidently excluded then an ‘appropriate assessment’ is completed (rather than a more detailed ‘secondary screening’ or similar). This applies to the options alone and in combination.

4.1 Demand-side options

4.1.1 The demand side options are summarised in **Tables 2.3 – 2.5**, Section 2. Whilst their application and requirements are slightly different in each WRZ, they essentially comprise the following generic option types:

- Physical amendments to the network:
  - District Metered Area (DMA) optimisation (reducing the size of DMAs through network interventions to improve the detection of smaller leaks);
  - Flow regulators (installation of flow restrictors and pressure reducing valves);
  - In-pipe repairs and lining technologies (typically non-invasive);
  - Mains rehabilitation/renewal/replacement (typically invasive);
  - Permanent network sensors (installation of acoustic loggers within assets);
  - Pressure management (reduces leakages);
  - Enhanced metering of households (smart meters);
  - Upgrade existing household meters to smart meters;
  - Non-household (NHH) smart meters;
  - Upstream tile optimisation (installation of larger meters ‘upstream’ in the supply network to improve monitoring of network losses).
- Water efficiency support:
  - Free water efficiency audits for households;
  - Free water efficiency devices (internal or external) for households;
  - Government intervention (water labelling, standards);
  - Non-household water efficiency programmes;
  - Rainwater harvesting and water reuse (new builds).

4.1.2 Of these, the 'water efficiency support' options cannot have significant effects due to the nature of the option (based on established guidance for similar policies and proposals in strategic planning documents that do not promote development[41]).

4.1.3 The remaining demand-side options are likely to require some form of physical intervention or amendment to the network. The works required for the vast majority of these options will be very minor (e.g. meter installation) with virtually no risk of significant effects on European sites. In some instances effect pathways might be conceivable (for example, a hypothetical leaking pipe might be located in or near a European site), but it is not possible to predict or identify specific locations where such measures might be applied and so effects on specific European sites cannot be identified.

4.1.4 Non-specific residual risks such as these can almost always be avoided with established scheme-level mitigation measures and it is very unlikely that significant or significant and adverse effects as the result of a particular demand-side measure would be unavoidable at the scheme level; however, these options are carried forward to the 'appropriate assessment' stage for procedural reasons and to avoid potential conflict with the 'People over Wind' case.

4.2 Supply-side options

4.2.1 The initial 'alone' screening assessments for each preferred portfolio option are set out in **Tables 4.2 – 4.15** below, and summarised by option in **Table 4.16**. In summary, the assessment aims to identify those European site features that are potentially vulnerable to a particular option – i.e. which have features that are both exposed and sensitive to the likely outcomes (see **Table 4.1**), taking into account the baseline for the site including the conservation objectives. Features that are both exposed and sensitive to an environmental change are assumed to be subject to 'likely significant effects' unless there is a clear over-riding reason why significant effects cannot occur.

Table 4.1 Summary of screening criteria

LSE?	Notes
0	Sites or features that are not exposed to the effects of an option via any reasonable impact pathways and so there will be 'no effect' (hence no risk of 'in combination' effects)
No (N)	Sites or features that are potentially exposed and sensitive to the predicted environmental changes, but where effects are not considered significant (alone) due to their scale, nature etc. based on the information within the EARs and other contextual assessment information.
Uncertain (U)	Sites or features where a potential effect is clear and identifiable, which cannot be self-evidently excluded and which require additional consideration through 'appropriate assessment' (including options relying on mitigation to ensure significant effects do not occur).
Yes (Y)	Sites or features where significant effects are very likely or certain due to the scale/nature of the option proposals, or the vulnerability and distribution of the interest features on the European site. Adverse effects may be more likely and there is more certainty that (at scheme level) the option would have to rely on specific mitigation or compensation rather than general / simple environmental avoidance measures.

[41] e.g. Tyldesley, D. & Chapman, C. (2021). The Habitats Regulations Assessment Handbook [online]. DTA Publications Limited. Available at: https://www.dtapublications.co.uk/handbook/.

Table 4.2 Option screening summary – WR107a GWE_Aughton Park a2

WR107a			
GWE_Aughton Park a2			
Option Summary			
[redacted]			
General Assessment Notes			
[redacted]			
European sites in scope	**Dist (km)***	**LSE (alone?)**	**Notes**
Martin Mere Ramsar	[redacted]	U	No pathways for construction-related effects (distance); site principally fed by surface water from its local catchment and so operational effects would not be expected although there is a small residual uncertainty relating to the groundwater contribution to the surface water courses near the site.
Martin Mere SPA		U	No pathways for construction-related effects (distance); site principally fed by surface water from its local catchment and so operational effects would not be expected although there is a small residual uncertainty relating to the groundwater contribution to the surface water courses near the site.
Sefton Coast SAC		N	Site coincides with the mouth of the Alt but features (dune systems) not considered sensitive to changes in flows within the Alt; no other pathways for operation- or construction-related effects (distance and site characteristics, but site considered for completeness through AA).

European sites in scope	Dist (km)*	LSE (alone?)	Notes
Mersey Narrows and North Wirral Foreshore Ramsar		U	Site separated from Alt by the Crosby Channel so there will be 'no effects' on this site directly; risk of mobile species associated with this site utilising areas of the Ribble and Alt Estuaries SPA / Ramsar for foraging.
Mersey Narrows and North Wirral Foreshore SPA		U	As for Mersey Narrows and North Wirral Foreshore Ramsar.
Ribble and Alt Estuaries Ramsar		U	Option may have marginal effect on freshwater inputs to this site from the Alt.
Ribble and Alt Estuaries SPA		U	Option may have marginal effect on freshwater inputs to this site from the Alt.
Liverpool Bay / Bae Lerpwl SPA		U	Site offshore from Alt Estuary; risk of mobile species associated with this site utilising areas of the Ribble and Alt Estuaries SPA / Ramsar for foraging.
Dee Estuary/ Aber Dyfrdwy SAC		0	No pathways for operation- or construction-related effects (distance, no hydrological connectivity).
Mersey Estuary Ramsar		U	No pathways for operation- or construction-related effects (distance, no hydrological connectivity); risk of mobile species associated with this site utilising areas of the Ribble and Alt Estuaries SPA / Ramsar for foraging.
Mersey Estuary SPA		U	No pathways for operation- or construction-related effects (distance, no hydrological connectivity); risk of mobile species associated with this site utilising areas of the Ribble and Alt Estuaries SPA / Ramsar for foraging.

Table 4.3 Option screening summary – WR111 GWE_Woodford

WR111			
GWE_Woodford			
Option Summary			
[redacted].			
General Assessment Notes			
[redacted].			
European sites in scope	**Dist (km)***	**LSE (alone?)**	**Notes**
South Pennine Moors SAC	[redacted]	0	No pathways for operation- or construction-related effects (distance, up-catchment of abstraction and pipeline route).
Peak District Moors (South Pennine Moors Phase 1) SPA	[redacted]	0	No pathways for operation- or construction-related effects (distance, up-catchment of abstraction and pipeline route; mobile features of site will not be functionally associated / reliant on the habitats affected by construction or operation (habitats affected predominantly urban edge / unexceptional improved pasture and arable farmland).
Midland Meres and Mosses Phase 1 Ramsar	[redacted]	0	No pathways for operation- or construction-related effects (distance, no hydrological connectivity).
Rostherne Mere Ramsar	[redacted]	0	No pathways for operation- or construction-related effects (distance, no hydrological connectivity).
Rochdale Canal SAC	[redacted]	0	No pathways for operation- or construction-related effects (distance, no hydrological connectivity).

European sites in scope	Dist (km)*	LSE (alone?)	Notes
Peak District Dales SAC		0	No pathways for operation- or construction-related effects (distance; up-catchment of abstraction and pipeline route).
Mersey Estuary Ramsar		N	Option likely to have very marginal alone effect on freshwater inputs to this site (distance, attenuation); i/c effects possible; construction effects likely nil irrespective of mitigation.
Mersey Estuary SPA		N	Option likely to have very marginal alone effect on freshwater inputs to this site (distance, attenuation); i/c effects possible; construction effects likely nil irrespective of mitigation.

Table 4.4 Option screening summary – WR113 GWE_Tytherington

WR113			
GWE_Tytherington			
Option Summary			
[redacted].			
General Assessment Notes			
[redacted].			
European sites in scope	**Dist (km)***	**LSE (alone?)**	**Notes**
Peak District Moors (South Pennine Moors Phase 1) SPA	[redacted]	0	No pathways for operation- or construction-related effects (distance, up-catchment of abstraction and pipeline route; mobile features of site will not be functionally associated / reliant on the habitats affected by construction or operation (all works within urban environment).
South Pennine Moors SAC	[redacted]	0	No pathways for operation- or construction-related effects (distance, up-catchment of abstraction and pipeline route).
Peak District Dales SAC	[redacted]	0	No pathways for operation- or construction-related effects (distance, up-catchment of abstraction and pipeline route).
Midland Meres and Mosses Phase 1 Ramsar	[redacted]	0	No pathways for operation- or construction-related effects (distance, no hydrological connectivity).
Rostherne Mere Ramsar	[redacted]	0	No pathways for operation- or construction-related effects (distance, no hydrological connectivity).
Mersey Estuary Ramsar	[redacted]	N	Option likely to have very marginal alone effect on freshwater inputs to this site (distance, attenuation); i/c effects possible; construction effects likely nil irrespective of mitigation.

European sites in scope	Dist (km)*	LSE (alone?)	Notes
Mersey Estuary SPA	[redacted]	N	Option likely to have very marginal alone effect on freshwater inputs to this site (distance, attenuation); i/c effects possible; construction effects likely nil irrespective of mitigation.

Table 4.5 ‘Alone’ screening summary by option

Option	European sites in scope	Summary
WR107a: GWE_Aughton Park a2	Liverpool Bay / Bae Lerpwl SPA	Uncertain
	Martin Mere Ramsar	Uncertain
	Martin Mere SPA	Uncertain
	Mersey Estuary SPA	No LSE
	Mersey Estuary Ramsar	No LSE
	Mersey Narrows and North Wirral Foreshore Ramsar	Uncertain
	Mersey Narrows and North Wirral Foreshore SPA	Uncertain
	Ribble and Alt Estuaries Ramsar	Uncertain
	Ribble and Alt Estuaries SPA	Uncertain
	Sefton Coast SAC	No LSE
	Dee Estuary/ Aber Dyfrdwy SAC	No effects
WR111: GWE_Woodford	Mersey Estuary SPA	No LSE
	Mersey Estuary Ramsar	No LSE
	Mersey Narrows and North Wirral Foreshore Ramsar	No LSE
	Mersey Narrows and North Wirral Foreshore SPA	No LSE
	Midland Meres and Mosses Phase 1 Ramsar	No effects
	Peak District Dales SAC	No effects
	Peak District Moors (South Pennine Moors Phase 1) SPA	No effects
	Rochdale Canal SAC	No effects
	South Pennine Moors SAC	No effects
WR113: GWE_Tytherington	Mersey Estuary SPA	No LSE
	Mersey Estuary Ramsar	No LSE
	Mersey Narrows and North Wirral Foreshore Ramsar	No LSE
	Mersey Narrows and North Wirral Foreshore SPA	No LSE
	Midland Meres and Mosses Phase 1 Ramsar	No effects
	Peak District Dales SAC	No effects
	Peak District Moors (South Pennine Moors Phase 1) SPA	No effects
	South Pennine Moors SAC	No effects

4.3 Inter-option ‘in combination’ screening assessment

4.3.1 The inter-option in combination screening assessment is summarised in **Table 4.13**. This identifies all those European sites that could potentially be affected by two or more WRMP options to ensure a conservative in combination position for each European site), and then determines whether ‘in combination’ likely significant effects can be excluded.

Table 4.6 Summary of screening stage inter-option 'in combination' assessment

European site	Options affecting site	'Alone' screening summary?	In combination summary
Dee Estuary/ Aber Dyfrdwy SAC	WR107a: GWE_Aughton Park a2	No effect	[redacted]
Liverpool Bay / Bae Lerpwl SPA	WR107a: GWE_Aughton Park a2	Uncertain	
Martin Mere Ramsar	WR107a: GWE_Aughton Park a2	Uncertain	
Martin Mere SPA	WR107a: GWE_Aughton Park a22	Uncertain	
Mersey Estuary SPA	WR107a: GWE_Aughton Park a2 WR111: GWE_Woodford WR113: GWE_Tytherington	No LSE No LSE No LSE	
Mersey Estuary Ramsar	WR107a: GWE_Aughton Park a2 WR111: GWE_Woodford WR113: GWE_Tytherington	No LSE No LSE No LSE	

European site	Options affecting site	'Alone' screening summary?	In combination summary
Mersey Narrows and North Wirral Foreshore Ramsar	WR107a: GWE_Aughton Park a2 WR111: GWE_Woodford WR113: GWE_Tytherington	No LSE No LSE No LSE	
Mersey Narrows and North Wirral Foreshore SPA	WR107a: GWE_Aughton Park a2 WR111: GWE_Woodford WR113: GWE_Tytherington	No LSE No LSE No LSE	
Midland Meres and Mosses Phase 1 Ramsar	WR111: GWE_Woodford WR113: GWE_Tytherington	No effects No effects	
Peak District Dales SAC	WR111: GWE_Woodford WR113: GWE_Tytherington	No effects No effects	
Peak District Moors (South Pennine Moors Phase 1) SPA	WR111: GWE_Woodford WR113: GWE_Tytherington	No effects No effects	
Ribble and Alt Estuaries Ramsar	WR107a: GWE_Aughton Park a2 WR111: GWE_Woodford WR113: GWE_Tytherington	Uncertain No effects No effects	
Ribble and Alt Estuaries SPA	WR107a: GWE_Aughton Park a2 WR111: GWE_Woodford WR113: GWE_Tytherington	Uncertain No effects No effects	
Rochdale Canal SAC	WR111: GWE_Woodford	No effect	
Rostherne Mere Ramsar	WR111: GWE_Woodford WR113: GWE_Tytherington	No effect No effect	

European site	Options affecting site	'Alone' screening summary?	In combination summary
Sefton Coast SAC	WR107a: GWE_Aughton Park a2	No LSE	
South Pennine Moors SAC	WR111: GWE_Woodford WR113: GWE_Tytherington	No effects No effects	

4.4 Drought Option Screening

4.4.1 The screening of the Drought Options is as per the 2022 Drought Plan HRA[42]; **this concluded that none of the Drought Plan options would have likely significant effects, alone or in combination**.

4.4.2 With regard to European sites that may be exposed to Drought Plan options and WRMP options, these are as follows:

Table 4.7 European sites that may be affected by Drought Plan and WRMP options

Site	Plan Options and screening conclusions		I/C screening
	Drought Plan 2022	WRMP 2024	
Rochdale Canal SAC	[redacted] No LSE alone or in combination (no pathways)	WR111 (No effect – no pathways)	No effect
South Pennine Moors SAC	[redacted] No LSE alone or in combination (no pathways)	WR111 WR113 (No effect – no pathways)	No effect

4.4.3 Based on this, **there will be no in combination effects between the Drought Plan and the WRMP options**.

4.5 Screening Conclusions

4.5.1 The screening has concluded that significant effects are either likely or uncertain for the following sites and options (note, this includes options that may rely on mitigation measures to prevent significant effects occurring); these are therefore taken forward to an appropriate assessment stage.

Table 4.8 Summary of options and sites requiring 'appropriate assessment'

European site	Preferred Portfolio Options	Alone or IC*?
Liverpool Bay SPA	WR107a: GWE_Aughton Park a2	Alone
Martin Mere Ramsar	WR107a: GWE_Aughton Park a2	Alone
Martin Mere SPA	WR107a: GWE_Aughton Park a2	Alone
Mersey Estuary Ramsar	WR107a: GWE_Aughton Park a2 WR111: GWE_Woodford WR113: GWE_Tytherington	IC IC IC

[42] https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/water-resources/uu-revised-draft-dp-hra-_300721.pdf

European site	Preferred Portfolio Options	Alone or IC*?
Mersey Estuary SPA	WR107a: GWE_Aughton Park a2 WR111: GWE_Woodford WR113: GWE_Tytherington	IC IC IC
Mersey Narrows and North Wirral Foreshore Ramsar	WR107a: GWE_Aughton Park a2	Alone
Mersey Narrows and North Wirral Foreshore SPA	WR107a: GWE_Aughton Park a2	Alone
Ribble and Alt Estuaries Ramsar	WR107a: GWE_Aughton Park a2	Alone
Ribble and Alt Estuaries SPA	WR107a: GWE_Aughton Park a2	Alone
Sefton Coast SAC	WR107a: GWE_Aughton Park a2	Alone

*IC – 'In combination' with other WRMP options

5. Appropriate Assessment – Martin Mere SPA / Ramsar

5.1 Screening Summary

5.1.1 Martin Mere was an extensive marsh and lake complex that formed at the end of the last glacial period. It was drained for agriculture after the 17th century. **Martin Mere SPA** and **Martin Mere Ramsar** (hereafter **Martin Mere SPA / Ramsar**) are coincident sites covering a small part of the former mere, which support open water and seasonally flooded marsh; these are predominantly supplied by surface water from the local catchment of the mere, and water levels within the site are closely managed. The sites are designated for their wintering wildfowl populations.

5.1.2 One option is located within 20km of these sites:

- **Option WR107a** (GWE_Aughton Park a2) involves the commissioning of existing (unused, unlicensed) boreholes and the transfer of raw water to Royal Oak WTW via new pipelines; the boreholes associated with WR107a are over [redacted] from the SPA / Ramsar, although small streams that run close to the site (e.g. Mescar Brook; Langley Brook) have headwaters closer to the abstraction that may have some groundwater connectivity.

5.1.3 Water levels in Martin Mere SPA / Ramsar are closely managed, although theoretical pathways for effects exist through:

- effects on surface water flows that supply the sites; and
- effects on habitats of the Ribble or Alt estuaries, which are periodically used by birds from Martin Mere (note, this is primarily addressed in **Section 6**).

5.1.4 Construction effects from the pipeline are not considered a likely outcome (irrespective of mitigation) due to distance and because the site is not hydrologically downstream from the likely construction areas.

5.1.5 Note, the SPA / Ramsar sites are addressed together in the following sections as the site boundaries and interest features are practically and ecologically coincident.

5.2 European site summaries

Site overview

5.2.1 **Martin Mere SPA / Ramsar** is a low-lying wetland complex of open-water, marsh and grassland habitats overlying deep peat that is actively managed by the Wildfowl and Wetlands Trust (WWT). It occupies a small part (~119 ha.) of the formerly substantial (~1300 ha.) Martin Mere lake and marsh, which was formed in a large depression in the drift deposits at the end of the last glacial period, and which was drained for agriculture post-1700 (with most drainage taking place from the mid-19th century with the introduction of steam pumps).

5.2.2 The wetlands of the SPA / Ramsar were effectively re-created from grazed pasture when the site was acquired by WWT in 1974.

5.2.3 The drainage and cultivation of the original mere has resulted in significant lowering of the ground levels around the SPA/Ramsar due to shrinkage of the peat, and so water levels within the site rely on active management through pumping and maintenance of flood embankments.

Interest Features and Conservation Objectives

5.2.4 The **SPA** has the following **qualifying features**:

- Tundra swan *Cygnus columbianus bewickii*
- Eurasian wigeon *Anas penelope*
- Pink-footed goose *Anser brachyrhynchus*
- Northern pintail *Anas acuta*
- Whooper swan *Cygnus cygnus*
- Waterbird assemblage

5.2.5 The site meets the following **Ramsar** criteria:

- Criterion 5: The site supports a waterfowl assemblage of international importance.
- Criterion 6: The site supports the following qualifying species:
  - Pink-footed goose *Anser brachyrhynchus* (spring/autumn)
  - Tundra swan *Cygnus columbianus bewickii* (winter)
  - Whooper swan *Cygnus cygnus* (winter)
  - Eurasian wigeon *Anas penelope* (winter)
  - Northern pintail *Anas acuta* (winter)

5.2.6 With regard to the **supporting habitats** for the SPA qualifying features, these are identified in the 'supplementary advice' as those that support the key behaviours of the nonbreeding/wintering period (moulting, roosting, loafing and feeding), i.e.

- Open standing water and other adjacent waterbodies
- Lowland damp Neutral grassland
- Swamp and tall herb fen

5.2.7 With regard to '**functional habitat'**, the supplementary advice also identifies 'arable land outside of the SPA' as a supporting habitat due to the feeding opportunities this provides (a target in the supplementary advice is to "*Maintain the availability of cereal grains, rape, potatoes and sugar beet, where these sources are locally important to feeding flocks*"), although specific areas of arable land are not identified. It should be noted that the value of the arable habitats for the qualifying features is not associated with ground- or surface water inputs. Other sites locally are also periodically used by birds associated with Martin Mere SPA/Ramsar (including Mere Sands Wood SSSI (approximately 2km to the north-east) and the nearby estuary sites (including the Ribble and Alt SPA/Ramsar and Mersey Estuary SPA / Ramsar).

5.2.8 The overarching **conservation objectives** for the site are essentially as per those outlined in Section 3.3. Specific attributes and targets associated with the conservation objectives are provided in the 'Supplementary advice on conservation objectives'; these

are not explicitly listed here but are available online[43] and are referred to as appropriate in the assessment sections below.

Condition, Pressures and Threats

5.2.9 The SSSI underpinning the SPA / Ramsar is in 'favourable' condition due to the ongoing management of the site.

5.2.10 The SIP identifies 'hydrological changes', 'invasive species' and 'water pollution' as threats to site integrity. With regard to hydrological changes, the threat principally relates to the retention of water within the site (as the site is higher than the surrounding land) and the consequent need to maintain embankments around the site, rather than supply; the SIP identifies a goal to re-wet areas outside the site boundary to assist with this in the long-term.

5.3 Assessment of Effects

Option summary and effect pathways

5.3.1 **Option WR107a** involves:

- the commissioning of existing boreholes at [redacted]; not currently licenced);
- abstracting up to 10Ml/d from the boreholes (collectively);
- constructing a new raw water transfer main from the boreholes to [redacted]; and
- upgrading of [redacted] to treat the additional volumes.

5.3.2 The option has a maximum capacity of 10.0Ml/d, however the anticipated utilisation of option WR107a would see the average year rate of abstraction peak in summer at 4.9Ml/d, with a minimum of approximately 0.1Ml/d in winter. For the '1 in 500 year drought' scenario, the option may be utilised at its maximum capacity for a number of months through the summer and early autumn.

5.3.3 The screening has determined that Martin Mere SPA / Ramsar will not be exposed to likely significant effects as a result of construction due to the absence of pathways (borehole sites and pipelines are within separate surface water catchments) and/or distance, irrespective of mitigation (although standard project-level measures can be relied on to ensure that construction-related effects cannot occur).

5.3.4 With regard to operation, guidance from the EA (*National EA guidance: Habitats Directive Stage 2 Review: Water Resources Authorisations – Practical Advice for Agency Water Resources Staff*) suggests that significant direct effects on groundwater dependent terrestrial ecosystems (GWDTEs) from drawdown associated with abstraction are unlikely for European sites over 5 km from the abstraction. The closest boreholes for Option 107a are approximately [redacted] from the site. However this aspect is being explored with the development of the Lower Mersey Basin groundwater model.

5.3.5 All the boreholes are in the [redacted]. The WFD assessment suggests that interaction between groundwater in the Permo-Triassic sandstone aquifer and groundwater in the superficial deposits is uncertain, and so abstraction from [redacted]

[43] Available at: http://publications.naturalengland.org.uk/file/6661715513311232

[redacted] boreholes ([redacted]) may theoretically influence water supply to minor streams that partly supply the SPA/Ramsar if these have a significant groundwater component / baseflow. However, the available data suggest that the abstraction impacts of **WR107a** will be ascribed to the Alt catchment and not to the catchments to the north.

5.3.6 No other potential effect pathways (e.g. through changes in water quality or increases in air pollution) will be realised as a result of these options.

Option uncertainties

5.3.7 There are no key uncertainties over the intended operation of the option.

5.3.8 Groundwater models for the sandstone aquifer are being developed to allow the likely impacts of the option on water levels within the aquifer to be robustly estimated. Early model outputs indicate that option will have very little effect on water levels in the aquifer near Martin Mere; however, the model is still being tested and refined to ensure it is robust and so these early outputs are not relied on in the assessment. Note, there is a small amount of residual uncertainty relating to the extent to which the aquifer is in continuity with the surface deposits at the site (the model is being refined to improve the characterisation of this) although the anecdotal evidence suggests that there is limited connectivity between the sandstone and the surface waterbodies within the designated sites.

Assessment of effects

Interest feature exposure

5.3.9 The qualifying features and supporting habitats are found in all of the SPA / Ramsar units (plus in areas outside the site boundary) and so cannot be excluded based on location.

Water levels and supply

5.3.10 As noted, the drainage and cultivation of the original mere has resulted in significant lowering of the ground levels outside the SPA/Ramsar due to shrinkage of the peat, and so the site appears to be essentially 'perched' above the surrounding land, with water levels maintained through active management (pumping and maintenance of flood embankments).

5.3.11 With regard to the water supply to Martin Mere, in summary:

- Water levels within The Sluice (the river that drains from Martin Mere) are set by the Crossens sluice / pumping station at Fiddler's Ferry, with water levels set higher in summer and lower in winter to provide better flood defence.
- Water supply to the site is pumped from Boat House Sluice (with contributions from small brooks in the area (such as Langley's Brook) and (significantly) from Burscough WwTW); the brooks may have a small groundwater component.

5.3.12 With regard to **groundwater contributions to surface watercourses**, a surface water management plan produced for Burscough[44] indicates that two watercourses that flow from the Burscough area towards the SPA/Ramsar are fed principally from local run-off, and the watercourses within this area are all generally perched above the regional water

[44] Jacobs (2020). *Burscough Level 2 Surface Water Management Plan: SWMP Report & Action Plan*. Report for Lancashire County Council ref. B2327FF1-JUK-ZZ-BU-RP-Z1201. Jacobs, Manchester.

table in the sandstone aquifer and therefore hydraulically disconnected (although they will receive runoff and shallow lateral interflow from the superficial deposits). Early outputs from the Lower Mersey Basin groundwater model indicate that Q95 flows in Langley's Brook and Boat House Sluice (which comprise the 'Back Drain and Sluice' waterbody GB112070064880) would be essentially unaffected by operation of WR107a, although these model data are being audited and refined.

5.3.13 With regard to **direct supply from groundwater** (i.e. upwelling / hydraulic continuity with the sandstone aquifer beneath the site), the site is identified as a GWDTE by the EA although the extent of hydraulic connectivity between the sandstone aquifer and the site itself is uncertain. The development of the Lower Mersey Basin groundwater model will assist with the characterisation of this connectivity.

5.3.14 However, borehole data from BGS suggests that the superficial deposits are generally quite thick locally, and it is known that the mere was formed in a depression in the glacial drift that is likely to be confining; furthermore, groundwater levels were notably lower historically than they are currently (due to historically greater levels of abstraction regionally), although this did not prevent the site being designated or FCS achieved. There is consequently much anecdotal data suggesting the site is largely or entirely perched above the sandstone aquifer and so not directly dependent on groundwater.

5.3.15 It should also be noted that the wetland habitats of the site (and the bird interest features) are not particularly dependent on very precise water levels (i.e. within a few cm) being maintained at specific points in the year (unlike, for example, some Annex I wetland habitats). The supplementary advice notes that "…*meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will* [usually]…*be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature*".

5.3.16 Consequently, groundwater associated with the sandstone aquifer is not thought to be a significant component of the water supply to the SPA/Ramsar, and any impacts on groundwater levels are likely to be inconsequential in relation to (a) water supply from the local surface catchment and (b) the active water management measures undertaken at the site. Confirmation of this assessment requires final testing and refinement of the Lower Mersey Basin groundwater model, which will be completed in 2024 (although as noted early outputs suggest the impacts of the option on groundwater levels near Martin Mere will be nominal). The available data suggest that the abstraction impacts of **WR107a** will be ascribed to the Alt catchment with limited effects on streams flowing north[45].

5.3.17 It should also be noted that whilst the GWMU is categorised as 'over-licensed' the required volumes (10Ml/d for WR107a) are considered available within recent actual surplus[46]. Contextually, therefore, the risk to Martin Mere from groundwater abstraction is low. This aspect will be subject to further evaluation as part of the planned updates to the Lower Mersey Basin groundwater model, but the available data and conceptual models for the site and area very strongly suggest that adverse effects on integrity due to impacts on water levels or supply will not occur due to the operation of WR107a alone (note in combination effects with other plans and projects are considered below).

[45] The watercourses that flow from the Ormskirk area towards the SPA/Ramsar are thought to be generally perched above the regional water table in the sandstone aquifer and therefore hydraulically disconnected (although they will receive runoff and shallow lateral interflow from the superficial deposits), and so effects on freshwater flow volumes to the north of the boreholes are expected to be negligible.

[46] Based on the Environment Agency water availability summary, provided to UU in March 2022.

Functionally-associated habitats

5.3.18 With regard to the non-designated supporting habitats in the surrounding agricultural fields, the value of these to the qualifying features is a function of the forage they provide (e.g. "*cereal grains, rape, potatoes and sugar beet*") rather than water-level associated habitat characteristics, and this aspect will not be affected by the operation of the options.

5.3.19 A future goal for the long-term management of the SPA/Ramsar is the creation of 'buffer zones' around the site to reduce nutrient inputs from the surrounding land (potentially) the embankment maintenance requirements for the site itself; the options will not conflict with these goals for the same reasons noted above.

5.3.20 The habitats of the Ribble and Alt Estuaries SPA / Ramsar are also used by wintering birds associated with Martin Mere SPA/Ramsar. Based on the assessments of the effects of the WRMP options on the Ribble and Alt Estuaries SPA / Ramsar (see **Section 6**) no options will adversely affect the value of these sites to wintering birds, and so adverse effects on the integrity of the Martin Mere SPA/Ramsar would not be expected through this mechanism.

Other projects 'in combination'

Options in other UUW plans

5.3.21 With regard to other UUW plans:

- Currently, STT is not part of any other water company revised draft WRMP24 preferred plan, and therefore the NWT SRO scenario (i.e. three options) is fundamentally the same as the revised draft WRMP24, and so in combination effects cannot occur.
- The NWT SRO as it might be delivered under 'WRSE higher demand' and 'WRSE no SESRO' scenarios is dependent on selection of STT in future planning cycles by other water companies and so these scenarios are a 'plan' or 'programme' that can be meaningfully assessed for in combination effects at this point (since substantial components of the assessment would be speculative, and the additional SRO options would not be required until 2043 at the earliest)[47].
- The drought options identified in UUW's revised draft **Drought Plan 2021**[48] do not affect these European sites.
- The interaction of the WRMP options with specific schemes derived from the emerging **Drainage and Wastewater Management Plan** (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Minor projects

5.3.22 It has not been possible to produce a definitive list of existing (minor) planning applications near each option's zone of influence and, generating a list at this stage would be of little value. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be

[47] Note that any such in combination effects will be addressed by the forthcoming SRO Gate 3 investigations (this includes additional groundwater modelling, water quality, ecological and hydrological monitoring and fish pass assessments) and in future WRMP cycles.

[48] https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/water-resources/draft-final-drought-plan-2022.pdf

assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major Projects

5.3.23 Reference has been made to the Planning Inspectorate's National Infrastructure Projects database[49] which includes major projects; no major projects are identified that are likely to affect this site.

Uncertainties, mitigation and conclusion

5.3.24 The groundwater model for the aquifer is being finalised, and although initial outputs support the assessment above[50] there remains some minor uncertainty over (a) the exact extent and magnitude of any drawdown effects; and (b) the extent to which the site is separated from the aquifer (hence exposed to any changes). These residual uncertainties will be resolved through completion of the groundwater model in 2024.

5.3.25 Notwithstanding this, based on the available evidence and site data there can be a high level of confidence that the integrity of Martin Mere SPA and Martin Mere Ramsar will not be adversely affected by the NWT options, alone or in combination (particularly as abstraction in the area was historically greater). However, it is appropriate for the WRMP to manage and mitigate this uncertainty by identifying a specific alternative 'no adverse effects' option that would be employed if **WR107a** proves unachievable due to its impact on Martin Mere SPA / Ramsar (see **Appendix D**). Therefore, **with the addition of this mitigation it can be concluded that the WRMP will have no adverse effect on the integrity of Martin Mere SPA and Martin Mere Ramsar, alone or in combination**.

[49] https://infrastructure.planninginspectorate.gov.uk/projects/

[50] i.e. the site will have limited exposure to changes in groundwater in the aquifer; and any changes as a result of the option will be too small to affect the site features in any case.

6. Appropriate Assessment – Ribble and Alt Estuaries SPA / Ramsar and Sefton Coast SAC

6.1 Screening Summary

6.1.1 The **Ribble and Alt Estuaries SPA** and **Ribble and Alt Ramsar** are largely coincident sites covering the coastal and estuarine habitats from Lytham St. Anne's at the mouth of the Ribble estuary, south to Crosby near the Mersey Narrows. The sites are designated for their wintering wildfowl populations and (for the Ramsar only) the population of natterjack toad *Epidalea calamita*. The **Sefton Coast SAC** covers the dune systems between Crosby and Southport, and largely overlaps with the SPA and Ramsar sites in this area. These sites are considered together due to their close functional relationships and shared exposure to the environmental changes associated with the options.

6.1.2 One option is located within 20km of these sites, or otherwise connected:

- **Option WR107a** (GWE_Aughton Park a2) involves the commissioning of existing (unused, unlicensed) boreholes and the transfer of raw water to [redacted] via new pipelines; the groundwater body associated with these boreholes underlies the catchments of the Ribble and the Alt, and may contribute to the surface water inputs to these sites.

6.1.3 Theoretical pathways for effects exist:

- Minor streams with headwaters [redacted] to the north of the boreholes (e.g. Mescar Brook; Langley Brook) may have a small groundwater component. Operation of the option may result in a small reduction in freshwater input to the Ribble estuary at Crossens / Fiddlers Ferry, potentially affecting the supporting habitats for the SPA / Ramsar qualifying features (although the boreholes are located in the surface water catchment of the Alt, which suggests that the impacts will be limited to watercourses in this catchment).
- Operation is more likely to affect groundwater contributions to the Alt, hence reducing freshwater input to the Alt estuary and potentially affecting the supporting habitats for the SPA / Ramsar qualifying features at this location.
- Construction will be required in the surface water catchments of the Alt estuary (hence potential construction-related impacts on the SPA/Ramsar habitats from site-derived pollutants).
- The boreholes are approximately [redacted] from the sand dune habitats of the Sefton Coast SAC and associated areas of the Ribble and Alt Estuaries SPA/Ramsar and so effects from groundwater drawdown would not typically be expected at this distance, although this pathway is considered further for completeness.

6.2 European site summaries

Site overviews

6.2.1 **Ribble and Alt Estuaries SPA** comprises an extensive area of intertidal mud and sandflats along the Irish Sea coast between Blackpool and Crosby, areas of salt- and grazing-marsh in the Ribble estuary, and parts of some dune systems. The **Ribble and Alt Ramsar** site covers the same areas, plus dune systems on the Sefton coast north and south of Formby; **Sefton Coast SAC** covers the dune systems between Crosby and Southport, and largely overlaps with the SPA and Ramsar sites in this area. The sites are underpinned by the Ribble Estuary SSSI and the Sefton Coast SSSI.

6.2.2 The dominant estuarine feature is the Ribble estuary (the Ribble Estuary SSSI covers ~9200 ha.), which has extensive intertidal sand-silt flats and saltmarshes that provide feeding areas and high-tide roosts for wintering wildfowl. South of Southport the habitats mainly comprise intertidal sands and the sand dune systems of the Sefton Coast SSSI that include all successional stages from embryonic to fixed dunes. These dune systems support several protected species of herpetofauna, including natterjack toad, great crested newt and sand lizard. The sands are crossed by the River Alt at Formby Bank, although this is a substantially smaller feature than the Ribble.

Interest Features and Conservation Objectives

Ribble and Alt Estuaries SPA

6.2.3 The **SPA** has the following **qualifying features**:

- Non-breeding:
  - Great cormorant *Phalacrocorax carbo*
  - Tundra swan *Cygnus columbianus bewickii*
  - Whooper swan *Cygnus cygnus*
  - Pink-footed goose *Anser brachyrhynchus*
  - Common shelduck *Tadorna tadorna*
  - Eurasian wigeon *Anas penelope*
  - Eurasian teal *Anas crecca*
  - Northern pintail *Anas acuta*
  - Greater scaup *Aythya marila*
  - Black (common) scoter *Melanitta nigra*
  - Eurasian oystercatcher *Haematopus ostralegus*
  - Ringed plover *Charadrius hiaticula*
  - European golden plover *Pluvialis apricaria*
  - Grey plover *Pluvialis squatarola*
  - Northern lapwing *Vanellus vanellus*
  - Red knot *Calidris canutus*

- Sanderling *Calidris alba*
- Bar-tailed godwit *Limosa lapponica*
- Whimbrel *Numenius phaeopus*
- Eurasian curlew *Numenius arquata*
- Common redshank *Tringa totanus*
- Black-tailed godwit *Limosa limosa islandica*
- Dunlin *Calidris alpina alpina*
- Waterbird assemblage

- Breeding
  - Ruff *Philomachus pugnax*
  - Black-headed gull *Larus ridibundus*
  - Lesser black-backed gull *Larus fuscus*
  - Common tern *Sterna hirundo*
  - Seabird assemblage

6.2.4 With regard to the within-site **supporting habitats** for the SPA qualifying features, these are not explicitly listed in the 'supplementary advice'[51] for the SPA although these are taken to be

- those that support the key behaviours of the nonbreeding/wintering period (moulting, roosting, loafing and feeding), e.g.
  - intertidal mud- and sandflats;
  - salt- and grazing marshes; and
- those that support the breeding cycle (courtship, nesting, feeding) for the breeding species, e.g.
  - intertidal rock;
  - intertidal mud- and sandflats;
  - salt- and grazing marshes / reedbeds.

6.2.5 With regard to non-designated '**functional habitat'**, the supplementary advice and reporting by BTO[52] identifies several high-tide roost sites outside the boundaries of the designated sites. These are noted in the assessment below where relevant. Arable land near the sites is also periodically used by some species (this is particularly important for feeding and roosting pink-footed geese), although specific areas of non-designated farmland are not identified.

51 https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK9005103&SiteName=ribble+and+alt&SiteNameDisplay=Ribble+and+Alt+Estuaries+SPA&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=20

52 NE (2015). *Review and analysis of changes in waterbird use of the Mersey Estuary SPA, Mersey Narrows & North Wirral Foreshore pSPA and Ribble & Alt Estuaries SPA*. Report by BTO for Natural England, ref. NECR173.

6.2.6 More broadly, wintering birds associated with the site will frequently move between the other SPA and Ramsar sites around the north-west coast, including the Mersey Estuary SPA / Ramsar, the Mersey Narrows and North Wirral Foreshore SPA / Ramsar, the Dee Estuary SPA / Ramsar, Martin Mere SPA / Ramsar, Morecambe Bay and Duddon Estuary SPA, and Morecambe Bay Ramsar. Breeding seabirds will forage within the Liverpool Bay SPA.

6.2.7 The overarching **conservation objectives** for the site are essentially as per those outlined in Section 3.3.

Sefton Coast SAC

6.2.8 The **SAC** has the following **qualifying features**:

- Annex I habitats
  - Embryonic shifting dunes
  - Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")
  - Fixed coastal dunes with herbaceous vegetation ("grey dunes")
  - Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)
  - Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*)
  - Humid dune slacks
- Annex II species:
  - Great crested newt *Triturus cristatus*
  - Petalwort *Petalophyllum ralfsii*

6.2.9 All of these features are primary reasons for site selection.

6.2.10 The 'supplementary advice' also provides guidance on the '**typical species**' considered to be associated with the site; these include the key species associated with the dune communities, referable to the relevant NVC types, and other species including Northern dune tiger-beetle *Cicindela hybrida*, Sand lizard *Lacerta agilis*, natterjack toad and Dune fescue *Vulpia fasciculate*.

6.2.11 With regard to non-designated **functional habitats** for the qualifying features, the importance of functional connectivity with the wider coastal sedimentary system is noted, particularly in relation to the current dredging regime in the Mersey Estuary and the availability of sediment to feed the dunes. No other specific areas of functionally associated land are identified.

6.2.12 The overarching **conservation objectives** for the site are essentially as per those outlined in Section 3.3. Specific attributes and targets associated with the conservation objectives are provided in the 'Supplementary advice on conservation objectives'; these are not explicitly listed here but are available online[53] and are referred to as appropriate in the assessment sections below.

Ribble and Alt Ramsar

6.2.13 The site meets the following **Ramsar** criteria:

[53] Available at: http://publications.naturalengland.org.uk/file/6735322931265536

- Criterion 2: the site supports up to 40% of the Great Britain population of natterjack toads.
- Criterion 5: The site supports a waterfowl assemblage of international importance.
- Criterion 6: The site supports the following qualifying species:
  - Lesser black-backed gull *Larus fuscus (breeding and on passage)*
  - Ringed plover *Charadrius hiaticula* (on passage)
  - Grey plover *Pluvialis squatarola* (on passage)
  - Red knot *Calidris canutus* (on passage)
  - Sanderling *Calidris alba* (on passage)
  - Common redshank *Tringa totanus* (on passage)
  - Black-tailed godwit *Limosa limosa islandica* (on passage)
  - Dunlin *Calidris alpina alpina* (on passage)
  - Tundra swan *Cygnus columbianus bewickii* (over winter)
  - Whooper swan *Cygnus cygnus* (over winter)
  - Pink-footed goose *Anser brachyrhynchus* (over winter)
  - Common shelduck *Tadorna tadorna* (over winter)
  - Eurasian wigeon *Anas penelope* (over winter)
  - Eurasian teal *Anas crecca* (over winter)
  - Northern pintail *Anas acuta* (over winter)
  - Eurasian oystercatcher *Haematopus ostralegus* (over winter)
  - Bar-tailed godwit *Limosa lapponica* (over winter)

6.2.14 With regard to the **supporting habitats** and **functional habitats** for the Ramsar qualifying features are taken to be the habitats for the equivalent SPA and SAC features.

6.2.15 The overarching **conservation objectives** for the site are essentially as per those outlined in Section 3.3.

Condition, Pressures and Threats

6.2.16 Two SSSIs underpin the Ribble and Alt Estuaries SPA, Ribble Estuary SSSI and Sefton Coast SSSI.

6.2.17 All of the units of the Ribble Estuary SSSI are in ‘favourable’ condition with the exception of one grassland unit in the upper estuary that is in ‘unfavourable no change’ condition due to the ongoing agricultural practices and management of the unit. In contrast, although approximately 92% of Sefton Coast SSSI is in ‘favourable’ or ‘unfavourable recovering’ condition, six of the 31 units are in ‘unfavourable no change’ or ‘unfavourable declining’ condition, invariably due to inappropriate management of the dune systems, particularly scrub management.

6.2.18 Accordingly, the Sefton Ribble SIP (which covers the SPA and SAC) identifies the following as a pressures or threats on site integrity:

- Coastal squeeze (particularly erosion around Formby Point);
- Air pollution (nitrogen deposition);
- Inappropriate scrub control (principally of the dune systems);
- Invasive species (non-native scrub encroachment in the dunes; non-native marine species in Liverpool Docks);
- Hydrological changes (water availability in the dune systems, linked to local effects on the water table from scrub encroachment, woodland interception of surface flows by adjacent urban drainage systems);
- Public Access/Disturbance (through disturbance of bird populations by terrestrial and marine recreation);
- Inappropriate coastal management (parking on beaches / dunes);
- Fisheries (commercial marine and estuarine);
- Change to site conditions (erosion of dune systems exposing industrial waste);
- Shooting / scaring;
- Feature location/ extent/ Pressure condition unknown (data gaps relating to bird populations, although work by the BTO has partially resolved this).

6.2.19 The WRMP option will not affect any of these pressures or threats, with the possible exception of 'hydrological changes'.

6.3 Assessment of Effects

6.3.1 The SPA / Ramsar sites are addressed together in the following sections as the site boundaries and interest features are largely coincident in the areas of the sites that are likely to be exposed to the outcomes of the options[54].

6.3.2 In addition, the SPA / Ramsar partly overlap with the **Sefton Coast SAC** (designated for its dune systems and associated species) between Crosby and Southport, and some Ramsar features (natterjack toad) are specifically associated with the habitats of the SAC.

6.3.3 The assessment therefore considers the sites and features according to the functional relationships and exposure to option outcomes.

Option summaries and effect pathways

6.3.4 **Option WR107a** involves:

- the commissioning of existing boreholes at [redacted]; not currently licenced);
- abstracting up to 10Ml/d from the boreholes (collectively);
- constructing a new raw water transfer main from the boreholes to [redacted]; and
- upgrading of [redacted] to treat the additional volumes.

[54] The Ramsar site is larger than the SPA, including inland dune systems between Formby and Southport.

6.3.5 The option has a maximum capacity of 10.0Ml/d, however the anticipated utilisation of would see the average year rate of abstraction peak in summer at 4.9Ml/d, with a minimum of approximately 0.1Ml/d in winter. For the '1 in 500 year drought' scenario, the option may be utilised at its maximum capacity for a number of months through the summer and early autumn.

Effect pathways (including inter-option 'in combination' pathways)

6.3.6 The impacts from the boreholes at [redacted] (**WR107a**) are not yet assigned to a waterbody (new abstractions) although the boreholes are located within the [redacted] (which ultimately flows to the Alt). It is therefore very likely that the influence of this option on flows in watercourses leading to the Ribble Estuary is slight.

6.3.7 Therefore, with regard to **operation**:

- Guidance from the EA (National EA guidance: Habitats Directive Stage 2 Review: Water Resources Authorisations – Practical Advice for Agency Water Resources Staff) suggests that significant direct effects on groundwater dependent terrestrial ecosystems (GWDTEs) from drawdown associated with abstraction are unlikely for European sites over 5 km from the abstraction. The nearest boreholes to the designated sites are [redacted] ([redacted] from the SAC boundary at Ainsdale).
- All the boreholes associated with **WR107a** are in the [redacted], and there may be interaction between groundwater in the Permo-Triassic sandstone aquifer and groundwater in the superficial deposits; therefore
  - abstraction from [redacted] may directly influence water supply to the groundwater dependent ecosystems of the Sefton Coast SAC and associated species of the Ramsar (this is recognised as a highly precautionary position given the distance to the boreholes);
  - abstraction from the option may reduce freshwater inputs to the Ribble and Alt Estuary sites via surface water bodies[55] which may affect the physio-chemical characteristics of the estuary (e.g. salinity gradients, water quality) hence the supporting habitats for the SPA / Ramsar qualifying features in these locations.

6.3.8 With regard to **construction**:

- The screening has determined that no sites will be exposed to construction-related environmental changes as a result of **WR107a** due to the distance of these options from the closest sites and the absence of significant surface water connectivity to the likely construction areas (although standard project-level measures can be relied on to ensure that construction-related effects cannot occur).

6.3.9 No other potential effect pathways (e.g. through direct changes in water quality or increases in air pollution) will be realised as a result of these options.

6.3.10 There will be no spatially coincident 'in combination' effects with other WRMP options, although a theoretical interaction may exist for mobile species that move between the north west estuaries.

[55] Principally the Alt; effects on flows to Crossens Pool in the Ribble Estuary will almost certainly be negligible based on the location of the boreholes and conventional conceptual models of aquifer hydrogeology and relationships with the surface water catchment).

Assessment of effects - Water levels and supply to the dune systems of Sefton Coast SAC

6.3.11 The shallow hydrology of the Sefton Coast dune systems is relatively well-understood due to long-term monitoring since 1972 and the development of associated hydrological models[56,57].

6.3.12 In summary, the dune systems typically comprise a layer of sand several metres thick, which is underlain by a poorly-permeable clay and silt layer that appears to largely isolate the dune systems from the underlying sandstone aquifer (Stratford *et al*. 2013; Environment Agency 2010). The sands overlying the clay layers therefore form a shallow sand aquifer for which the principal source of recharge is direct rainfall and perhaps shallow lateral flow and drainage from the immediate surrounding areas. Water levels within the dune slacks are therefore "*a local expression of the water table developed within a dune sand aquifer*".

6.3.13 The essentially local and shallow nature of the water supply and balance is reinforced by models (Clarke & Sanitwong Na Ayutthaya, 2010) and monitoring (Clarke & Pegg, 1993) that have demonstrated the effects of land use on the water table (e.g. areas forested with pine trees have significantly lower water table levels than open dunes, and the controls on water levels from tree planting, golf course development and dewatering operations are recognised (Environment Agency 2010). It is noted that the hydrological threats noted in the SIP relate to colonisation of the dunes by scrub and woodland, and interception of local run-off by urban drainage networks.

6.3.14 Therefore, whilst some localised seepage of deep groundwater from the sandstone into the shallow sand aquifer associated with the dune systems cannot be categorically excluded, it is evident that any such input is an essentially inconsequential component of the water balance for the dune habitats.

Uncertainties and preliminary conclusion

6.3.15 Despite the residual uncertainty associated with the precise response of the sandstone aquifer to utilisation of the boreholes (which will be resolved with the finalisation of the groundwater model), there is a very high degree of confidence that the groundwater abstraction associated with **WR107a** will not adversely affect the integrity of the interest features of the **Sefton Coast SAC** or the associated features of the **Ribble and Alt Estuaries Ramsar** (natterjack toad); and that in reality the magnitude of any effects would almost certainly constitute a 'no likely significant effects' conclusion if the options were re-screened.

Assessment of effects - Flows in the Ribble Estuary and effects on qualifying bird species

Context

6.3.16 Several studies have suggested that the number and densities of wintering waterbirds around estuarine freshwater channels are consistently greater than across associated mudflats, and that several bird species show significant preferences for freshwater flow

[56] Stratford et al. (2013). An ecohydrological review of dune slacks on the west coast of England Wales. *Ecohydrology.* 6, 162–171.

[57] Environment Agency (2010). *Ecohydrological guidelines for wet dune habitats: Wet dunes phase 2*. Environment Agency, Bristol.

areas over mudflats (e.g. Ravenscroft *et al*. (1997), Ravenscroft (1998, 1999), Ravenscroft & Beardall (2002) & Ravenscroft & Emes (2004)), although other studies have indicated that deeply incised channels associated with large volume inflows (such as the Ribble) are less attractive to birds (Ravenscroft & Beardall, 2002).

6.3.17 There are a number of possible mechanisms for this. Correlations between freshwater flow and particle size (e.g. Ravenscroft & Emes (2004)), and substrate particle size distribution and invertebrate distribution have been recognised (e.g. Goss-Custard *et al*. (1991), Colwell and Landrum (1993), Yates *et al*. (1993)). Freshwater flow, salinity and invertebrate distribution have also been correlated (Kelly (2001)).

6.3.18 These physical relationships between invertebrate distributions and freshwater flows are important since there are numerous studies detailing relationships between overwintering waterbirds and the densities or distributions of their invertebrate prey (e.g. Goss-Custard et al. (1991), Colwell (1993), Colwell and Landrum (1993), Yates *et al*. (1993), Dierschke *et al*. (1999), Ravenscroft *et al*. (2002, 2004). Associations between bird densities and particle size (Granadeiro *et al*. 2004) have also been recognised.

6.3.19 Possible relationships between birds and freshwater flows were investigated in detail through a series of studies in The Swale SPA/Ramsar and the Medway Estuary and Marshes SPA/Ramsar (RPS 2004a, 2004b, 2004c, 2005a; Humpheryes & Kellett 2003). These studies found few consistent patterns, however; for example:

- Whilst the general relationship of birds and creek corridors (rather than channels) was usually replicated between watercourses and embayments, the species assemblage was variable between creeks and years, suggesting that creek-specific variables may be less important for determining the community composition than environmental or community processes operating in the wider estuary or beyond. Most species (67%) displayed no, or a negative, association with creeks (70% when feeding behaviour only was considered).
- Latitudinal relationships between creeks and invertebrates were inconsistent, with only a slight tendency for invertebrate biomass to be higher within the creek corridor than the channel or surrounding mudflats.
- Significant decreases in invertebrate abundance and biomass down longitudinal gradients from the shore (potentially related to greater exposure to tidal processes) were recorded, although bird numbers showed the opposite (i.e. greater numbers towards the sea), perhaps reflecting greater foraging accessibility due to interstitial water, or less disturbance.
- Furthermore, no significant differences in the usage of creeks by birds were recorded between freshwater creeks and those that were predominantly saline.

6.3.20 A broad consensus position appears to be that it is not freshwater flow volumes *per se* that are critical to the bird / intertidal channel relationship, rather the presence of ‘some flows’ within channels to maintain morphology, and that bird distributions are often influenced instead by regional factors (e.g. changes in disturbance levels, reductions in bird populations altering estuary usage, proximity of roost sites), local factors (e.g. the role of creek morphology or substrate penetrability) and small-scale interactions (e.g. inter and intra-specific bird relationships, or prey availability associated with behavioural or physiological responses to intertidal exposure). The SACO advice relating to estuarine sites typically reflects this to some extent, in that the targets only refer to maintaining the 'availability' of freshwater in feeding and resting areas, not specific flow volumes / rates and so on.

6.3.21 It should be noted that this relationship relates to smaller freshwater channels, such as Crossens Pool; as noted, there is some evidence that incised channels associated with

large volume inflows (such as the Ribble) are less attractive to birds (Ravenscroft & Beardall, 2002).

6.3.22 With regard to overall volume of freshwater input to the estuary as a whole, whilst this will be important for maintaining the productivity of the ecosystem hence attractiveness to overwintering birds, the effects of small changes in inputs are typically subtle. The daily mean flows from the Rivers Ribble, Darwen and Douglas (~46m^3/s, based on gauging station data) are small compared to the average tidal inflow of 12,000m^3/s on a spring tide (Halcrow, 2013)[58], and so the effects of freshwater input will be most noticeable in the upper estuary. It should also be noted that the Ribble and Alt Estuaries SPA/Ramsar have not been identified as sites that are in unfavourable condition due to excessive nutrients (such that 'nutrient neutrality'[59] is being deployed or considered as mitigation in recent NE advice to LPAs[60]).

6.3.23 The effects of flow reduction must be looked at in the context of the requirements of the qualifying features of the SPA/Ramsar. Site integrity (based on the conservation objectives) requires, subject to natural change, the maintenance or restoration of

- the extent and distribution of the habitats of the qualifying features;
- the structure and function of the habitats of the qualifying features;
- the supporting processes on which the habitats of the qualifying features rely;
- the population of each of the qualifying features; and,
- the distribution of the qualifying features within the site.

6.3.24 However, it must be recognised that estuaries are naturally dynamic environments and so none of these aspects (with the possible exception of the populations of the qualifying features) will necessarily have a fixed and specific target from which deviation would always constitute an adverse effect on integrity. For example, it is known that the Ribble is an accreting estuary (partly as a result of historical interventions, such as the canalisation of the main channel and construction of the North and South Training Walls).

Hydrological Effects

6.3.25 As noted, the available data suggest that the abstraction impacts of **WR107a** will be ascribed to the Alt catchment; if the abstractions have any effects on streams flowing north[61] then flows to the SPA/Ramsar are only likely to be affected through impacts on:

- the Three Pools Waterway and The Sluice, which discharge across the Crossens Marsh foreshore at Fiddler's Ferry; or
- via the minor streams that ultimately flow to the River Douglas (hence the Ribble), such as the Castle Brook or New Park Brook north east of Ormskirk.

[58] Halcrow (2013). *North West Estuaries Process Reports: Ribble Estuary*. Report for Sefton Council, Halcrow, York.

[59] Poor water quality due to nutrient enrichment from elevated nitrogen and phosphorus levels is one of the primary reasons for European sites being in unfavourable condition, and substantial reductions are needed to achieve favourable conservation status. 'Nutrient neutrality' is a mitigation approach that potentially allows new developments to be approved provided that there is no net increase in nutrient loading within the catchments of the affected European site.

[60] Letter from NE to LPA Chief Executives and Heads of Planning, 16 March 2022; Re. Advice for development proposals with the potential to affect water quality resulting in adverse nutrient impacts on habitats sites.

[61] The watercourses that flow from the Ormskirk area towards the SPA/Ramsar are thought to be generally perched above the regional water table in the sandstone aquifer and therefore hydraulically disconnected (although they will receive runoff and shallow lateral interflow from the superficial deposits), and so effects on freshwater flow volumes to the Ribble SSSI component of the SPA/Ramsar will be negligible (particularly for the River Douglas).

6.3.26 The River Douglas contributes (very approximately) 16.5% of the annual mean flows to the Ribble estuary main channel[62]. The Q95 flow for the lowest gauges within the Ribble catchment combined is ~678Ml/d. Therefore, even if the entire impact of the **WR107a** (10Ml/d) were ascribed to the Douglas catchment (essentially impossible), the effect of this on the flows into the estuary would be entirely inconsequential: certainly too small to for any detectable changes in habitats (etc) within the estuary that might be considered 'adverse'.

6.3.27 No gauged flow data for Three Pools Waterway or The Sluice are available. However, the flows into the Ribble estuary at Crossens / Fiddler's Ferry are self-evidently relatively small, and are heavily regulated by a sluice and pumping station at Crossens which controls water-levels and flood risk upstream in The Sluice (water levels are set higher in summer and lower in winter to provide better flood defence).

6.3.28 Determining the exact effects of the borehole options requires development of the regional model, but the available data (including established conceptual understanding of aquifer hydrogeology and relationships with surface water catchments) and the distance of the boreholes from the waterbody headwaters strongly suggests that the effects of borehole abstraction on flows into the Crossens Pool (the intertidal channel at Fiddler's Ferry) will be too negligible to alter the characteristics of the habitats associated with SPA/Ramsar in this location, such that the integrity of the sites would be adversely affected; and, in any case, flows are already regulated by sluices at this location. Early outputs from the Lower Mersey Basin groundwater model indicate that Q95 flows in Langley's Brook and Boat House Sluice (which comprise the 'Back Drain and Sluice' waterbody GB112070064880) would be essentially unaffected by operation of WR107a, although these model data are being audited and refined.

Effects on the physio-chemical environment

6.3.29 The effects of WR107a on flows into the Ribble estuary via the Douglas or at Crossens will be nil or negligible, based on the available data. As a result, effects on the physio-chemical environment of the estuary are also expected to be nil or negligible, and almost certainly indistinguishable from natural variations (particularly when considering the dominance of the tidal turnover within the estuary).

Exposure of features

6.3.30 As noted, the daily mean flows from the Rivers Ribble, Darwen and Douglas are small compared to the average tidal inflow of 12,000m^3/s on a spring tide, and so the effects of freshwater input will be most noticeable in the upper estuary and along the immediate margins of the Ribble main channel.

6.3.31 NE (2015) provides data on the typical distributions of wintering birds at low tide within the Ribble Estuary SSSI[63]; in summary, the species most obviously associated with the Ribble channel within the estuary are widgeon and teal (principally in the upper estuary, where they utilise the adjacent salt- and grazing-marsh) and shelduck (typically associated with Salter's Bank adjacent to the river channel, south of Lytham St. Anne's)[64]. However, the

[62] Based on flow monitoring data from the Ribble at Samlesbury, the Douglas at Wanes Blades Bridge, Yarrow at Croston Mill, Lostock at Littlewood Bridge and Darwen at Blue Bridge (although other minor sources will also contribute to flows, so 16.5% will overestimate the contribution)

[63] See Appendix 4 of NE (2015); available at http://publications.naturalengland.org.uk/file/4869603618455552

[64] This distribution reflects dietary preferences; wigeon are predominantly grazers, particularly of the saltmarsh grass *Puccinellia maritima*; teal typically feed on plant seeds and some invertebrates (e.g. chironomid larvae and small snails)

habitats of these species will not be sensitive to the anticipated magnitude of change associated with the options. For example, the saltmarshes will only be periodically inundated by the highest tides and the principal sources of freshwater to these areas will be local run-off and rainfall rather than water from the Ribble or Crossens; similarly, the areas preferred by shelduck have a strong marine influence due to the proximity to the sea and hence tidal coverage, irrespective of the effects of freshwater flow within the Ribble main channel.

Uncertainties, mitigation and conclusion

6.3.32 Based on the available data, there is a very high degree of confidence that the options will have no adverse effects on the integrity of the Ribble estuary component of the Ribble and Alt Estuaries SPA/Ramsar, alone or in combination through changes in freshwater input. This is based principally on the very small magnitude of change for the flows into the estuary, in proportion to freshwater flows from the Ribble and other sources, and in relation to the tidal volumes; and on the low sensitivity of the interest features (specifically the habitats used by the qualifying features) to changes in freshwater inputs of this magnitude. Any changes will be small and within the range of natural variation for the estuary.

6.3.33 The residual uncertainty associated with this aspect is considered too small to demand the identification of specific plan-level mitigation (i.e. alternative options), although the alternatives identified in Appendix D will mitigate the uncertainties associated with Option 107a.

Assessment of effects - Flows in the Alt at Crosby and effects on qualifying bird species

Context

6.3.34 The context for potential effects on the Alt is largely as per the Ribble (see above) – i.e. reductions in freshwater flows may affect the supporting habitats for the qualifying bird species, although evidence suggests that any relationship between birds and freshwater inputs is subtle and probably not related to flow volumes *per se*; and is probably secondary to a range of other regional and local variations in estuary characteristics that change over the short- and long-term.

6.3.35 With regard to the Alt specifically, this is a substantially smaller watercourse than the Ribble, with substantially different characteristics in the intertidal area. Its channel cuts through the dunes and sandbanks of Formby Bank and is not associated with extensive area of typical estuarine habitats (e.g. intertidal mud and silts; saltmarsh; etc.).

Hydrological Effects

6.3.36 Flows in the Alt may be affected by the borehole abstractions associated with **WR107a**. All of the boreholes are located with WFD river water bodies that ultimately flow to the [redacted]). Regional groundwater flows west and north to discharge at the coast and to the lower River Alt. The watercourses in this area are all generally perched above the regional water table in the sandstone aquifer and therefore hydraulically disconnected, although will receive runoff and shallow lateral interflow from the superficial deposits (especially

in shallow pools in the mudflats, creeks and saltmarshes; shelduck typically forage on mud-snails and tubifex worms found in the open flats (Brown & Grice 2005).

where the Shirdley Hill Sand Formation is found), depending on the nature and thickness of the superficial deposits.

6.3.37 It should be noted that the [redacted]) may have a closer relationship to the sandstone aquifer; here the sandstone is overlain by the superficial Shirdley Hill Sand Formation and may have a good hydraulic connection with the river.

6.3.38 The lowest gauging station on the Alt (69033 Alt at Sefton) has a Q95 flow of ~76Ml/d; if there was no other flow accretion prior to the estuary (this is not possible) then the 10Ml/d abstraction from WR107a (if ascribed in its entirety to the Alt) would be over 10% of this. However this station is some way upstream of the Alt estuary, and has a catchment that is less than half the size of that for the Alt as a whole. It is therefore certain that the impacts on Q95 flows into the estuary will be substantially less than 10%. Note also that Q50 flows at the gauging station are around 160Ml/d. The effect on flows into the Alt estuary will therefore be very small, and arguably inconsequential in relation to the tidal flux (particularly for offshore areas beyond the estuary). Early outputs from the Lower Mersey Basin groundwater model support this, although these model data are currently being audited and refined.

6.3.39 Determining the exact effects of the borehole options requires development of the regional model, but the available data (including established conceptual understanding of aquifer hydrogeology and relationships with surface water catchments) and the required volumes strongly suggests that the effects of borehole abstraction on flows into the Alt estuary will be too negligible to alter the characteristics of the habitats associated with SPA/Ramsar in this location, such that the integrity of the sites would be adversely affected.

Effects on the physio-chemical environment

6.3.40 The reduction flows to the Alt estuary may affect the physio-chemical environment; however, the reduction in volumes will almost certainly be too small to have any noticeable effect on physio-chemical parameters, particularly in relation to the dominance of the marine influences.

Exposure of features

6.3.41 With regard to the wintering bird qualifying features, NE (2015) provides data on the typical distributions of wintering birds at low tide near the Alt estuary and Formby Bank[65]; in summary, the species most obviously associated with this sector are those commonly found on open sand- and mudflats which exploit the tidal edge (e.g. knot, sanderling, dunlin) and there is a general tendency for birds in this area to be loosely associated with the Alt as it crosses the sandflats at Formby Bank. However, as noted, based on other studies it is unlikely that the volumes of freshwater *per se* are a key factor or critical factor in any relationship that might exist with the intertidal sections of the Alt.

6.3.42 The current status of breeding common tern within and near the SPA/Ramsar is complicated by several colony abandonments and shifts in recent years; in particular, whilst colonies were historically present among the dune systems of the Sefton coast the main colonies in Lancashire now appear to be along the Ribble (e.g. Ribble Marshes, Banks Marsh, Hesketh Out Marsh); and on the Mersey Estuary at Seaforth (White et al. 2013[66]). The NE supplementary advice for the SPA/Ramsar notes that "…*the Alt Estuary*

[65] See Appendix 4 of NE (2015); available at http://publications.naturalengland.org.uk/file/4869603618455552

[66] White, S.J. (Ed.), McCarthy, B., Dunstan, S., Martin, S.J., Harris, R.J., Hulme, G. and Marsh, P.J. (2013). The State of Lancashire's Birds: An atlas survey of the breeding and wintering birds of Lancashire and North Merseyside, 2007-2011. Lancashire and Cheshire Fauna Society, Rishton.

represents an important breeding area with sandy foreshore, marsh and estuarine habitats ideal for nesting, roosting and feeding opportunities" although the associated references are somewhat opaque on this point and there do not appear to be records of significant colonies in this area based on data from the Lancashire Bird Atlas.

6.3.43 Common terns take a wide range of prey although appear to provision their chicks mainly with small fish (herring, sprat, sandeels etc.) caught using various methods but typically through shallow dives. They feed widely in marine, estuarine and freshwater habitats, but in marine areas tend to favour locations where features such as sandbanks or upwelling currents force fish towards the surface, or areas with high velocity water flows (Eglington & Perrow 2014[67]). This may include offshore areas where the Alt enters the Crosby Channel.

6.3.44 Thaxter *et al*. (2012) record maximum foraging ranges of 30km for common tern, with the mean (± 1SE) maximum distance being 15.2km (± 11.2km); therefore, the Alt estuary and Crosby Channel are within the mean/max foraging range of most known common tern colonies within or associated with the Ribble and Alt Estuaries SPA/Ramsar (and colonies associated with other SPAs in the region, such as at Seaforth (linked to the Liverpool Bays SPA)), although in practice terns from the Ribble are unlikely to make significant use of the Alt estuary and surrounding areas given the distance and availability of foraging resources closer to these colonies.

Uncertainties, mitigation and conclusion

6.3.45 Based on the available data, there is confidence that the options will have no adverse effects on the integrity of the Alt estuary component of the Ribble and Alt Estuaries SPA/Ramsar, alone or in combination. This is based principally on the anticipated small magnitude of change for the flows into the Alt estuary, and in relation to the tidal volumes and high exposure of Formby Bank to marine influence; and on the low sensitivity of the interest features (specifically the habitats used by the qualifying features) to changes in freshwater inputs of this magnitude. It is likely that any changes that can be ascribed to the option will be small and within the range of natural variation for the estuary.

6.3.46 The groundwater model for the aquifer is being finalised however, and although initial outputs support the assessment above[68] there remains some minor uncertainty over the precise effects of the option on flows in the Alt at Altmouth. These residual uncertainties will be resolved through completion of the groundwater model in 2024.

6.3.47 However, it is appropriate for the WRMP to manage and mitigate this uncertainty by identifying a specific alternative 'no adverse effects' option that would be employed if **WR107a** proves unachievable due to its impact on the Ribble and Alt Estuaries SPA / Ramsar (see **Appendix D**). Therefore, **with the addition of this mitigation it can be concluded that the WRMP will have no adverse effect on the integrity of Ribble and Alt Estuaries SPA and Ribble and Alt Estuaries Ramsar, alone or in combination**.

[67] Eglington, S.M. & Perrow, M.R.(2014) Literature review of tern (Sterna & Sternula spp.) foraging ecology. Report for JNCC [online]. Available at https://data.jncc.gov.uk/data/926cdbbd-c384-42a9-b9e5-81abd778bbd0/JNCC-Report-500-Annex8-Eglington-Perrow2014.pdf

[68] i.e. the site will have limited exposure to changes in groundwater in the aquifer; and any changes as a result of the option will be too small to affect the site features in any case.

Other projects 'in combination'

Options in other UUW plans

6.3.48 With regard to other UUW plans:

- Currently, STT is not part of any other water company revised draft WRMP24 preferred plan, and therefore the NWT SRO scenario (i.e. three options) is fundamentally the same as the revised draft WRMP24, and so in combination effects cannot occur.
- The NWT SRO as it might be delivered under 'WRSE higher demand' and 'WRSE no SESRO' scenarios is dependent on selection of STT in future planning cycles by other water companies and so these scenarios are a 'plan' or 'programme' that can be meaningfully assessed for in combination effects at this point.
- The drought options identified in UUW's revised draft **Drought Plan 2021**[69] do not affect these European sites.
- The interaction of the WRMP options with specific schemes derived from the emerging **Drainage and Wastewater Management Plan** (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Minor projects

6.3.49 It has not been possible to produce a definitive list of existing (minor) planning applications near each option's zone of influence and, generating a list at this stage would be of little value. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major Projects

6.3.50 Reference has been made to the Planning Inspectorate's National Infrastructure Projects database[70] which includes major projects; no major projects are identified that are likely to affect this site, although given the likely timing of this option any assessment would be of limited value.

6.4 Assessment Summary

6.4.1 There are some residual uncertainties regarding the behaviour of the sandstone aquifer and option **WR107a** (which will be resolved by the development of the Lower Mersey Basin groundwater model); however, the conclusions of the assessment are as follows:

- There will be no adverse effects, alone or in combination, on the Ribble Estuary SSSI component of the **Ribble and Alt Estuaries SPA / Ramsar** as a result of the options; the effects of **WR107a** on surface water flows to the estuary will almost certainly be negligible, and inconsequential relative to the overall freshwater inputs to the estuary and the tidal flows.

[69] https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/water-resources/draft-final-drought-plan-2022.pdf

[70] https://infrastructure.planninginspectorate.gov.uk/projects/

- There will be no adverse effects, alone or in combination, on the dune habitats of the **Sefton Coast SAC** and the associated qualifying features of the **Ribble and Alt Estuaries Ramsar** as a result of **WR107a**; the dune systems are supplied primarily by rainfall and lateral flows from the local catchment, and not from connectivity with the underlying sandstone aquifer.
- There is a high degree of confidence that there will be no adverse effects, alone or in combination, on the Alt estuary component of the **Ribble and Alt Estuaries SPA / Ramsar** as a result of the option; the effects of **WR107a** on surface water flows to the Alt are likely to be negligible, and evidence demonstrates that the volumes proposed for abstraction are available and minor relative to the overall freshwater inputs to the estuary and the dominating influence of tidal flows on this section of sandflat. **However, there are some residual uncertainties associated with this and so identification of 'no adverse effect' alternative options is considered appropriate to ensure that the WRMP meets the requirements of the Habitats Regulations** (see **Appendix D**)
- Note, if no adverse effects alone or in combination are expected for the **Ribble and Alt Estuaries SPA / Ramsar**, other European sites in the area (i.e. Mersey Estuary SPA / Ramsar, the Mersey Narrows and North Wirral Foreshore SPA / Ramsar, the Dee Estuary SPA / Ramsar, Martin Mere SPA / Ramsar, Morecambe Bay and Duddon Estuary SPA, and Morecambe Bay Ramsar) will not be indirectly affected if / when their qualifying feature populations utilise the **Ribble and Alt Estuaries SPA / Ramsar**.

6.4.2 Note, the residual uncertainties will be resolved by finalisation of the groundwater model in 2024; however, early outputs from the model essentially support the conclusions noted above.

7. Appropriate Assessment – Mersey Estuary SPA / Ramsar

7.1 Screening Summary

7.1.1 The **Mersey Estuary SPA** and **Mersey Estuary Ramsar** are largely coincident sites covering the coastal and estuarine habitats of the Mersey Estuary from Runcorn Bridge in the east to Devil's Bank near St. Michael's in the west. The sites are designated for their wintering wildfowl populations.

7.1.2 Three options are located within 20km of these sites, or within their catchment:

- WR107a: GWE_Aughton Park a2
- WR111: GWE_Woodford
- WR113: GWE_Tytherington

7.1.3 Theoretical pathways for effects exist through:

- potential construction-related impacts on the estuary associated with some options that will rely on project-level mitigation (and so cannot be 'screened out');
- reduced freshwater input to the Mersey estuary from the options cumulatively, affecting the supporting habitats for the SPA / Ramsar qualifying features;

7.2 European site summaries

Site overviews

7.2.1 The Mersey Estuary SPA / Ramsar is a large, sheltered estuary with a narrow mouth and wide shallow basin. It is composed of extensive intertidal mud and sandflats on the northern and southern shores of the estuary, distinct areas of rocky shore and areas of saltmarsh which are constantly eroding and accreting. The site also includes an area of reclaimed marshland, salt-marshes, brackish marshes and boulder clay cliffs with freshwater seepages. The Manchester Ship Canal forms part of the southern boundary of the site and separates a series of pools from the main estuary. These pools together with Hale Marsh are important roosting sites for wildfowl and waders at high tide. The sites are underpinned by the Mersey Estuary SSSI and New Ferry SSSI.

Interest Features and Conservation Objectives

Mersey Estuary SPA

7.2.2 The **SPA** has the following **qualifying features**:

- Non-breeding:
  - Common shelduck *Tadorna tadorna*
  - Eurasian teal *Anas crecca*

- Northern pintail *Anas acuta*
- European golden plover *Pluvialis apricaria*
- Common redshank *Tringa totanus*
- Black-tailed godwit *Limosa limosa islandica*
- Dunlin *Calidris alpina alpina*

- Waterbird assemblage, including the above species plus Ringed plover *Charadrius hiaticula*, Northern lapwing *Vanellus vanellus*, Eurasian curlew *Numenius arquata*, Eurasian wigeon *Anas penelope*, Grey plover *Pluvialis squatarola*, Great crested grebe *Podiceps cristatus*

7.2.3 With regard to the within-site **supporting habitats** for the SPA qualifying features, these are taken to be those that support the key behaviours of the nonbreeding/wintering period (moulting, roosting, loafing and feeding), i.e.

- intertidal mud- and sandflats;
- salt- and grazing marshes; and
- associated high-tide roosting sites.

7.2.4 With regard to non-designated '**functional habitat'**, reporting by BTO[71] identifies several high-tide roost sites outside the boundaries of the designated sites, including at Frodsham Marsh. More broadly, wintering birds associated with the site will frequently move between the other SPA and Ramsar sites around the north-west coast, including the Mersey Estuary SPA / Ramsar, the Mersey Narrows and North Wirral Foreshore SPA / Ramsar, the Dee Estuary SPA / Ramsar, Martin Mere SPA / Ramsar, Morecambe Bay and Duddon Estuary SPA, and Morecambe Bay Ramsar.

7.2.5 The overarching **conservation objectives** for the site are essentially as per those outlined in Section 3.3.

Mersey Estuary Ramsar

7.2.6 The site meets the following **Ramsar** criteria:

- Criterion 5: The site supports a waterfowl assemblage of international importance.
- Criterion 6: The site supports the following qualifying species/populations:
  - Common shelduck *Tadorna tadorna*
  - Eurasian teal *Anas crecca*
  - Northern pintail *Anas acuta*
  - Common redshank *Tringa totanus*
  - Black-tailed godwit *Limosa limosa islandica*
  - Dunlin *Calidris alpina alpina*

7.2.7 With regard to the **supporting habitats** and **functional habitats** for the Ramsar qualifying features are taken to be the habitats for the equivalent SPA features.

[71] NE (2015). *Review and analysis of changes in waterbird use of the Mersey Estuary SPA, Mersey Narrows & North Wirral Foreshore pSPA and Ribble & Alt Estuaries SPA*. Report by BTO for Natural England, ref. NECR173.

7.2.8 The overarching **conservation objectives** for the site are essentially as per those outlined in Section 3.3.

Condition, Pressures and Threats

7.2.9 Most of the units of the Mersey Estuary SSSI are in 'favourable' or 'unfavourable recovering' condition (8 of 12; approximately 55% of the SSSI). Four of the units (~45% of the SSSI) are in 'unfavourable no change' or 'unfavourable declining' condition, invariably due to inappropriate management of the saltmarsh (grazing) or due to overall declines in some species (notably pintail) across the estuary (although the reasons for this decline are unclear).

7.2.10 Accordingly the Mersey Estuary SIP identifies the following as a pressures or threats on site integrity:

- Changes in species distributions (there have been large decreases in bird numbers on this SPA compared to local SPAs and regional trends);
- Invasive species (significant increase in population of Canada geese; non-native marine species in Liverpool Docks);
- Public Access/Disturbance (through disturbance of bird populations by terrestrial and marine recreation).

7.2.11 The options will not affect any of these pressures or threats, with the possible exception of the 'changes in species distributions' through hydrological changes.

7.3 Assessment of Effects

7.3.1 The SPA / Ramsar sites are addressed together in the following sections as the site boundaries and interest features are coincident. The assessment therefore considers the sites and features according to the functional relationships and exposure to option outcomes.

Option summaries and effect pathways

7.3.2 Two options within the Mersey catchment are a substantial distance from the SPA/Ramsar (such that significant effects alone would not be anticipated through either construction or operation). The options and effect pathways are described in **Table 7.1**

Table 7.1 Summary of WRMP Preferred Portfolio and Reserve options and potential pathways for effects on the Mersey Estuary SPA / Ramsar

Option	Distance from SPA / Ramsar	Option summary and yield profile	Potential pathways for effects on the Mersey Estuary SPA / Ramsar
WR107a: GWE_Aughton Park a22	[redacted]	See Section 6.3	This will not affect the Mersey Estuary SPA / Ramsar (see Section 6.3 for information on the conceptual understanding of the groundwater body) and so is not considered further (note, the assessment of effects for the Ribble and Alt SPA/Ramsar has determined that this option will not adversely affect these sites and hence indirect effects on mobile features of the Mersey estuary sites when using the Ribble and Alt SPA / Ramsar would not be expected).
WR111: GWE_Woodford	[redacted]	This option involves: • increasing abstraction above the current daily licensed quantity to a peak daily total of 12 Ml/d, but keeping the annual average to a maximum of 9.1Ml/d (recent actuals of 0.2Ml/d); • a new or upgraded raw water transfer main; • a new WTW located at [redacted]. The option has a maximum capacity of 12Ml/d, however in an average year the rate of abstraction would peak in summer at 9Ml/d, with a minimum of approximately 2.5Ml/d in winter. For the '1 in 500 year drought' scenario, the option may be utilised at its maximum capacity for a number of months through the spring, summer and early autumn, keeping abstraction within the groundwater resource available within the groundwater management unit ([redacted].	[redacted] No notes are provided by the Environment Agency with the WRGIS data but this type of impact distribution is thought to reflect a large thickness of Glacial Till and glaciofluvial superficial deposits in this area, plus the presence of the Mercia Mudstones in the lower reaches, which limit local abstraction impacts on surface water bodies, such that the abstraction impact is mostly felt much further downstream on the discharge of groundwater to the River Mersey.

Option	Distance from SPA / Ramsar	Option summary and yield profile	Potential pathways for effects on the Mersey Estuary SPA / Ramsar
	[redacted]		Construction will be located at operational sites within urban and semi-urban areas a substantial distance from the estuary, and so pathways for effects would not occur. Operation may reduce freshwater inputs to the Mersey Estuary indirectly via reduced surface water inputs. The Environment Agency assessment of groundwater resource availability has indicated the GWMU is over-licensed but 11 M/d is available within recent actual surplus.
WR113: GWE_Tytherington		This option involves: • upsizing an existing treated water main between [redacted]; • increase abstraction within the current licensed quantity by 3 Ml/d, but keeping abstraction within the groundwater resource available within the groundwater management unit ([redacted] (currently licensed for 4.3Ml/d annual average, 6.82Ml/d daily; recent actuals of 1.9Ml/d). The option has a maximum capacity of 3Ml/d, however in an average year the rate of abstraction would peak in summer at 2.3Ml/d, with a minimum of approximately 0.4Ml/d in winter. For the '1 in 500 year drought' scenario, the option may be utilised at its maximum capacity for a number of months through the spring, summer and early autumn.	[redacted] No notes are provided by the Environment Agency with the WRGIS data but this type of abstraction impact distribution could reflect a large thickness of superficial deposits limiting local abstraction impacts on surface water bodies, such that the abstraction impact is mostly felt much further downstream on the discharge of groundwater to the River Mersey where the river may be in good continuity with the sandstone aquifer.

Option	Distance from SPA / Ramsar	Option summary and yield profile	Potential pathways for effects on the Mersey Estuary SPA / Ramsar
	[redacted]		Construction will be located at operational sites and within urban and semi-urban areas as substantial distance from the estuary, and so pathways for effects would not occur. Operation may reduce freshwater inputs to the Mersey Estuary indirectly via reduced surface water inputs. The Environment Agency assessment of groundwater resource availability has indicated the GWMU is over-licensed but 3Ml/d is possible within recent available surplus.

7.3.3 No other potential effect pathways (e.g. through direct changes in water quality or increases in air pollution) will be realised as a result of these options.

7.3.4 In terms of spatially coincident 'in combination' effects from the options, **Figure 7.1** provides a conceptual model of the options in relation to the Mersey Estuary. There are some complexities associated with the Ship Canal and the River Mersey[72] but broadly speaking Options WR111 and WR113 are likely to impact flows entering the estuary via the River Mersey main channel, and via the Ship Canal at the Weaver Sluices.

Assessment of effects - Flows in the Mersey Estuary and effects on qualifying bird species

Context

7.3.5 The broad context for this impact is as per that outlined in Section 6.3.

7.3.6 The effects of flow reduction must be looked at in the context of the requirements of the qualifying features of the SPA/Ramsar. Site integrity (based on the conservation objectives) requires, subject to natural change, the maintenance or restoration of

- the extent and distribution of the habitats of the qualifying features;
- the structure and function of the habitats of the qualifying features;
- the supporting processes on which the habitats of the qualifying features rely;
- the population of each of the qualifying features; and,
- the distribution of the qualifying features within the site.

7.3.7 However, it must be recognised that estuaries are naturally dynamic environments and so none of these aspects (with the possible exception of the populations of the qualifying features) will necessarily have a fixed and specific target from which deviation would always constitute an adverse effect on integrity.

Hydrological Effects

7.3.8 The cumulative flow impacts for all the options in the WRMP have been calculated to determine the potential impact on freshwater volumes entering the Mersey Estuary compared to gauged flows (see **Table 7.2**). This is a very conservative worst-case assessment scenario, and assumes that:

- all options are used at full capacity 100% of the time; and
- that all impact from the groundwater abstractions will ultimately impact on the lower reaches of the Mersey/estuary (either via impacts on flow upstream, or reduced accretion to the lower reaches).

7.3.9 The total flow is calculated for a location downstream of the confluence of the Mersey, Bollin and the Ship Canal (MSC), based on the furthest downstream gauges on the principal tributaries, i.e.:

- Irwell at Adelphi Weir;

[72] Water in the MSC flows in a south-easterly direction towards the River Weaver; most of the flow enters the Mersey estuary at this point (along with flows from the Weaver) via the Weaver Sluices. A relatively small proportion of the flow enters the inner Mersey Estuary further downstream at Eastham Lock (at the western end of the SPA / Ramsar).

- Irk at Collyhurst Weir;
- Medlock at London Road;
- Worsley Brook at Eccles;
- Mersey at Ashton Weir;
- Glaze Brook at Little Woolden Hall;
- Sinderland Brook at Partington;
- Bollin at Bollington Mill.

Table 7.2 Maximum cumulative impact of all options at different flows

Aspect	Q95	Q70	Q50
Total flow at D/S terminus of Mersey/MSC at conf. with Bollin (Ml/d)	1070	1702	2401
Total abstraction (Ml/d)	12	12	12
Total Q95 flow minus total abstraction (Ml/d)	1058	1690	2389
Flow change %	1.1%	0.7%	0.5%

7.3.10 As noted, this assessment is conservative; however it shows that the maximum cumulative impacts on freshwater inputs into the upper estuary from the Mersey catchment (note, there will be additional inputs from the catchment local to the estuary, from the Wirral and Liverpool) are extremely small at all flows.

7.3.11 In addition, it should be noted **that the impact summarised in Table 7.2 is at least 20km upstream of the closest point of the Mersey Estuary SPA / Ramsar at Runcorn Bridge**, following the Mersey, and that there are additional inputs of freshwater to the Mersey prior to the SPA/Ramsar boundary. A proportion of this impact may be passed via the MSC (which has a discharge close to the SPA/Ramsar at the Weaver) but this will be extremely small and arguably inconsequential. The magnitude of change in freshwater inputs is therefore very small and well within natural variability for the estuary.

7.3.12 The East Cheshire groundwater model is being tested and refined; initial outputs from the model support the above assessment – i.e. the impacts of Options WR111 and WR113 on flows to the estuary is extremely marginal. In terms of direct inputs to the estuary from groundwater, the sandstone block within which Woodford and Tytherington are located is bounded by large extents of mudstone, and is over 15km from the estuary; it is therefore predicted that the groundwater impact will be squeezed into the surface before the estuary is reached, so any impact will be via the surface water courses (which the above data indicate will be minimal).

7.3.13 With regard to the availability of water, in some of the Mersey catchments there is limited water is available for licensing or abstraction; however, it is understood that this is not due to identified or potential impacts on the Mersey Estuary SPA / Ramsar.

Effects on the physico-chemical environment

7.3.14 The effect of reduced freshwater input to the estuary on key physio-chemical parameters cannot be precisely quantified without the development or adaptation of bespoke models of the tidal flows and mixing in the estuary. However, it is evident that the magnitude of

change in freshwater inputs will be extremely small, and the effects on the intertidal areas of the SPA / Ramsar will be correspondingly extremely limited.

7.3.15 The freshwater flow into the Mersey estuary is relatively small for the estuary's size in any case (Ridgeway *et al*. 2012), with estimates of typical freshwater input being around 66m^3/s compared to the tidal influx into the Narrows of 2000m^3/s during a spring tide (Pye *et al*. 2002). The Mersey is therefore considered a well-mixed estuary due to high tidal current velocities, relatively low freshwater input and high degree of turbulent mixing. The small reductions in freshwater input due to the options (in relation to inputs from the River Mersey catchment, and to the estuary catchment as a whole) are therefore likely to have very limited effects that will not be measurable outside the upper estuary, and almost certainly not detectable at the SPA/Ramsar boundary.

7.3.16 Monitoring (RPS 2011) indicates that salinities within the Inner Mersey Estuary range from 16.9 Practical Salinity Units (PSU) to 32.9 PSU, depending on the tidal cycle and seasonal inputs from freshwater sources. The invertebrate fauna of the estuary are therefore adapted to wide variations in salinity, and the small reductions in freshwater input associated with the WRMP options will not result in salinity changes that are outside of this normal range.

7.3.17 With regard to water quality, assessments have been undertaken at relevant locations downstream of the proposed surface water abstractions for the WFD assessment (see Appendix D of the WFD report). It should be noted that these assessments relate to the tributary rivers upstream of the SPA/Ramsar, but have some relevance for the estuary.

7.3.18 Invariably, comparison of the baseline and predicted concentrations of physio-chemical parameters demonstrates that the abstractions would not result in a change in status on either the source river or the downstream Mersey. The risk to water quality (in the context of the WFD) is shown from this assessment to be very low, and it is noted that the Mersey Estuary SPA/Ramsar have not been identified as sites that are in unfavourable condition due to excessive nutrients (such that 'nutrient neutrality'[73] is being deployed or considered as mitigation in recent NE advice to LPAs[74]). This would suggest that the marginal reduction in freshwater input to the estuary will not have potentially notable effects on estuarine water quality.

7.3.19 However, the WFD assessment also recognises that there is an ongoing programme of water quality improvements in the Irwell catchment, including to waste water treatment works and combined sewer overflows. The primary purpose of these works is to improve water quality (particularly dissolved oxygen) in the heavily managed reaches of the downstream Mersey and Manchester Ship Canal. There is a theoretical risk that reduced dilution as a result of the proposed abstractions could reduce the effectiveness of those planned improvements.

7.3.20 More detailed water quality modelling has been undertaken using existing SAGIS-SIMCAT and ICM models, to assess the impact of surface water abstractions proposed by the NWT scheme on water quality in the Irwell and Bollin, and for the Mersey catchment cumulatively[75]. Note, these models do not yet account for the groundwater abstractions

[73] Poor water quality due to nutrient enrichment from elevated nitrogen and phosphorus levels is one of the primary reasons for European sites being in unfavourable condition, and substantial reductions are needed to achieve favourable conservation status. 'Nutrient neutrality' is a mitigation approach that potentially allows new developments to be approved provided that there is no net increase in nutrient loading within the catchments of the affected European site.

[74] Letter from NE to LPA Chief Executives and Heads of Planning, 16 March 2022; Re. Advice for development proposals with the potential to affect water quality resulting in adverse nutrient impacts on habitats sites.

[75] WSP (2023). *United Utilities North West Transfer Strategic Resource Option: Surface Water Quality Modelling. Phase 3 report*. Report by WSP for UU, ref. 62282744-0008-V02.

proposed by the WRMP (i.e. WR111 / WR113), although the impact of groundwater abstractions on water quality (given the small contribution of these abstractions to flows in the Mersey) will be nominal in relation to the large surface water abstractions considered by the water quality modelling. The models indicate that the cumulative impacts of the potential surface water abstractions that may be employed for the NWT will be modest: For both the No NWT Abstraction and All Years (Phase 3) NWT abstraction scenarios, these show only a small impact on the water quality entering the MSC. In all scenarios, there is no deterioration in FIS exceedances at the bottom end of the Mersey, Irwell or Bollin. The impact on DO (10%iles) is low, with only a reduction of -0.01 mg/l seen at the bottom end of the Mersey. These small impacts are considered inconsequential. Given that the impacts associated with the groundwater abstractions WR111 and WR113 will be substantially less (due partly to the significantly smaller size of these abstractions relative to the modelled surface water abstractions), with the location of maximum impact located some distance upstream of the SPA/Ramsar boundary, it can be reasonably concluded that the options proposed for the WRMP will have no meaningful effects on water quality in the Mersey Estuary.

7.3.21 It should be noted that these water quality improvements and concerns relate to the freshwater environment and are driven by the protection of the Ship Canal for cyprinid fish under the WFD (previously under the Freshwater Fish Directive). The effects of this on the supporting habitats of the SPA / Ramsar is likely to be negligible for most areas of these sites due to the size and influence of the tidal influx relative to the freshwater inputs from the Irwell. However, some very minor effects on DO in the immediate vicinity of the River Mersey or Ship Canal where they enter the estuary are possible, compared to a predicted future baseline without the WRMP abstractions; however, the abstractions would not offset the benefits of the WwTW and discharge improvements (i.e. sufficient to result in the quality of water entering the estuary declining relative to the current baseline[76]). Adverse effects via this mechanism would not therefore be expected, although this may require additional analysis following the planned water quality modelling.

7.3.22 With regard to geomorphology, the fluvial supply of sediment to the estuary is small compared to the supply of sediment from offshore sources, and the Ship Canal acts as a notable sediment trap for fluvial sediments from the catchment. The estuary as whole is accreting, although the channels within the upper estuary are highly dynamic, frequently undergoing substantive re-orientation in response to both river flows and (more usually) tidal processes on decadal timescales. The small change in freshwater volumes will not substantially alter this; minor changes to sediment deposition may occur as this is related to salinity, but this will be within the range of natural variation for the estuary and will in any case occur outside the SPA/Ramsar site based on the distance downstream from the location of maximum impact.

Exposure of features

7.3.23 NE (2015) provides data on the typical distributions of wintering birds at low tide within the Mersey Estuary[77]; in summary, the vast majority of the wintering birds in the estuary are

[76] This is relevant as minor negative impacts are often interpreted in the context of longer-term indirectly related improvements for which there is sufficient surety over delivery. It should be noted that this is consistent with the 'Dutch Nitrogen' case; this essentially concluded (*inter alia*) that an appropriate assessment could not take into account conservation measures, preventive measures, or measures that are not part of the proposal if the expected benefits of those measures are not certain at the time of that assessment. This is not the case for the improvements to the Ship Canal, which are backed by an agreed strategy and included in UU's Business Plan. A similar example is found in air quality assessments that are consistent with IAQM guidance (IAQM 2020), where (for example) minor impacts on NOx are set in the context of the predicted long-term decline that will result from the transition to electric vehicles.

[77] See Appendix 4 of NE (2015); available at http://publications.naturalengland.org.uk/file/4869603618455552

associated with the mudflats and saltmarsh on the southern side of the main channel, near Ince Banks, particularly teal, dunlin and black-tailed godwit. However, these areas will not be particularly exposed or sensitive to the anticipated magnitude of change associated with the options, which are likely to be largely restricted to the main channel of the Mersey. For example, the saltmarshes will only be periodically inundated by the highest tides and the principal sources of freshwater to these areas will be local run-off and rainfall rather than water from the Mersey. The negligible changes in freshwater input will not alter the supporting habitats for the qualifying features, such that the integrity of the species' population may be undermined.

Uncertainties, mitigation and conclusion

7.3.24 Based on the available data, there is a very high degree of confidence that the options will have **no adverse effects on the integrity of the Mersey Estuary SPA/Ramsar**, alone or in combination. This is based principally on the very small magnitude of change for the flows into the estuary, in proportion to freshwater flows from the River Mersey catchment and other flows into the estuary, and in relation to the tidal volumes; and on the low sensitivity of the interest features (specifically the habitats used by the qualifying features) to changes in freshwater inputs of this magnitude. Any changes will be negligible and within the range of natural variation for the estuary.

7.3.25 This conclusion will be verified through the finalisation of the East Cheshire regional groundwater model but is considered robust for the HRA of the WRMP. The residual uncertainty associated with this aspect is considered too small to demand the identification of specific plan-level mitigation (i.e. alternative options), although the alternatives identified in Appendix D will mitigate the uncertainties associated with Options 111 and 113.

Assessment of Effects – Construction in the catchment

7.3.26 The precise scope of the construction requirements for each option (including location, timing, materials, extent, duration, etc.) cannot be precisely defined at this point, although none of the options will require construction activity particularly close to the estuary.

7.3.27 The SPA / Ramsar features may be exposed to construction-related effects through:

- site-derived pollutants (principally oils and other contaminants) entering tributaries of the Mersey estuary, hence affecting their supporting habitats.

7.3.28 With regard to **site-derived pollutants**; again it is not possible to quantify the likely effects without details of the construction (including intended approaches and time of year). However, it is clear that the construction requirements of these options are unexceptional, and that there are numerous established measures that can be employed to reliable avoid impact pathways being realised (see Appendix C). As a result, there is a high-degree of confidence that the SPA/Ramsar will not be adversely affected through this mechanism.

Other projects 'in combination'

Options in other UUW plans

7.3.29 With regard to other UUW plans:

- Currently, STT is not part of any other water company revised draft WRMP24 preferred plan, and therefore the NWT SRO scenario (i.e. three options) is

fundamentally the same as the revised draft WRMP24, and so in combination effects cannot occur.

- The NWT SRO as it might be delivered under 'WRSE higher demand' and 'WRSE no SESRO' scenarios is dependent on selection of STT in future planning cycles by other water companies and so these scenarios are a 'plan' or 'programme' that can be meaningfully assessed for in combination effects at this point.
- The drought options identified in UUW's revised draft **Drought Plan 2021**[78] do not affect these European sites.
- The interaction of the WRMP options with specific schemes derived from the emerging **Drainage and Wastewater Management Plan** (DWMP) can only be assessed at the project level due to the generic nature of the DWMP options.

Minor projects

7.3.30 It has not been possible to produce a definitive list of existing (minor) planning applications near each option's zone of influence and, generating a list at this stage would be of little value. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major Projects

7.3.31 The Planning Inspectorate's National Infrastructure Projects database[79] identifies three major projects with the potential to affect the Mersey Estuary sites; in addition, HS2 is a major construction scheme within the catchment:

Table 7.3 National Infrastructure Projects that may affect the Mersey estuary

Project	Summary	Status	Effect pathways / HRA conclusions
Hydrodec Oil Re-Refinery Eastham	The construction of a new hazardous waste recovery facility at Power House Road, Eastham, Port Wirral, Merseyside comprising the construction and operation of a waste oil re-refining plant together with associated and ancillary development.	Not submitted (due 2015)	Not yet submitted; no assessment possible

[78] https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/water-resources/draft-final-drought-plan-2022.pdf

[79] https://infrastructure.planninginspectorate.gov.uk/projects/

Project	Summary	Status	Effect pathways / HRA conclusions
Hynet North West Hydrogen Pipeline	The Hynet North West Hydrogen Pipeline will convey hydrogen from the Stanlow production site to industrial users and to blending points at Partington and Warburton for introduction into the existing gas network. It will also connect with associated hydrogen storage facilities to help balance supply and demand on the pipeline. It is anticipated to consist of approximately 125km of underground high pressure steel pipeline with associated user connection spurs, together with a number of Hydrogen Above Ground Installations along the route of the pipeline.	Not submitted (expected 2023)	Not yet submitted; no assessment possible but in combination effects only likely in relation to construction, and these will be avoidable at the scheme level with mitigation that can be employed for the WRMP options.
Keuper Gas Storage Project	Underground Gas Storage Facility - up to 19 underground caverns, gas processing plant and associated development with capacity to store up to 500 standard million cubic meters (mcm) of natural gas, having an import and export capability of up to 34 mcm per day.	Approved; pre-commencement.	Scheme will discharge brine to the estuary at Runcorn; HRA concluded 'no LSE'
HS2	High speed rail between Crewe and Manchester.	Approved; under construction.	Scheme will involve construction within the Mersey estuary catchment; appears to have been screened out of the HRA process, and in practice there are no potential i/c effects on the Mersey estuary.
Protos	Protos is an energy and resource hub located near Ellesmere Port in the North West of England. Developed by Peel NRE, it clusters together innovative technologies, connecting energy-intensive businesses with sources of low-*carbo*n energy. Note, this is not an NSIP but essentially a cluster of smaller projects with outline planning permission that are currently being developed, but with uncertain delivery periods for specific plots (similar to a land-use plan industrial allocation), and so identifying and testing specific 'in combination' effects cannot be reasonably completed at this stage (and will depend on the timing and delivery of the SRO options and the remaining Protos plot developments).	Approved; under construction.	This collection of developments received outline planning permission in 2009; the HRA for that concluded 'no LSE' and areas of the site have been built out; in combination effects only likely in relation to future development plots (since existing will form part of the baseline) and potential effects from these can only be determined at the project stage; there are no realistic mechanisms for in combination effects assuming that the individual projects meet any consenting requirements for discharges etc to the estuary.

7.3.32 There is a potential interaction with the Keuper Gas Storage Project, as this will discharge brine to the Ship Canal and hence the Mersey estuary at Runcorn. The effects of this brine discharge were modelled by RPS (2011)[80] as part of the EIA for the scheme; the HRA of the scheme (ERM 2015)[81] notes the following:

7.3.33 "*The RPS Environmental Appraisal is based on a simulated mixing zone and salinity resulting from an additional discharge of saturated brine (310 g/l) to the Mersey Estuary via the MSC under low flow (Q75) conditions with a maximum discharge rate of 0.22 m3/s (19,000 m3/day). Modelling of the salinity change during low flow (Q75) conditions indicates the salinity of MSC water discharging to the Mersey at the Weaver Sluices will increase from 4-6 PSU to 11-12 PSU. This is below the natural range of salinity (16.9-32.9 PSU) recorded in the inner Mersey Estuary*".

7.3.34 The HRA therefore concluded that this would not significantly affect the sites as the habitat communities and species living in estuaries are habituated to a range salinities and temperatures and are highly tolerant to fluctuating environmental conditions; and the scheme would not be outside the natural range of salinity. It should also be noted that:

- this assessment assumed the implementation of conditions on operation that would require that brine discharges be reduced to maintain salinities in the normal range when flows at the Weaver Sluices were below Q75;
- the brine discharges will occur for six years only during the solution mining phase, and so is unlikely to overlap substantially with the delivery or operation of the WRMP options (assuming this project is delivered to schedule).

7.3.35 In theory, the WRMP options may marginally reduce flows in the Ship Canal which may affect brine dilution; however, the reduction (and the corresponding effects on salinity) will be negligible; furthermore, the conditions relating to the brine discharge below Q75 will ensure that salinities remain within the predicted range. Adverse in combination effects will not therefore occur with this scheme, even if there is a minor overlap with the options required by 2031.

7.4 Assessment Summary

7.4.1 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); however, based on the available hydrological and European site data it can be concluded that the WRMP options will have no adverse effects, alone or in combination, on the **Mersey Estuary SPA / Ramsar.** The maximum cumulative effect of the options on flows from the River Mersey catchment into the estuary is very 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 effects on the SPA/Ramsar.

7.4.2 Note, if no adverse effects alone or in combination are expected for the Mersey Estuary SPA / Ramsar, other European sites in the area (i.e. Ribble and Alt Estuaries SPA / Ramsar, the Mersey Narrows and North Wirral Foreshore SPA / Ramsar, the Dee Estuary SPA / Ramsar, Martin Mere SPA / Ramsar, Morecambe Bay and Duddon Estuary SPA, and Morecambe Bay Ramsar) will not be indirectly affected if / when their qualifying feature populations utilise the Mersey Estuary SPA / Ramsar.

[80]Available at: www.kgsp.co.uk/wp-content/uploads/2015/12/6.2-KGSP-ES-Technical-Appendices.pdf]

[81] Available at: http://www.kgsp.co.uk/wp-content/uploads/2015/12/5.4-KGSP-HRA.pdf

8. Appropriate Assessment – Liverpool Bay SPA; Mersey Narrows and North Wirral Foreshore SPA / Ramsar

8.1 Screening Summary

8.1.1 This section focuses on the potential effects on those sites that will not themselves be exposed to environmental changes as a result of the options, but which support mobile species that may utilise areas of other sites that are exposed to environmental changes. This is for clarity and simplicity, as the effect pathways are limited and largely the same.

8.1.2 These sites are:

- Liverpool Bay SPA
- Mersey Narrows and North Wirral Foreshore SPA
- Mersey Narrows and North Wirral Foreshore Ramsar

8.1.3 Liverpool Bay SPA is a large marine site extending from low water to approximately 20km offshore in the Eastern Irish Sea between Anglesey and Blackpool. It is principally designated to protect overwintering and foraging areas for common scoter and red throated diver, but was extended to include areas within the Mersey estuary used for foraging by common tern associated with the Mersey Narrows and North Wirral Foreshore SPA, areas adjacent to the north Wales coast used by breeding little tern associated with the Dee Estuary SPA, and marine areas to the east used by wintering little gull.

8.1.4 The Mersey Narrows and North Wirral Foreshore SPA is a coastal site covering intertidal habitats at Egremont foreshore, man-made lagoons at Seaforth Nature Reserve and the extensive intertidal flats at North Wirral Foreshore; it is designated for its wintering waders and also supports breeding common tern.

8.1.5 The Mersey Narrows and North Wirral Foreshore Ramsar is coincident with the SPA and is largely designated for the same reasons.

8.1.6 No options are located within 20km of these sites, nor are the sites themselves likely to be affected by the environmental changes associated with the options. However, the mobile features of these sites may be affected when using areas of the Ribble and Alt Estuaries SPA/Ramsar or the Mersey Estuary SPA/Ramsar that are exposed environmental changes as a result of the WRMP options. In particular:

- The wintering bird populations will make use of the other estuary sites.
- Common tern associated with the Mersey Narrows and North Wirral Foreshore SPA forage near the mouth of the Alt estuary and in the Mersey estuary (areas covered by the Liverpool Bay SPA extension).
- Common tern associated with the Liverpool Bay SPA forage near the mouth of the Alt estuary and in the Mersey estuary (areas covered by the Liverpool Bay SPA extension).
- Red-throated diver associated with the Liverpool Bay SPA utilise relatively shallow inshore waters, including some areas within the estuaries, for foraging.

8.1.7 Note:

- Common scoter essentially use offshore areas of the Liverpool Bay SPA that will not be affected by the environmental changes associated with the options, and so are not considered further (i.e. there will be no significant effects, alone or in combination, on this qualifying feature).
- The areas potentially affected by the environmental changes associated with the options are substantially beyond the foraging range of little tern associated with the Dee Estuary SPA (i.e. there will be no significant effects, alone or in combination, on this qualifying feature).

8.1.8 Note, due to the limited scope of the effects, and the overlaps with the assessments for the Mersey Estuary SPA/Ramsar and the Ribble and Alt SPA/Ramsar, the assessment structure has been simplified relative to Sections 5 – 7 to ensure it remains appropriate to the scale and complexity of the potential effects.

8.2 Assessment of Effects

Mersey Narrows and North Wirral Foreshore SPA / Ramsar

The qualifying features of these sites are:

- Mersey Narrows and North Wirral Foreshore SPA:
  - Great cormorant *Phalacrocorax carbo* (non-breeding)
  - Eurasian oystercatcher *Haematopus ostralegus* (non-breeding)
  - Grey plover *Pluvialis squatarola* (non-breeding)
  - Sanderling *Calidris alba* (non-breeding)
  - Bar-tailed godwit *Limosa lapponica* (non-breeding)
  - Common redshank *Tringa totanus* (non-breeding)
  - Little gull *Larus minutus* (non-breeding)
  - Common tern *Sterna hirundo* (non-breeding and breeding)
  - Red knot *Calidris canutus islandica* (non-breeding)
  - Dunlin *Calidris alpina alpina* (non-breeding)
  - Waterbird assemblage (non-breeding)
- Mersey Narrows and North Wirral Foreshore Ramsar
  - Criterion 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge (important numbers of non-breeding little gulls and common terns).
  - Criterion 5 - regularly supports 20,000 or more waterbirds.
  - Criterion 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds (Red knot, Bar-tailed godwit).

8.2.1 The site is partly in unfavourable declining condition (2012 assessment), principally due to recreational pressure and disturbance, which is damaging the supporting habitats and displacing bird species elsewhere within the north-west estuaries complex.

8.2.2 The site itself is ~6km from the mouth of the Alt estuary (located on the far side of the Crosby Channel) and over 22km downstream of Runcorn Bridge on the Mersey, and so will not be directly affected by any environmental changes associated with the WRMP options (i.e. any environmental changes will be entirely attenuated by the SPA/Ramsar boundary). The only mechanism for effects is therefore if the mobile species of the site rely on habitats that may be exposed to environmental changes during their life cycle.

8.2.3 With regard to the **overwintering bird assemblage**, the assessments for the Ribble and Alt Estuaries SPA/Ramsar and the Mersey Estuary SPA/Ramsar demonstrate that the options will not affect the integrity of the habitats of these sites, such that the integrity of the populations of the qualifying species would be adversely affected. Due to the overlaps in species and habitat requirements, this conclusion can be extended to the Mersey Narrows and North Wirral Foreshore SPA/Ramsar also, although the residual uncertainties in relation to the Alt and the impacts of Option WR107a are recognised.

8.2.4 **Common terns** that nest at the site are known to forage across the Mersey Narrows and near the Alt estuary, and within the inner Mersey estuary also. Their use of the inner Mersey estuary was assessed by the investigations underpinning the extension of the Liverpool Bay SPA into the Mersey estuary[82], and so the principal foraging areas are relatively well-established. These do not extend into the upper estuary (i.e. into the non-designated areas beyond Runcorn Bridge) and hence will not overlap with the zone of hydrological change (such that it is) that may be associated with Options WR111 and WR113 (note also, the effect of these options on the physio-chemical characteristics of the Mersey Estuary SPA/Ramsar are considered negligible). This feature will not therefore be affected at all by Options WR111 and WR113.

8.2.5 However, common tern also forage offshore near the mouth of the Alt, and so may be exposed to environmental changes associated with Option WR107a in this location; the uncertainties in relation to the Alt and the impacts of Option WR107a are recognised (see also **Section 6.3** above).

8.2.6 Based on this, the mobile features of the Mersey Narrows and North Wirral Foreshore SPA/Ramsar will not be exposed to any environmental changes as a result of Options WR111 or WR113 (alone or in combination). There is a high degree of confidence that the magnitude of change associated with Option WR107a and the Alt estuary will not adversely affect the integrity of the populations (and hence the European site integrity) although there is some residual uncertainty here that requires completion of the groundwater model to fully characterise the impact on flows. Therefore, the identification of 'no adverse effect' alternative options is required to mitigate this uncertainty at the plan level.

Liverpool Bay SPA

8.2.7 The qualifying features of this site are:

- Red-throated diver *Gavia stellata* (Non-breeding)
- Common scoter *Melanitta nigra* (Non-breeding)
- Little gull *Hydrocoloeus minutus* (Non-breeding)
- Common tern *Sterna hirundo* (Breeding)

[82] NE 2016. *Tern verification surveys for marine sites*. Natural England Commissioned Report NECR212 [online]. Available at: https://publications.naturalengland.org.uk/file/4504267260428288https://publications.naturalengland.org.uk/file/4504267260428288.

- Little tern Sternula *albifrons* (Breeding)

8.2.8 The site is a marine site and so condition assessments for underpinning SSSIs are not available.

8.2.9 The site itself borders the Ribble and Alt Estuaries SPA / Ramsar, including at the mouth of the Alt estuary, although the dominance of marine processes will ensure that effects on the habitats of the Liverpool Bay SPA due to reduced freshwater input from the Alt will be negligible; the site covers part of the outer Mersey estuary but is substantially outside the likely zone of influence for hydrological changes associated with WR111 and WR113.

8.2.10 Likewise, the effect of any reduced freshwater input to the Crossens Pool in the Ribble estuary on the habitats of Liverpool Bay SPA will be nil (irrespective of the anticipated negligible effect of option WR107a on flows through Fiddlers Ferry).

8.2.11 The principal pathways for effects are as follows:

- **Common terns** that nest at Seaforth are associated with this SPA and are known to forage near the Alt estuary, and within the inner Mersey estuary also. Their use of the inner Mersey estuary was assessed by the investigations underpinning the extension of the Liverpool Bay SPA into the Mersey estuary[83], and so the principal foraging areas are relatively well-established. These do not extend into the upper estuary (i.e. into the non-designated areas beyond Runcorn Bridge) and hence will not overlap with the zone of hydrological change (such that it is) that may be associated with Options WR111 and WR113 (note also, the effect of these options on the physio-chemical characteristics of the Mersey Estuary SPA/Ramsar are considered negligible). This feature will not therefore be affected at all by Options WR111 and WR113. However, common tern also forage offshore near the mouth of the Alt, and so may be exposed to environmental changes associated with Option WR107a in this location; the uncertainties in relation to the Alt and the impacts of Option WR107a are recognised (see also **Section 6.3** above), although the impacts are likely to be negligible based on the available data.
- **Red throated divers** utilise areas of the Ribble estuary; however, the effects of WR107a on the habitats of the Ribble estuary will be too small to affect their usage of this part of the site.

8.2.12 The remaining features are unlikely to be exposed to the environmental changes associated with any of the options due to their behavioural preferences (common scoter and little gull do not make significant use of inshore waters during the periods for which the SPA is designated; and little tern are associated with the Dee and do not range as far as the Alt when foraging).

8.2.13 The mobile features of the Liverpool Bay SPA/Ramsar will not be exposed to any environmental changes as a result of **Options WR111** or **WR113** (alone or in combination). There is a high degree of confidence that the magnitude of change associated with **Option WR107a** and the Alt estuary will not adversely affect the integrity of the populations (and hence the European site integrity) although there is some residual uncertainty here that requires completion of the groundwater model to fully characterise the impact on flows. **Therefore, the identification of 'no adverse effect' alternative options is required to mitigate this uncertainty at the plan level (**see **Appendix D)**.

[83] NE 2016. *Tern verification surveys for marine sites*. Natural England Commissioned Report NECR212 [online]. Available at: https://publications.naturalengland.org.uk/file/4504267260428288https://publications.naturalengland.org.uk/file/4504267260428288.

9. Strategic In Combination Assessment

9.1 Between-option 'in combination' effects

9.1.1 The effects of the WRMP options operating 'in combination' have been explored through the screening and appropriate assessment phases (see **Sections 5 – 8**). These assessments indicate that adverse 'in combination' effects are not likely to occur for any European sites or features.

9.2 'In combination' effects with other UUW Plans

NWT SRO

9.2.1 As noted, currently STT is not part of any other water company revised draft WRMP24 preferred plan, and therefore the NWT SRO scenario (i.e. three options) is fundamentally the same as the revised draft WRMP24, and so in combination effects cannot occur.

9.2.2 The NWT SRO as it might be delivered under 'WRSE higher demand' and 'WRSE no SESRO' scenarios is dependent on selection of STT in future planning cycles by other water companies and so these scenarios are a 'plan' or 'programme' that can be meaningfully assessed for in combination effects at this point (since substantial components of the assessment would be speculative, and the additional SRO options would not be required until 2043 at the earliest).

9.2.3 Note that any such in combination effects will be addressed by the forthcoming SRO Gate 3 investigations (this includes additional groundwater modelling, water quality, ecological and hydrological monitoring and fish pass assessments) and in future WRMP cycles.

Drought Plan

9.2.4 The requirements of UUW's current Drought Plan are accounted for within the WRMP calculations and the HRA of this plan, and so there cannot be additional 'in combination' effects between the WRMP and the Drought Plan.

9.2.5 In addition, the drought options identified in the revised draft Drought Plan 2022[84] do not affect any of the European sites potentially affected by the preferred WRMP options[85], and the revised draft Drought Plan 2022 HRA[86] confirms that there will be 'no LSE' alone or in combination as a result of the Drought Plan.

[84] https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/water-resources/draft-final-drought-plan-2022.pdf

[85] Note, the two Drought Plan options (River Lune LCUS abstraction; and Lake Windermere) have the potential to affect this **Morecambe Bay Ramsar, Morecambe Bay SAC and Morecambe Bay and Duddon Estuary SPA,** which may also be affected by reserve option WR191 (see Appendix D); however, the assessment in Appendix D concludes that The Lake Windermere DP option will not affect the Lune (which is the only part of the European sites exposed to WR191); and the effects of option WR191 alone will be too small to alter the conclusion for the River Lune LCUS abstraction. There will therefore be no operational in combination effects if the DP options are utilised and reserve option WR191 is in operation.

[86] https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/water-resources/uu-revised-draft-dp-hra-_300721.pdf

Drainage and Wastewater Management Plan (DWMP)

9.2.6 UUW's draft DWMP has identified a total of 403 options for 22 Tactical Planning Units (TPUs)[87]. For each of the 22 TPU catchments a legal obligation to 'increase treatment capacity' option has been identified for the relevant wastewater treatment works; however, the options are largely generic (e.g. 'enhanced operational maintenance'; 'sludge centre rationalisation'; 'surface water source control measures') that do not identify specific locations for interventions below the TPU level.

9.2.7 The DWMP HRA concludes that there is insufficient information available in the DWMP to enable potential effects on European sites within, near or downstream of TPUs to be meaningfully assessed, and so assessment is necessarily deferred 'down the line'. However:

- The options will involve minor and/or unexceptional construction works, and construction effects can clearly be avoided with normal best-practice measures.
- Implementation of the 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.

9.2.8 Consequently, the interaction of the WRMP options with specific schemes derived from the DWMP can only be assessed at the project level (although there is nothing to suggest that adverse effects will be unavoidable); and overall water quality within the receiving waterbodies (including European sites potentially affected by the WRMP) will be positive as a result of the DWMP (so adverse in combination effects would not occur).

9.3 Between-company 'in combination' effects

WRMPs

9.3.1 UUW's WRMP options will not affect any European sites that are likely to also be exposed to effects associated with options from other WRMPs, and so in combination effects with other WRMPs would not be expected.

Drought Plans

9.3.2 As with the WRMPs, the drought options within other water company Drought Plans will not affect any European sites that are likely to also be exposed to effects associated with the WRMP options, and so in combination effects with other WRMPs would not be expected.

[87] TPUs are essentially units within wastewater drainage catchments, typically associated with a treatment works.

9.4 In combination effects with other plans and programmes

Effects with other strategic plans and water resource demand

9.4.1 The WRMP explicitly accounts for growth forecasts when calculating future water demand (and hence areas with potential deficits). This means that 'in combination' water-resource effects with growth promoted by other plans or projects are considered and accounted for during the WRMP development process and its deficit calculations.

9.4.2 Potential 'in combination' effects in respect of water-resource demands due to other plans or projects are therefore unlikely since these demands are explicitly modelled when determining deficit zones and hence developing Feasible Options. As a result (in respect of water resources) the WRMP is not likely to make non-significant effects in other plans significant (indeed, other plans are arguably the 'source' of any potential effects in respect of water demand, with the WRMP having to manage potential effects that are not generated by the WRMP itself).

9.4.3 Local plans are not all consistent with regard to planned growth and this arguably introduces some uncertainty. However, with regard to water resources and planning uncertainty it is important to note the following:

- The WRMP safeguards against uncertainty in option yield and timing through 'Target Headroom'; this is an allowance provided in the planning process (i.e. designed-in spare capacity) that ensures that any supply-demand deficit will still be met if there is an underperforming demand management measure or growth exceeds predicted levels. It is therefore extremely unlikely that additional demand or a poorly-performing option would 'suddenly' result in a deficit that might affect a European site; and (in any case);
- The WRMP is revised on a five-yearly cycle, which allows any changes in demand forecasts (e.g. as new plans come forward) to be accounted for, and for timely intervention should a measure not be performing as expected. Delivery is also formally reviewed on an annual basis.

9.4.4 It is therefore considered that the WRMP options will not have significant 'in combination' effects with local plans in respect of water resources.

Effects with major projects

9.4.5 Known major projects that are likely to increase demand have been taken into account during the development of UUW's WRMP and determination of future deficits.

9.4.6 With regard to individual projects interacting with specific options to affect particular sites, this is addressed in **Sections 5 – 8**.

9.4.7 In summary, reference has been made to the Planning Inspectorates National Infrastructure Projects database[88] which includes major projects, subject to the requirements of the Planning Act 2008. It includes projects:

- where the developer has advised the Planning Inspectorate in writing that they intend to submit an application in the future;
- where an application has already been made to the Planning Inspectorate and is undergoing the development consent process;

[88] https://infrastructure.planninginspectorate.gov.uk/projects/

- where a Development Consent Order (DCO) application has been determined.

9.4.8 This exercise did not identify any major projects likely to adversely affect the integrity of any sites in combination with the WRMP.

Minor projects

9.4.9 It has not been possible to produce a definitive list of existing (minor) planning applications near each option's zone of influence and, generating a list at this stage would be of little value. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Effects with strategic development pressure

9.4.10 Regional and local plans have been reviewed at a high level to determine whether there are any likely significant 'in combination' effects, with allocation sites identified where possible. This review has not indicated any potential or likely 'in combination' effects that could occur as a result of cumulative development pressure, and in reality the timescales involved in the implementation of the options and the absence of detail on allocation proposals makes any 'in combination' assessment difficult and potentially meaningless. However, the construction works required for the options are temporary and not of a scale or type that would make 'in combination' effects likely.

10. Demand-Side Options

10.1 Screening Summary

10.1.1 Sixteen demand-side options may involve physical interventions in the network (e.g. meter installation; pipe lining; etc.), with the remaining options essentially providing support for direct and indirect measures to improve water efficiency (e.g. household visits). The 'water efficiency support' options cannot have significant effects due to the nature of the option (based on established guidance for similar policies and proposals in strategic planning documents that do not promote development.

10.1.2 The physical works required for the remaining demand-side options will typically be very minor (e.g. meter installation) with virtually no risk of significant effects on European sites. In some instances effect pathways might be conceivable (for example, a hypothetical leaking pipe might be located in or near a European site) but it is not possible to predict or identify specific locations where such measures might be applied and so effects on specific European sites cannot be identified.

10.1.3 Non-specific residual risks such as these can almost always be avoided with established scheme-level mitigation measures and it is very unlikely that significant or significant and adverse effects as the result of a particular demand-side measure would be unavoidable at the scheme level; however, these options are carried forward to the 'appropriate assessment' stage for procedural reasons and to avoid potential conflict with the 'People over Wind' case.

10.2 Appropriate Assessment

10.2.1 Demand-side options will have no negative operational effects on European sites as they will reduce treated water use. The only realistic mechanism for a negative effect would be through any construction required (for example, the leakage reduction programme may require repair of a pipe in or near an SAC), but this cannot be meaningfully assessed at the strategic level since information on the location of specific intervention requirements (e.g. leaks; households requesting meters) is not available without specific investigations, which would form part of the option package (e.g. the precise location and severity of most leakages is not known ahead of detection), and there is consequently no information on the scale (etc.) of any construction required. Therefore, from an HRA perspective, the options are 'screened in' (as an effect pathway is conceivable) but as a meaningful appropriate assessment is not possible, the assessment is necessarily deferred to the project level.

10.2.2 However, it is clear that the anticipated works associated with these options are not of a scale that would suggest that effects are potentially unavoidable at the project stage, and the WRMP requires that the standard avoidance measures in **Appendix C** be employed (which includes a requirement for the potential for European sites to be affected to be considered at the planning stage). The WRMP does not imply any approval for schemes that come forward under these options or remove the need for project-level assessments, although the measures noted in **Appendix C** will ensure that potential adverse effects can be identified and avoided at the project stage. **The distribution management and leakage-reduction options are therefore excluded from further assessment.**

11. Conclusions

11.1 Overview

11.1.1 UUW has identified three supply-side and 33 demand-side options to maintain supplies to customers in the north-west.

11.1.2 Water company WRMPs are subject to the provisions of the *Conservation of Habitats and Species Regulations 2017.* UUW has a statutory duty to prepare a WRMP and is therefore the Competent Authority for the HRA of that plan. This HRA report accompanies the submission version of the WRMP24, and summarises the current assessment of UUW's preferred portfolio of options (plus its reserve supply-side options) against the requirements of the Habitats Regulations. It also documents the iterative HRA process that has been applied through the development of the draft WRMP24.

11.1.3 For each option (or group of options, as appropriate), the assessment comprises:

- a 'screening' of European sites within the study area to identify those sites and features where there will self-evidently be 'no effect', 'no likely significant effects', or positive effects due to the option[89], and those where significant effects are likely or uncertain; and
- an 'appropriate assessment' of any European sites where significant effects cannot be excluded (this may include 'down-the-line' deferral of some options in accordance with established HRA practice, where appropriate).

11.1.4 The conservation objectives (including any supplementary advice) are taken into account at the screening and appropriate assessment stages as necessary.

11.2 Screening

11.2.1 The screening has concluded that significant effects are either likely or uncertain for the following sites and options (note, this includes options that may rely on mitigation measures to prevent significant effects occurring); these are therefore taken forward to an appropriate assessment stage.

Table 11.1 Summary of options and sites requiring 'appropriate assessment'

European site	Preferred Portfolio Options	Alone or IC*?
Liverpool Bay SPA	WR107a: GWE_Aughton Park a2 WR111: GWE_Woodford WR113: GWE_Tytherington	Alone IC IC
Martin Mere Ramsar	WR107a: GWE_Aughton Park a2	Alone
Martin Mere SPA	WR107a: GWE_Aughton Park a2	Alone
Mersey Estuary Ramsar	WR107a: GWE_Aughton Park a2 WR111: GWE_Woodford WR113: GWE_Tytherington	IC IC IC

[89] Note, for options with 'no effects' or positive effects there is no possibility of 'in combination' effects.

European site	Preferred Portfolio Options	Alone or IC*?
Mersey Estuary SPA	WR107a: GWE_Aughton Park a2 WR111: GWE_Woodford WR113: GWE_Tytherington	IC IC IC
Mersey Narrows and North Wirral Foreshore Ramsar	WR107a: GWE_Aughton Park a2 WR111: GWE_Woodford WR113: GWE_Tytherington	Alone IC IC
Mersey Narrows and North Wirral Foreshore SPA	WR107a: GWE_Aughton Park a2 WR111: GWE_Woodford WR113: GWE_Tytherington	Alone IC IC
Ribble and Alt Estuaries Ramsar	WR107a: GWE_Aughton Park a2	Alone
Ribble and Alt Estuaries SPA	WR107a: GWE_Aughton Park a2	Alone
Sefton Coast SAC	WR107a: GWE_Aughton Park a2	Alone

*IC – 'In combination' with other WRMP options

11.3 Appropriate Assessments

11.3.1 Appropriate assessments were undertaken for those European sites that may be significantly affected by WRMP options (or where there was uncertainty at the screening stage), alone or in combination.

11.3.2 With regard to **demand-side measures**, the only realistic mechanism for a negative effect would be through any construction required (for example, the leakage reduction programme may require repair of a pipe in or near an SAC), but this cannot be meaningfully assessed at the strategic level since information on the location of specific intervention requirements (e.g. leaks; households requesting meters) is not available without specific investigations, which would form part of the option package, and there is consequently no information on the scale (etc.) of any construction required. Therefore, from an HRA perspective, the options are 'screened in' (as an effect pathway is conceivable) but as a meaningful appropriate assessment is not possible, the assessment is necessarily deferred to the project level.

11.3.3 The results of the assessments of the **supply-side options** are summarised in **Table 11.2**.

11.3.4 In summary:

- **Options WR111** and **WR113** will have **no adverse effects on any European sites, alone or in combination**.
- **Option WR107a** is predicted to have **no adverse effects** on any European sites, alone or in combination; however, the following residual uncertainties remain, pending completion of the Lower Mersey basin groundwater model:
  - The is a very small degree of residual uncertainty relating to the hydraulic connectivity of **Martin Mere SPA / Ramsar** with the underlying sandstone aquifer, although the available direct, proxy and anecdotal data suggest that the SPA/Ramsar is very likely to be largely isolated from the aquifer and not dependent

on direct groundwater inputs; it should be noted that abstraction was historically greater, and groundwater levels historically lower, than currently.

- There is some residual uncertainty over the impact of Option WR107a on flows in the Alt estuary component of the Ribble and Alt Estuaries SPA/Ramsar (i.e. at Altmouth). The habitats of these sites may be directly affected if the flow reduction is notable (although all of the available contextual data suggests this impact will be small and will not adversely affect the estuarine habitats at this location), and so qualifying species associated with these sites and other SPA/Ramsar sites locally may be exposed and sensitive to these changes (notably terns associated with Liverpool Bay SPA and Mersey Narrows and North Wirral Foreshore SPA/Ramsar; and wintering birds associated with these sites plus the other estuarine sites in the north-west estuaries complex[90])

11.3.5 The minor uncertainties relating to WR107a will be largely resolved with the development of the Lower Mersey Basin groundwater model, although the currently available data and contextual information strongly suggests that the option will not adversely affect the integrity of any European sites, alone or in combination.

11.3.6 However, it is considered appropriate for the WRMP to mitigate these uncertainties through the identification of alternative 'no adverse effect' options that would be employed if WR107a proves unachievable due to its impact on European sites. **These options are identified and assessed in Appendix D**. This assessment concludes that the reserve options will have no adverse effects, alone or in combination, on any European sites (including in combination with any preferred options that are retained).

11.4 Conclusion

11.4.1 Options WR111 and WR113 will have no adverse effects on any European sites, alone or in combination. The inclusion of the 'no adverse effect' options (Appendix D) provides plan-level mitigation for the uncertainties associated with Option WR107a, and therefore **the HRA of the WRMP can conclude that the WRMP (as drafted) will have no adverse effect alone or in combination on the integrity of any European sites**.

11.4.2 Note that this conclusion relates to the WRMP only and does not remove the need for project-level HRA as the options are developed and delivered.

[90] Although it should also be recognised that the area of impact will be extremely small in comparison to the total habitat resource available to these features.

Table 11.2 Summary of HRA conclusions, key uncertainties and additional investigations that may be required

Site(s)	Assessment summary	Key uncertainties	Additional investigations
Martin Mere SPA / Martin Mere Ramsar	Water levels in Martin Mere SPA / Ramsar are closely managed, although theoretical pathways for effects exist through effects on surface water flows that supply the sites from groundwater abstraction; and indirectly through effects on habitats of the Ribble or Alt estuaries, which are periodically used by birds from Martin Mere (see below). However, there is much anecdotal and historical data indicating that the site is largely or entirely perched above the sandstone aquifer and so not directly dependent on groundwater. Available data also suggests that the watercourses within this area are all generally perched above the regional water table in the sandstone aquifer. Although there is little to suggest that groundwater is a significant component of the water supply to the SPA/Ramsar (hence effects on this from the operation of **WR107a** are likely to be inconsequential in relation to (a) water supply from the local surface catchment and (b) the active water management measures undertaken at the site) there is nevertheless some residual uncertainty that will be resolved by finalisation of the Lower Mersey Basin groundwater model. These uncertainties are mitigated through inclusion of 'no adverse effect' alternatives in the WRMP (see Appendix D).	• Groundwater models for the aquifer are being finalised, which will more accurately characterise the extent and magnitude of any effects on groundwater contributions to surface waterbodies, although all the evidence suggests that this is marginal for this site.	• Groundwater model completion
Mersey Estuary SPA / Mersey Estuary Ramsar	Two options are located within the Mersey estuary catchment; these will not have adverse effects on the SPA / Ramsar alone or in combination due to the small magnitude of change associated with the abstraction relative to freshwater inputs to the estuary and the large tidal influx.	• Groundwater models for the aquifer are being finalised (precise impact of groundwater exploitation on freshwater input to the estuary not certain, although the current assessment is conservative (assumes all of the abstraction	• Groundwater model completion. • Additional information on the operation of the Ship Canal and typical apportionment of flows with the River Mersey.

Site(s)	Assessment summary	Key uncertainties	Additional investigations
	Initial conservative analysis of the maximum cumulative impact the options on freshwater input to the estuary (based on gauged flows and assuming that all of the impact from groundwater abstractions will affect the lower Mersey) have indicated that the relative impact of the options cumulatively of flows into the estuary from the River Mersey is 1.1% at Q95; it should be noted that these decreases will not be at a single location, as the confluences of the Ship Canal and the River Mersey with the Mersey Estuary are several kilometres apart. However, freshwater inputs to the estuary are relatively small for the estuary's size, and the estuary is considered 'well-mixed' due to the high tidal current velocities, low freshwater input and high degree of mixing. Any effects due to the reduction in freshwater input is therefore unlikely to be measurable outside the upper estuary. Furthermore, this location of this impact is at least 20km upstream of the closest point of the Mersey Estuary SPA / Ramsar at Runcorn Bridge. Based on the available data, it is considered that the options will have **no adverse effects on the integrity of the SPA/Ramsar, alone or in combinatio**n through changes in freshwater input (and any associated physio-chemical changes). This is based principally on the small magnitude of change for the flows into the estuary, in proportion to freshwater flows from the Mersey and other sources and other sources, and in relation to the tidal volumes and turnover.	from groundwater is felt at the estuary).	
Ribble and Alt Estuaries Ramsar / Sefton Coast SAC	The shared features of the Ribble and Alt Estuaries Ramsar and the Sefton Coast SAC (specifically, natterjack toad and hence the associated dune systems) may theoretically be exposed to drawdown associated with the borehole option WR107a. However, the dune systems are a substantial distance from the boreholes and	• None	• None

Site(s)	Assessment summary	Key uncertainties	Additional investigations
	evidence from long-term monitoring indicates that the dune systems of the Sefton coast are isolated from the underlying sandstone aquifer by poorly-permeable clay and silt layers, and that water levels therefore relate to local inputs and water-balance within a shallow dune aquifer, not to the underlying sandstone. **The conclusion is that there would be no adverse effects alone or in combination.**		
Ribble and Alt Estuaries SPA / Ribble and Alt Estuaries Ramsar	**Option WR107a** is expected to have either no, or very marginal (and essentially inconsequential), effects on surface water flows into the Ribble estuary at Fiddler's Ferry (the available data suggest that the abstraction impacts of **WR107a** will be ascribed to the Alt catchment). With regard to the Alt, the lowest gauging station on the Alt (69033 Alt at Sefton) has a Q95 flow of ~76Ml/d; if there was no other flow accretion prior to the estuary then the 10Ml/d abstraction from WR107a (if ascribed in its entirety to the Alt) would be over 10% of this. However this station is some way upstream of the Alt estuary, and has a catchment that is less than half the size of that for the Alt as a whole. It is therefore certain that the impacts on Q95 flows into the estuary due to the option will be less than 10%. Note also that Q50 flows at the gauging station are around 160Ml/d. The effect on flows into the Alt estuary will therefore be small, and arguably inconsequential in relation to the tidal flux (particularly for offshore areas beyond the estuary). This aspect has some residual uncertainties associated with it that are being resolved by the groundwater model, so whilst the available evidence suggests that there will be **no adverse effect alone or in combination**, reserve options have been included in the WRMP to provide plan-level mitigation for this uncertainty.	• Groundwater models for the aquifer are being finalised (precise extent and magnitude of any effects on flows in the Alt uncertain).	• Groundwater model completion

Site(s)	Assessment summary	Key uncertainties	Additional investigations
Mersey Narrows and North Wirral Foreshore Ramsar / Mersey Narrows and North Wirral Foreshore SPA	These sites will not be directly exposed to the environmental changes associated with the options, and so effects are only likely through effects on foraging areas used by the mobile species (most notably the areas offshore of the Alt estuary (used by common tern). Effects are possible on the Alt estuary, depending on the hydrological effects of the abstractions on flows in the Alt (these are likely to be small, but this requires confirmation through the regional model); offshore areas near the Alt are used by common tern. This aspect has some residual uncertainties associated with it that can be resolved by the groundwater model, so whilst the available evidence suggests that there will be no adverse effect alone or in combination, reserve options have been included in the WRMP to provide plan-level mitigation for this uncertainty.	• Groundwater models for the aquifer are being finalised (precise extent and magnitude of any effects on flows in the Alt uncertain).	• Groundwater model completion
Liverpool Bay SPA	The exposure and sensitivity of the marine and inshore habitats of this site will be low or negligible, and so effects are only likely through effects on foraging areas used by the mobile species (most notably the areas offshore of the Alt estuary (used by common tern) and the outer Ribble estuary (important for red throated diver). However, it should be noted that the effects of the options on the Mersey and Ribble estuaries are unlikely to be measurable outside the upper estuary due to the dominance of marine influences and the tidal flux, and there is no evidence (from the Liverpool Bay SPA extension studies) of common tern making extensive use of the upper Mersey estuary. Effects are possible on the Alt estuary, depending on the hydrological effects of the abstractions on flows in the Alt (these are likely to be small, but this requires confirmation	• Groundwater models for the aquifer are still in development (precise extent and magnitude of any effects on flows in the Alt uncertain).	• Groundwater model completion

Site(s)	Assessment summary	Key uncertainties	Additional investigations
	through the regional model); offshore areas near the Alt are used by common tern. Birds using the Ribble estuary will not be affected by any options due to the small magnitude of change anticipated for this site. This aspect has some residual uncertainties associated with it that can be resolved by the groundwater model, so whilst the available evidence suggests that there will be **no adverse effect alone or in combination**, reserve options have been included in the WRMP to provide plan-level mitigation for this uncertainty.		
The Dee Estuary Ramsar / The Dee Estuary SPA **Morecambe Bay and Duddon Estuary SPA / Morecambe Bay Ramsar**	The qualifying features of these sites may potentially be exposed when utilising habitats associated with the Ribble and Alt Estuaries SPA / Ramsar, Mersey Estuary SPA / Ramsar or Martin Mere SPA / Ramsar. However, the assessments of these sites indicate that the WRMP will have no adverse effects on these sites that are likely to affect the usage of the estuaries by wintering birds, and so indirect adverse effects on these sites would not be expected.	• None.	• None.

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Appendix A
European sites considered by the HRA process

The table below lists the European sites and their features considered for the assessment of the supply-side options (i.e. sites within 20km of an option, or downstream, or upstream sites supporting fish that may use affected reaches of rivers). Hyperlinks to site documentation are provided to simplify presentation. Note, all European sites within or close to the UUW supply area might theoretically be exposed to effects of some demand-side options, but these sites are not listed here for clarity.

Berwyn SPA	
A074	Red kite *Milvus milvus*
A098	Merlin *Falco columbarius*
A082	Hen harrier *Circus cyaneus*
A103	Peregrine falcon *Falco peregrinus*
Bowland Fells SPA	
A183	Lesser black-backed gull *Larus fuscus*
A082	Hen harrier *Circus cyaneus*
A098	Merlin *Falco columbarius*
Brown Moss SAC	
S1831	Floating water-plantain *Luronium natans*
Dee Estuary/ Aber Dyfrdwy SAC	
H1130	Estuaries
H1140	Mudflats and sandflats not covered by seawater at low tide
H1210	Annual vegetation of drift lines
H1230	Vegetated sea cliffs of the Atlantic and Baltic Coasts
H1310	*Salicornia* and other annuals colonizing mud and sand
H1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
H2110	Embryonic shifting dunes
H2120	Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")
H2130	Fixed coastal dunes with herbaceous vegetation ("grey dunes")
H2190	Humid dune slacks
S1095	Sea lamprey *Petromyzon marinus*
S1099	River lamprey *Lampetra fluviatilis*
S1395	Petalwort *Petalophyllum ralfsii*
Fenn`s, Whixall, Bettisfield, Wem and Cadney Mosses SAC	
H7110	Active raised bogs
H7120	Degraded raised bogs still capable of natural regeneration
Liverpool Bay / Bae Lerpwl SPA	
A001	Red-throated diver *Gavia stellata*
A065	Black (common) scoter *Melanitta nigra*
A195	Little tern *Sterna albifrons*
A193	Common tern *Sterna hirundo*
A177	Little gull *Larus minutus*
WATR	Waterbird assemblage
Manchester Mosses SAC	

H7120	Degraded raised bogs still capable of natural regeneration

Martin Mere Ramsar	
Crit. 5	Crit. 5 - regularly supports 20,000 or more waterbirds
Crit. 6	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
Martin Mere SPA	
A037	Tundra swan *Cygnus columbianus bewickii*
A050	Eurasian wigeon *Anas penelope*
A040	Pink-footed goose *Anser brachyrhynchus*
A054	Northern pintail *Anas acuta*
A038	Whooper swan *Cygnus cygnus*
WATR	Waterbird assemblage
Mersey Estuary Ramsar	
Crit. 5	Crit. 5 - regularly supports 20,000 or more waterbirds
Crit. 6	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
Mersey Estuary SPA	
A162	Common redshank *Tringa totanus*
A052	Eurasian teal *Anas crecca*
A162	Common redshank *Tringa totanus*
A137	Ringed plover *Charadrius hiaticula*
A142	Northern lapwing *Vanellus vanellus*
A140	European golden plover *Pluvialis apricaria*
A054	Northern pintail *Anas acuta*
A160	Eurasian curlew *Numenius arquata*
A050	Eurasian wigeon *Anas penelope*
A048	Common shelduck *Tadorna tadorna*
A672	Dunlin *Calidris alpina alpina*
A141	Grey plover *Pluvialis squatarola*
A616	Black-tailed godwit *Limosa limosa islandica*
A005	Great crested grebe *Podiceps cristatus*
Mersey Narrows and North Wirral Foreshore Ramsar	
Crit. 4	Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge
Crit. 5	Crit. 5 - regularly supports 20,000 or more waterbirds
Crit. 6	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
Mersey Narrows and North Wirral Foreshore SPA	
A672	Dunlin *Calidris alpina alpina*
A193	Common tern *Sterna hirundo*
A130	Eurasian oystercatcher *Haematopus ostralegus*
A162	Common redshank *Tringa totanus*
A177	Little gull *Larus minutus*
A671	Red knot *Calidris canutus islandica*
A193	Common tern *Sterna hirundo*
A017	Great cormorant *Phalacrocorax carbo*
A141	Grey plover *Pluvialis squatarola*
A144	Sanderling *Calidris alba*
A157	Bar-tailed godwit *Limosa lapponica*
WATR	Waterbird assemblage
Midland Meres and Mosses Phase 1 Ramsar	
Crit. 1	Crit. 1 - sites containing representative, rare or unique wetland types

Midland Meres and Mosses Phase 2 Ramsar	
Crit. 1	Crit. 1 - sites containing representative, rare or unique wetland types
Crit. 2	Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities

Oak Mere SAC	
H3110	Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)
H7140	Transition mires and quaking bogs
Peak District Dales SAC	
H4030	European dry heaths
H6130	Calaminarian grasslands of the *Violetalia calaminariae*
H6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites)
H7230	Alkaline fens
H8120	Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*)
H8210	Calcareous rocky slopes with chasmophytic vegetation
H9180	*Tilio-Acerion* forests of slopes, screes and ravines
S1096	Brook lamprey *Lampetra planeri*
S1163	Bullhead *Cottus gobio*
S1092	White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*
Peak District Moors (South Pennine Moors Phase 1) SPA	
A098	Merlin *Falco columbarius*
A140	European golden plover *Pluvialis apricaria*
A222	Short-eared owl *Asio flammeus*
Ribble and Alt Estuaries Ramsar	
Crit. 2	Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities
Crit. 5	Crit. 5 - regularly supports 20,000 or more waterbirds
Crit. 6	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
Ribble and Alt Estuaries SPA	
A017	Great cormorant *Phalacrocorax carbo*
A616	Black-tailed godwit *Limosa limosa islandica*
A038	Whooper swan *Cygnus cygnus*
A179	Black-headed gull *Larus ridibundus*
A160	Eurasian curlew *Numenius arquata*
A062	Greater scaup *Aythya marila*
A144	Sanderling *Calidris alba*
A158	Whimbrel *Numenius phaeopus*
A183	Lesser black-backed gull *Larus fuscus*
A672	Dunlin *Calidris alpina alpina*
A162	Common redshank *Tringa totanus*
A048	Common shelduck *Tadorna tadorna*
A137	Ringed plover *Charadrius hiaticula*
A141	Grey plover *Pluvialis squatarola*
A065	Black (common) scoter *Melanitta nigra*
A193	Common tern *Sterna hirundo*
A162	Common redshank *Tringa totanus*
A142	Northern lapwing *Vanellus vanellus*
A144	Sanderling *Calidris alba*
A130	Eurasian oystercatcher *Haematopus ostralegus*
A143	Red knot *Calidris canutus*

A157	Bar-tailed godwit *Limosa lapponica*
A151	Ruff *Philomachus pugnax*
A037	Tundra swan *Cygnus columbianus bewickii*
A052	Eurasian teal *Anas crecca*
A050	Eurasian wigeon *Anas penelope*
A040	Pink-footed goose *Anser brachyrhynchus*
A140	European golden plover *Pluvialis apricaria*
A054	Northern pintail *Anas acuta*
SBA	Seabird assemblage
WATR	Waterbird assemblage
SBA	Seabird assemblage
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC	
H3260	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
S1095	Sea lamprey *Petromyzon marinus*
S1096	Brook lamprey *Lampetra planeri*
S1099	River lamprey *Lampetra fluviatilis*
S1106	Atlantic salmon *Salmo salar*
S1163	Bullhead *Cottus gobio*
S1355	Otter *Lutra lutra*
S1831	Floating water-plantain *Luronium natans*
Rixton Clay Pits SAC	
S1166	Great crested newt *Triturus cristatus*
Rochdale Canal SAC	
S1831	Floating water-plantain *Luronium natans*
Rostherne Mere Ramsar	
Crit. 1	Crit. 1 - sites containing representative, rare or unique wetland types
Sefton Coast SAC	
H2110	Embryonic shifting dunes
H2120	Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")
H2130	Fixed coastal dunes with herbaceous vegetation ("grey dunes")
H2150	Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)
H2170	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*)
H2190	Humid dune slacks
S1166	Great crested newt *Triturus cristatus*
S1395	Petalwort *Petalophyllum ralfsii*
South Pennine Moors Phase 2 SPA	
A098	Merlin *Falco columbarius*
A140	European golden plover *Pluvialis apricaria*
A222	Short-eared owl *Asio flammeus*
BBA	Breeding bird assemblage
BBA	Breeding bird assemblage
South Pennine Moors SAC	
H4010	Northern Atlantic wet heaths with *Erica tetralix*
H4030	European dry heaths
H7130	Blanket bogs (* if active bog)
H7140	Transition mires and quaking bogs
H91A0	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
The Dee Estuary Ramsar	
Crit. 6	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds

Crit. 2	Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities
Crit. 5	Crit. 5 - regularly supports 20,000 or more waterbirds
Crit. 1	Crit. 1 - sites containing representative, rare or unique wetland types

Appendix B
Notes on Effect Pathways

Table B1 (from UKWIR 2021) and the following paragraphs outline some of the general assumptions that are typically (and reliably) applied to plan-level assessments where effect pathways are imaginable but not quantifiable at the plan level. These are applied cautiously, recognising that there is always a risk of atypical scenarios, but have been proved to be generally robust across a wide range of scenarios.

Table B1 Potential Impacts of Plan Options (from UKWIR 2021)

Broad categories of potential impacts on European sites, with examples	Examples of operations responsible for impacts (distance assumptions in italics)
Physical loss: • Removal (including offsite effects, e.g. foraging habitat, and removal of supporting habitat within boundary of a SPA) • Smothering	Development of infrastructure associated with scheme, e.g. new or temporary pipelines, transport infrastructure, temporary weirs. Indirect effects from a reduction in flows e.g. drying out marginal habitat. Physical loss is most likely to be significant where the boundary of the scheme extends within the boundary of the European site, or within an offsite area of known foraging, roosting, breeding habitat (that supports species for which a European site is designated).
Physical damage: • Sedimentation / silting • Prevention of natural processes including coastal and fluvial bank stabilisation, prevention of long-shore drift etc. • Habitat degradation • Erosion • Fragmentation • Severance/barrier effect Edge effects	Reduction in river flow leading to permanent and/or temporary loss of available habitat, sedimentation/siltation, fragmentation, etc. Physical damage is likely to be significant where the boundary of the scheme extends within or is directly adjacent to the boundary of the European site, or within/adjacent to an offsite area of known foraging, roosting, breeding habitat (that supports species for which a European site is designated, or where natural processes link the scheme to the site, such as through hydrological connectivity downstream of a scheme, long shore drift along the coast, or the scheme impacts the linking habitat).
Non-physical disturbance: • Noise (incl. underwater) • Visual presence • Human presence • Light pollution Vibration (incl. underwater).	Noise from temporary construction or temporary pumping activities. Taking into consideration the noise level generated from general building activity (c. 122dB(A)) and considering the lowest noise level identified in appropriate guidance as likely to cause disturbance to bird species, it is concluded that noise impacts could be significant up to 1km from the boundary of the European site[91].

[91] British Standards Institute (BSI) (2009) BS5228 - Noise and Vibration Control on Construction and Open Sites. BSI, London.

Broad categories of potential impacts on European sites, with examples	Examples of operations responsible for impacts (distance assumptions in italics)
	Noise from vehicular traffic during operation of a scheme. Noise from construction traffic is only likely to be significant where the transport route to and from the scheme is within 3-5km of the boundary of the European site. Plant and personnel involved in in operation of the scheme. These effects (noise, visual/human presence) are only likely to be significant where the boundary of the scheme extends within or is directly adjacent to the boundary of the European site, or within/adjacent to an offsite area of known foraging, roosting, breeding habitat (that supports species for which a European site is designated). Schemes which might include artificial lighting, e.g. for security around a temporary pumping station. Effects from light pollution are only likely to be significant where the boundary of the scheme is within 500m of the boundary of the European site. Vibration from temporary construction From a review of Environment Agency internal guidance on HRA and various websites/sources[92,93,94] it is considered that effects of vibration are more likely to be significant if development is within 500m of a European site.
Water table/availability: • Drying • Flooding / stormwater • Changes to surface water levels and flows including both increases and reductions. • Changes in groundwater levels and flows Changes to coastal water movement	Changes to water levels and flows due to increased water abstraction, reduced storage or reduced flow releases from reservoirs to river systems. These effects are only likely to be significant where the boundary of the scheme extends within the same ground or surface water catchment as the European site. However, these effects are dependent on hydrological continuity between the scheme and the European site, and sometimes, whether the scheme is up or down stream from the European site.
Toxic contamination: • Water pollution • Soil contamination Air Pollution	Reduced dilution in downstream or receiving waterbodies due to changes in abstraction or reduced compensation flow releases to river systems. These effects are only likely to be significant where the boundary of the scheme extends within the same ground or surface water catchment as the European site. However, these effects are dependent on hydrological continuity between the scheme and the

[92] Institute of Lighting Professionals (2011) Guidance Notes for the Reduction of Obtrusive Light GN01:2011

[93] Environment Agency (2013 Bird Disturbance from Flood and Coastal Risk Management Construction Activities. Overarching Interpretive Summary Report. Prepared by Cascade Consulting and Institute of Estuarine and Coastal Studies.

[94] Cutts N, Hemingway K and Spencer J (2013) The Waterbird Disturbance Mitigation Toolkit Informing Estuarine Planning and Construction Projects. Produced by the Institute of Estuarine and Coastal Studies (IECS). Version 3.2.

Broad categories of potential impacts on European sites, with examples	Examples of operations responsible for impacts (distance assumptions in italics)
	European site, and sometimes, whether the scheme is up or down stream from the European site. Air emissions associated with plant and vehicular traffic during construction and operation of schemes. The effect of dust is only likely to be significant where site is within or in proximity to the boundary of the European site[95,96]. Without mitigation, dust and dirt from the construction site may be transported onto the public road network and then deposited/spread by vehicles on roads up to 500m from large sites, 200m from medium sites, and 50m from small sites as measured from the site exit. Effects of road traffic emissions from the transport route to be taken by the project traffic are only likely to be significant where the protected site falls within 200 metres of the edge of a road affected[97].
Non-toxic contamination: • Nutrient enrichment (e.g. of soils and water) • Algal blooms • Changes in salinity • Changes in water chemistry (e.g. pH, calcium balance etc) • Changes in thermal regime • Changes in turbidity Changes in sedimentation/silting	Changes to water salinity, nutrient levels, turbidity, thermal regime due to increased water abstraction, storage, or reduced compensation flow releases to river systems. These effects are only likely to be significant where the boundary of the scheme extends within the same ground or surface water catchment as the European Site. However, these effects are dependent on hydrological continuity between the scheme and the European site, and sometimes, whether the scheme is up or down stream from the European site.
Biological disturbance: • Direct mortality • Changes to habitat availability • Out-competition by non-native species • Selective extraction of species • Introduction of disease • Rapid population fluctuations Natural succession	Potential for changes to habitat availability, for example reductions in wetted width of rivers leading to desiccation of macrophyte beds due to changes in abstraction or reduced compensation flow releases to river systems. In addition, via removal of vegetation (including hedgerows and trees) used by based as foraging, roosting and hibernation sites and birds as roosting and nesting sites. Creation of new pathway of non-native invasive species. This effect is only likely to be significant where the scheme is situated within the European site or an upstream tributary of the European site (or affects groundwater levels supporting these sites or tributaries) Entrapment during in-river or terrestrial construction works causing injury and/or mortality of mobile species Likely to be a risk of entrapment, injury and/or mortality where the boundary of the option extends within or is directly adjacent to the

[95] Highways Agency (2003) Design Manual for Roads and Bridges (DMRB), Volume 11.

[96] Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction v1.1.

[97] NE Internal Guidance – Approach to Advising Competent Authorities on Road Traffic Emissions and HRAs V1.4 Final - June 2018

Broad categories of potential impacts on European sites, with examples	Examples of operations responsible for impacts (distance assumptions in italics)
	boundary of a European site or within/adjacent to offsite functionally linked habitat. Mobile species could include fish, bats and European otters for example. Potential for changes to habitat availability via removal of vegetation (including hedgerows and trees) to facilitate construction activities and potential entrapment, injury and/or mortality of breeding birds and roosting/hibernating bats. This effect is dependent on the requirement to remove vegetation (if it cannot be avoided), ecological surveys to determine species presence and timing of removal based on species specific ecological considerations.

In addition:

Water resource sensitive features

The EA has previously published advice on qualifying species and habitats that it considers to be water-resource dependent (*National EA guidance: Habitats Directive Stage 2 Review: Water Resources Authorisations – Practical Advice for Agency Water Resources Staff*). This is not reproduced here, but as a general rule most species are not considered water resource dependent with the exception of aquatic features (fish, otter) and wildfowl and waders associated with estuarine and wetland sites. Wide-ranging marine / marine dependent species associated with marine sites that are not directly connected to the hydrological zone of influence are not typically considered to be both sensitive and exposed to the effects of the options (except in certain relatively unique circumstances, such as some desalination schemes).

Estuarine birds and freshwater flows

Several studies have suggested that the number and densities of wintering waterbirds around estuarine freshwater channels are consistently greater than across associated mudflats, and that several bird species show significant preferences for freshwater flow areas over mudflats (e.g. Ravenscroft et al. (1997), Ravenscroft (1998, 1999), Ravenscroft & Beardall (2002) & Ravenscroft & Emes (2004)), although other studies have indicated that deeply incised channels associated with large volume inflows are less attractive to birds (Ravenscroft & Beardall, 2002).

There are a number of possible mechanisms for this. Correlations between freshwater flow and particle size (e.g. Ravenscroft & Emes (2004)), and substrate particle size distribution and invertebrate distribution have been recognised (e.g. Goss-Custard et al. (1991), Colwell and Landrum (1993), Yates et al. (1993)). Freshwater flow, salinity and invertebrate distribution have also been correlated (Kelly (2001)).

These physical relationships between invertebrate distributions and freshwater flows are important since there are numerous studies detailing relationships between overwintering waterbirds and the densities or distributions of their invertebrate prey (e.g. Goss-Custard et al. (1991), Colwell (1993), Colwell and Landrum (1993), Yates et al. (1993), Dierschke et al. (1999), Ravenscroft et al. (2002, 2004). Associations between bird densities and particle size (Granadeiro et al. 2004) have also been recognised.

Possible relationships between birds and freshwater flows were investigated in detail through a series of studies in The Swale SPA/Ramsar and the Medway Estuary and Marshes SPA/Ramsar

(RPS 2004a, 2004b, 2004c, 2005a; Humpheryes & Kellett 2003). These studies found few consistent patterns, however; for example:

- Whilst the general relationship of birds and creek corridors (rather than channels) was usually replicated between watercourses and embayments, the species assemblage was variable between creeks and years, suggesting that creek-specific variables may be less important for determining the community composition than environmental or community processes operating in the wider estuary or beyond. Most species (67%) displayed no, or a negative, association with creeks (70% when feeding behaviour only was considered).
- Latitudinal relationships between creeks and invertebrates were inconsistent, with only a slight tendency for invertebrate biomass to be higher within the creek corridor than the channel or surrounding mudflats.
- Significant decreases in invertebrate abundance and biomass down longitudinal gradients (potentially related to greater exposure to tidal processes) were recorded, although bird numbers showed the opposite (i.e. greater numbers towards the sea), perhaps reflecting greater foraging accessibility due to interstitial water, or less disturbance.

Furthermore, no significant differences in the usage of creeks by birds were recorded between freshwater creeks and those that were predominantly saline.

A broad consensus position appears to be that it is not freshwater flow volumes *per se* that are critical to the bird / intertidal channel relationship, rather the presence of some flows within channels to maintain morphology, and that bird distributions are often influenced instead by estuary-wide factors (e.g. changes in disturbance levels, reductions in bird populations altering estuary usage, proximity of roost sites), local factors (e.g. the role of creek morphology or substrate penetrability) and small-scale interactions (e.g. inter and intra-specific bird relationships, or prey availability associated with behavioural or physiological responses to intertidal exposure).

Bat species and functional land

Bat species associated with UK SACs are not considered 'water resource sensitive' and so (in the absence of substantial habitat changes caused by operational aspects (e.g. draining of a wetland or replacement of extensive foraging habitat with a reservoir; or introduction of light etc. sources that may disrupt commuting or seasonal moverments), their exposure to the outcomes of the WRMP will be limited to incidental effects from construction. In most instances potential effects will not be specifically identifiable or quantifiable (as the locations of works are not necessarily defined, and field surveys would not typically be undertaken at plan level).

UK bat species do not typically travel substantial distances (i.e. tens of kilometres) when foraging and the Bat Conservation Trust has therefore identified Core Sustenance Zones (CSZs) – defined as "*the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the roost"* – for UK bat species; the CSZs for all UK species have a radius of 4km or less, with the exception of the CSZ for barbastelle (6km). This can be cautiously applied to bat SACs, although it is recognised that many roosts used by SAC bat populations will not be within the boundaries of the SAC. In general, therefore, unavoidable adverse effects would not be expected unless significant permanent land-take within those zones is likely; virtually all other potential effects are avoidable with normal good practice in planning and design, and with established mitigation measures that are known to be effective – although these inevitably cannot be defined above the project level.

Birds and construction noise / visual disturbance

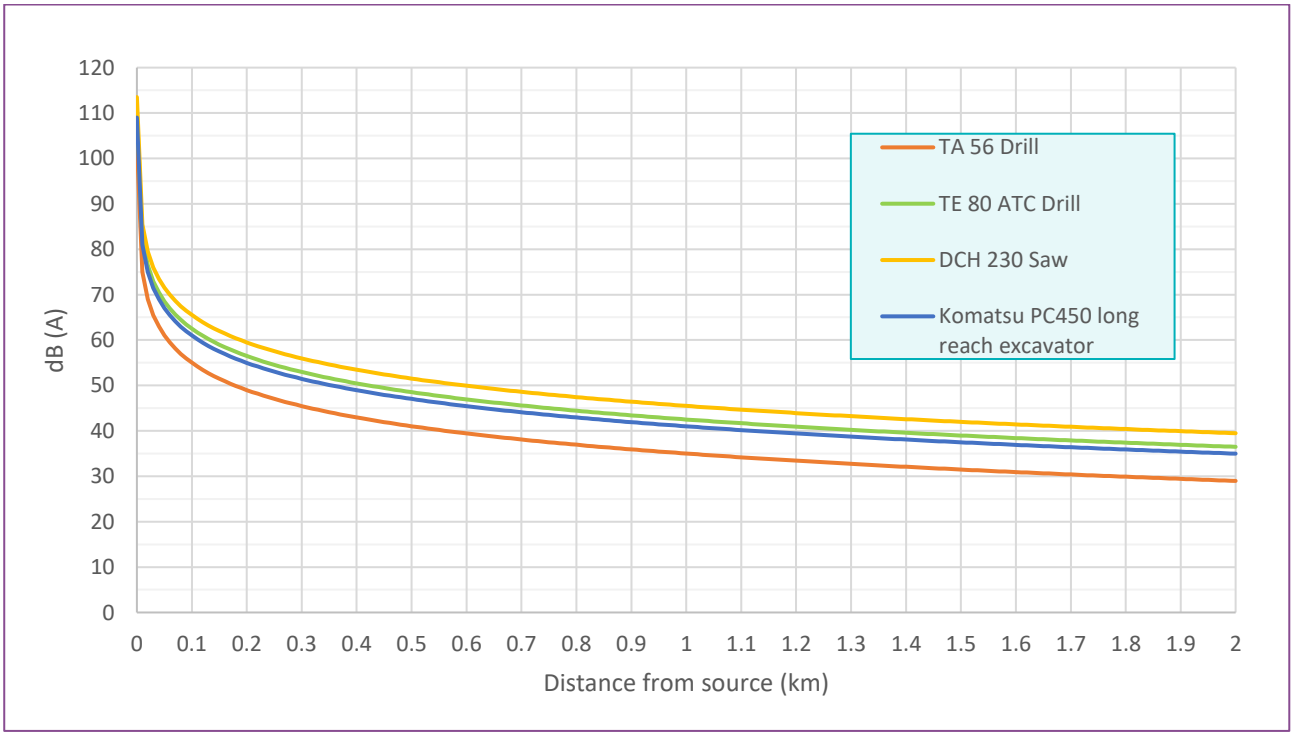
The **exposure** of any birds using the reservoir to **noise** and **visual disturbance** associated with the development will depend on several factors, including:

- the sound power level of the machinery;
- the principal habitats and locations used by the birds species (and hence the distance from the source of any disturbance);
- attenuating factors (such as screening by topography, buildings or vegetation);
- the seasonal timing of the works;
- background noise levels in this area[98].

The sensitivity of the interest features will depend on their behavioural characteristics, their general tolerance / habituation to existing or new activities at a site, and the extent to which avoidance behaviours are achievable. This may also vary during the year (for example, most bird species will be more sensitive when nesting as avoidance behaviours are more constrained).

With regard to noise, a typical long-reach excavator has sound power level of ~109 dB(A); drills and saws have sound power level between 103 dB(A) and 114 dB(A). Without any barriers, the noise level of the loudest equipment used would attenuate to around 55dB(A) within 300m, and to 50 dB(A)[99] within 600m due to distance alone (see Figure B1).

Figure B1 Approximate attenuation of equipment noise with no barriers



[98] Noise levels do not operate additively, so the dB levels in an area are not the sum of the component sources.

[99] As a guide, 60dB(A) is approximately equivalent to a conversation; 50dB(A) is approximately equivalent to the level associated with a quiet suburb or light traffic (which is unlikely to be reached except at night in this area).

With regard to visual disturbance, sensitivity may be broadly correlated with size, with larger species typically having greater 'flush distances' (the distances at which birds typically move when approached by people). Laursen *et al*. (2005) determined that the mean flush distance for shelduck was 225 m; 319 m for brent geese; but only 70 m for dunlin (a much smaller species).

Cutts *et al*. (2009)[100] provide a useful review of available data on bird disturbance. It makes particular reference to noise and disturbance investigations studies undertaken during sea defence works, which included piling works. These studies identified disturbance levels for various activities associated with construction, based on observations of bird responses, which are summarised in **Table B2** below.

Table B2 Estuarine bird responses to construction activity

Activity	Observed Disturbance Level
Personnel and plant on mudflat	High
Personnel and plant on seaward toe and face	High to Moderate
Intermittent plant and personnel on crest	High to Moderate
Irregular piling noise (above 70 dB)	High to Moderate
Long term plant and personnel on crest	Moderate
Regular piling noise (below 70dB)	Moderate
Irregular noise (50-70 dB)	Moderate
Regular noise (50-70dB)	Moderate to low
Occasional movement of the crane jib and load above sight-line	Moderate to low
Noise below 50 dB	Low
Long-term plant only on crest	Low
Activity behind flood bank (inland)	Low

Key:

High	Maximum response; preparing to fly away and flying away, may leave area altogether
Moderate-high Moderate Moderate-low	Head turning, scanning behaviour, reduced feeding, movement to other areas close by (decreasing response)
Low	No effect

The study also records the following observations from other construction schemes on the Humber:

- Piling activity on the landward side of the sea wall at Pyewipe (southern shore), associated with construction of a pumping station, had no disturbance effect on birds in January, February and March; the numbers and distributions of birds were similar

[100] Cutts N., Phelps A. & Burdon D. (2009) *Construction and waterfowl: defining sensitivity, response, impacts and guidance*. Report to Humber INCA by the Institute of Estuarine and Coastal Studies, University of Hull

during periods with and without piling. Disturbance only occurred when construction was moved to the seaward-side of the sea wall in April.

- Six years of bird monitoring associated with the construction of the Humber International Terminal (HIT) concluded that most disturbance only caused birds to move over a small area, and that the HIT development did not have a significant effect on usage of the area by birds.

In general, therefore, effects from noise and visual disturbance during construction typically have a limited range and duration, are reversible, and do not result in long-term adjustments in bird behaviours (such that they might constitute an adverse effect).

Air Quality Effects from Construction Schemes

A number of pollutants have a negative effect on air quality; however, the most significant and relevant to habitats and species (particularly plant species) are the primary pollutants sulphur dioxide (SO_2, typically from combustion of coal and heavy fuel oils although this has declined substantially), nitrogen oxides (NOx, mainly from vehicles) and ammonia (NH_3, principally from agriculture), which (together with secondary aerosol pollutants[101]) are deposited as wet or dry deposits. These pollutants affect habitats and species mainly through acidification and eutrophication.

Acidification increases the acidity of soils, which can directly affect some organisms and which also promotes leaching of some important base chemicals (e.g. calcium), and mobilisation and uptake by plants of toxins (especially metals such as aluminium).

Air pollution contributes to eutrophication within ecosystems by increasing the amounts of available nitrogen (N)[102]. This is a particular problem in low-nutrient habitats, where available nitrogen is frequently the limiting factor on plant growth, and results in slow-growing low-nutrient species being out-competed by faster growing species that can take advantage of the increased amounts of available N.

Overall in the UK, there has been a significant decline in SOx and NOx emissions in recent years and a consequential decrease in acid deposition. In England, SO_x and NO_x have declined by 97% and 72% respectively since 1970 (Defra, 2018) which is the result of a switch from coal to gas, nuclear and renewables for energy generation, and increased efficiency and emissions standards for cars. These emissions are expected to decline further in future years with the transition to electric vehicles. In contrast, emissions of ammonia have remained largely unchanged; they have declined by 10% in England since 1980 (Defra, 2018), but since 2008 have started to increase slightly.

The effect of SO_x and NO_x decreases on ecosystems has been marked, particularly in respect of acidification; the key contributor to acidification is now thought to be deposited nitrogen, for which the major source (ammonia emissions) has not decreased significantly. Indeed, eutrophication from N-deposition (again, primarily from ammonia) is now considered the most significant air quality issue for many habitats.

In terms of the exposure of designated sites to air quality changes associated with construction, this tends to be considered on a case-by-case basis. However, the Department of Transport's *Transport Analysis Guidance*[103] states that "***beyond 200m, the contribution of vehicle emissions from the roadside to local pollution levels is not significant***" and this distance is

[101] Secondary pollutants are not emitted, but are formed following further reactions in the atmosphere; for example, SO_2 and NO_x are oxidised to form SO_4^{2-} and NO_2^- compounds; ozone is formed by the reaction of other pollutants (e.g. NOx or volatile organic compounds) with UV light; ammonia reacts with SO_4^{2-} and NO_2^- to form ammonium (NH_4^+).

[102] Nitrogen that is in a form that can be absorbed and used by plants.

[103] See http://www.dft.gov.uk/webtag/documents/expert/unit3.3.3.php#013; accessed 15/06/14.

typically applied to construction schemes also when considering the potential for European sites to be exposed to any local effects associated with emissions to air. However, it should be noted that concentrations and deposition of traffic-generated pollutants do not decline linearly with distance from the road; typically, air pollution levels fall sharply within the first 20 – 30m before declining more slowly with increased distance[104]. Concentrations and deposition will also be affected by physical parameters, such as local topography or vegetation structure.

Highways England's *Design Manual for Roads and Bridges* (DMRB) sets out an approach for assessing the effect of emissions from specific road schemes on designated sites; this suggests that a quantitative air quality assessment may be required if a European site is within 200m of an affected road and the predicted change in annual average daily traffic (AADT) is over 1000. It should be noted that this is 'in combination' with other projects (etc.), but this is a relatively large increase which

- would not be met by the vast majority of construction schemes when considering either vehicle access to the site / deliveries, or the equivalent movement / use of construction plant); and
- is assumed to be permanent (which is not the case for most construction).

Although it is not simple to apply 'rule of thumb' estimates to relationships between traffic volumes and N-deposition (as this is influenced by a number of factors), it is worth noting that the DMRB guidance regarding air quality thresholds is based on the assumption that 1,000 extra vehicles is equivalent to ~0.01 kg N/ha/yr (this is obviously a coarse figure and there are other factors that come into play such as the emissions factors used for opening year/ wind direction / number of HGVs / speed etc.). The EA-accepted threshold for 'significant effects' on habitats to be possible is an increase of >1% of the minimum critical load[105].

Air quality modelling and assessment is unlikely to be achievable at the WRMP level due to the absence of information on scheme design and construction approaches; and arguably not proportionate. However, it is clear that in the vast majority of cases emissions associated with construction schemes are of a magnitude that (a) will not exceed the thresholds for significant or significant adverse effects (even if relatively close to a site), and which (b) can be reliably managed or avoided using standard and unexceptional avoidance and mitigation measures, if required.

[104] For example, recent air quality modelling by Wood of a new link road at an MoD establishment in the UK found that an Average Annual Daily Traffic (AADT) increase of ~7,000 increased nitrogen deposition by 0.21 kg N/ha/yr at the worst receptor point (at the immediate kerbside), and that by 25m from the road the increase in N-deposition was zero.

[105] The 1% threshold is used as it is accepted that levels below this are difficult to measure and not typically distinguishable from background fluctuations. An exceedance of 1% of the critical load should be seen as a 'starting point' for assessing the significance of any effects; the Institute of Air Quality Management (IAQM) position statement on air quality effects notes that "*it is the position of the IAQM that the use of a criterion of 1% of an assessment level in the context of habitats should be used only to screen out impacts that will have an insignificant effect. It should not be used as a threshold above which damage is implied and is therefore used to conclude that a significant effect is likely*."

Appendix C
Standard Mitigation and Avoidance Measures

Overview

The 'avoidance measures' that may be applied to the options are detailed below, and are grouped as follows:

- General Measures (established construction best-practice, etc.) which will be applied to all options;
- Option-specific Measures (established and reliable measures identified to avoid specific potential effects on European sites, such as in relation to mobile species from the sites).

These measures will be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Note that these measures are not exhaustive or exclusive and must be reviewed at the project stage, taking into account any changes in best-practice as well as scheme-specific survey information or studies.

General Measures and Principles

Scheme Design and Planning

All options will be subject to project-level environmental assessment as they are brought forward, which will include assessments of their potential to affect European sites during their construction or operation. These assessments will consider or identify (inter alia):

- opportunities for avoiding potential effects on European sites through design (e.g. alternative pipeline routes; micro siting; etc);
- construction measures that need to be incorporated into scheme design and/or planning to avoid or mitigate potential effects - for example, ensuring that sufficient working area is available for pollution prevention measures to be installed, such as sediment traps;
- operational designs required to ensure no adverse effects occur (e.g. screening, additional treatment, etc.) – although note that these measures can only be identified through detailed investigation schemes and agreed through the project-level HRA process.

Pollution Prevention

The habitats of European sites are most likely to be affected indirectly, through site-derived pollutants, rather than through direct encroachment. There is a substantial body of general construction good-practice which is likely to be applicable to all of the proposed options and can be

relied on (at this level) to prevent significant or adverse effects on a European site occurring as a result of construction site-derived pollutants. The following guidance documents detail the industry best-practices in construction that are likely to be relevant to the proposed schemes:

- Environment Agency Pollution Prevention Guidance Notes[106], including:
  - PPG1: General guide to the prevention of pollution (May 2001);
  - PPG5: Works and maintenance in or near water (October 2007);
  - PPG6: Pollution prevention guidance for working at construction and demolition sites (April 2010);
  - PPG21: Pollution incident response planning (March 2009);
  - PPG22: Dealing with spillages on highways (June 2002);
- Environment Agency (2001) Preventing pollution from major pipelines [online]. Available at www.environment-agency.gov.uk/static/documents/Business/pipes.pdf. [Accessed 1 March 2011];
- Venables R. et al. (2000) Environmental Handbook for Building and Civil Engineering Projects. 2nd Edition. Construction Industry Research and Information Association (CIRIA), London.

The best-practice procedures and measures detailed in these documents will be followed for all construction works derived from the DWMP as a minimum standard, unless scheme-specific investigations identify additional measures and/or more appropriate non-standard approaches for dealing with potential site-derived pollutants.

General measures for species

Most species-specific avoidance or mitigation measures can only be determined at the scheme level, following scheme-specific surveys, and 'best-practice' mitigation for a species will vary according to a range of factors that cannot be determined at the strategic (DP) level. In addition, some general 'best-practice' measures may not be relevant or appropriate to the interest features of the European sites concerned (for example, clearing vegetation over winter is usually advocated to avoid impacts on nesting birds; however, this is unlikely to be necessary to avoid effects on some SPA species (such as overwintering estuarine birds) and the winter removal of vegetation might actually have a negative effect on these species through disturbance). However, the following general measures will be followed to minimise the potential for impacts on species that are European site interest features unless project level environmental studies or HRA indicate that they are not required or not appropriate, or that alternative or additional measures are more appropriate/necessary:

- Scheme design will aim to minimise the environmental effects by 'designing to avoid' potential habitat features that may be used by species that are European site interest features when outside the site boundary (e.g. linear features such as hedges or stream corridors; large areas of scrub or woodland; mature trees; etc.) through scheme-specific routing studies.
- The works programme and requirements for each option will be determined at the earliest opportunity to allow investigation schemes, surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with NRW/NE.

[106] Note, the Environment Agency Pollution Prevention Guidance Notes have been withdrawn by the Government, although the principles within them are sound and form a reasonable basis for pollution prevention measures.

- Night-time working, or working around dusk/dawn, should be avoided to reduce the likelihood of negative effects on nocturnal species.
- Any lighting required (either temporary or permanent) will be designed with an ecologist to ensure that potential 'displacement' effects on nocturnal animals, particularly SAC bat species, are avoided.
- All compounds/pipe stores etc. will be sited, fenced or otherwise arranged to prevent vulnerable SAC species (notably otters) from accessing them.
- All materials will be stored away from commuting routes/foraging areas that may be used by species that are European site interest features.
- All excavations will have ramps or battered ends to prevent species becoming trapped.
- Pipe-caps must be installed overnight to prevent species entering and becoming trapped in any laid pipe-work.

Appendix D
Assessment of Reserve Options

Overview

As noted (see Section 3), case-practice in WRMP HRAs and the current WRPG suggests it may be acceptable to include Preferred Programme options with residual uncertainties provided that:

- there is sufficient flexibility within the terms of the WRMP to ensure adverse effects can be avoided at the project level (e.g. the plan does not dictate specific pipeline routes or yields that cannot be deviated from); and/or
- the option is not required within the first five years of the plan period, so allowing time for additional investigations to be completed; and
- the uncertainty that this creates is mitigated at the plan-level by the inclusion of alternative options which:
  - will meet the required demand / deficit should the Preferred Programme option prove to have an unavoidable risk of adverse effects on the European sites in question; **and**
  - will not themselves have any adverse effect on any European sites.

This approach allows for the WRMP to be compliant with the Habitats Regulations, since certainty over outcomes for the plan as a whole is provided, despite residual uncertainties over some options.

The assessments documented in Sections 5 – 8 of this report indicate that there are some residual uncertainties relating to the effects of **Option WR107a** (Aughton Park) on flows in the River Alt due to the absence of river gauge data from the lower reaches of the Alt and uncertainties over the relationship between groundwater and surface water in the Alt catchment. These uncertainties will be resolved by the development of the Lower Mersey Basin groundwater model, which will be completed prior to adoption of WRMP24. However, this uncertainty over the hydrological impacts on the Alt ensures some residual uncertainty over effects on the habitats of the Alt estuary; consequently, the possibility of adverse effects on integrity cannot be entirely excluded for the following European sites:

- Ribble and Alt Estuaries SPA / Ramsar (potential for direct effects on the estuarine habitats of the Alt component of the site due to flow reductions, and hence effects on the qualifying bird features of the SPA and Ramsar);
- Liverpool Bay SPA / Mersey Narrows and North Wirral Foreshore SPA/Ramsar (potential for breeding common tern to be affected if foraging near the mouth of the Alt – although note that this would be a small component of the total foraging resource available to these species)
- The north-west estuaries / wetlands complex (i.e. the above sites plus the Dee Estuary SPA/Ramsar, Mersey Estuary SPA/Ramsar, Martin Mere SPA/Ramsar, whereby overwintering waders and geese move between the sites over the winter period and may utilise areas around the Alt estuary – although it should be noted that any effect would be very weak due to the small area affected near the Alt relative to the total resource available for foraging across these sites).

It should be noted that this is a precautionary position, as the available evidence strongly suggests that the hydrological impacts of option WR107a on flows in the Alt estuary will be small, and very probably too small to adversely affect the site habitats (particularly in relation to the tidal turnover and dominance of marine influences) hence integrity of the qualifying feature populations.

As a result, UUW has identified alternative options where there is a high-degree of confidence / certainty that there will be no adverse effects on the integrity of any European sites, alone or in combination. These options are as follows:

Table D1 Alternative Options

Option Ref	Option Name	Summary	Capacity (Ml/d)	Year selected
WR026c	SWN_RIVER RIBBLE	New abstraction from the Middle Ribble catchment, treatment to potable standards and transfer to treated water storage in SRZ.	3	-
WR065b	RES_WHITEHOLME	Raise top water level of Whiteholme Reservoir to increase storage. This option would involve restoration the design capacity of the Whiteholme Reservoir (Whiteholme was subject to an 'In The Interests Of Safety' recommendation in 2015 made under section 10 of the Reservoir Act 1975. This recommendation related to insufficient freeboard in flood conditions, and led to the reservoir top water level being reduced by 1.07m from 382.86m AOD to 381.79m AOD).	2	
WR185	SSO_STOCKPORT PH II	Stockport Resilience Ph II: Pump more water from Manchester Ring Main (MRM). Longford Rd BSP to Greavefold SR and then to High Lane SR. This option is a network solution that utilises spare volumes in the MRM.	12	
WR191	PRO_NORTH LANCASHIRE	New washwater treatment system to treat the filter washwater. This scheme involves minor construction works at Lancaster WTW to recover ~3.5Ml/d of washwater that is otherwise sent to Lancaster WwTW for treatment and discharge into the tidal Lune.	4	

Note, it is considered that there is sufficient certainty over the effects of Options WR111 and WR113 on European sites that these do not require the identification of alternative options (although the options identified above will provide sufficient volumes to cover these schemes also).

The screening and (if required) appropriate assessments of these options are summarised in the following sections. Note, due to the limited scope of the effects and the overlaps with the assessments in the main body of this report, the assessment structure has been simplified relative to Sections 5 – 7 to ensure it remains appropriate to the scale and complexity of the potential effects.

WR026c – SWN River Ribble

Option Summary

This option would require a new abstraction on the River Ribble near Clitheroe (yielding 3Ml/d) with a new treatment works and treated water transfer mains (~7km) crossing the Ribble to feed service reservoirs at Waddington SR and Lowcocks SR.

Screening

The screening of **Option WR026c** is summarised in **Table D2.** In summary, the **Ribble and Alt Estuaries SPA** and **Ribble and Alt Estuaries Ramsar** are downstream receptors. Construction will be unexceptional and so construction effects would not be anticipated (although this aspect is 'screened in' to avoid conflict with 'People over Wind'). Operation will potentially reduce flows in the Ribble to the estuary by up to 3Ml/d. No other European sites will be exposed to potentially significant effects as a result of the option; note, as the option will have 'no effects' on these sites 'in combination' effects are not possible.

Table D2 Option screening summary – WR026c SWN River Ribble

European sites in scope	Dist (km)*	LSE (alone?)	Notes
North Pennine Dales Meadows SAC	5.4	0	Site/features not exposed and sensitive to likely outcomes of option (upstream; distance)
Bowland Fells SPA	8.1	0	Site not exposed to scheme effects; exposure / sensitivity of features will be low (distance; feature distribution in site; habitat preferences; species behaviour) and significant effects are unlikely.
South Pennine Moors SAC	18	0	Site/features not exposed and sensitive to likely outcomes of option (upstream; distance)
South Pennine Moors Phase 2 SPA	18.1	0	Site/features not exposed and sensitive to likely outcomes of option (upstream; distance)
Ribble and Alt Estuaries Ramsar	DS	U	Site is ultimate downstream receptor (>40km); alone effects likely to be nil / inconsequential; catchment-scale in combination effects theoretically possible depending on option mix.
Ribble and Alt Estuaries SPA	DS	U	Site is ultimate downstream receptor (>40km); alone effects likely to be nil / inconsequential; catchment-scale in combination effects theoretically possible depending on option mix.

Appropriate Assessment

The appropriate assessments for **Ribble and Alt Estuaries SPA** and **Ribble and Alt Estuaries Ramsar** are summarised in the following tables:

Table D3 Summary of Appropriate Assessment - Ribble and Alt Estuaries SPA

Aspect	Notes
Site Name	Ribble and Alt Estuaries SPA
Site Code	UK9005103
Qualifying Features	- A017w: Great cormorant *Phalacrocorax carbo* - A616w: Black-tailed godwit *Limosa limosa islandica* - A038w: Whooper swan *Cygnus cygnus* - A179r: Black-headed gull *Larus ridibundus* - A160w: Eurasian curlew *Numenius arquata* - A062w: Greater scaup *Aythya marila* - A144c: Sanderling *Calidris alba* - A158c: Whimbrel *Numenius phaeopus* - A183r: Lesser black-backed gull *Larus fuscus* - A672w: Dunlin *Calidris alpina alpina* - A162c: Common redshank *Tringa totanus* - A048w: Common shelduck *Tadorna tadorna* - A137c: Ringed plover *Charadrius hiaticula* - A141w: Grey plover *Pluvialis squatarola* - A065w: Black (common) scoter *Melanitta nigra* - A193r: Common tern *Sterna hirundo* - A162w: Common redshank *Tringa totanus* - A142w: Northern lapwing *Vanellus vanellus* - A144w: Sanderling *Calidris alba* - A130w: Eurasian oystercatcher *Haematopus ostralegus* - A143w: Red knot *Calidris canutus* - A157w: Bar-tailed godwit *Limosa lapponica* - A151r: Ruff *Philomachus pugnax* - A037w: Tundra swan *Cygnus columbianus bewickii* - A052w: Eurasian teal *Anas crecca* - A050w: Eurasian wigeon *Anas penelope* - A040w: Pink-footed goose *Anser brachyrhynchus* - A140w: European golden plover *Pluvialis apricaria* - A054w: Northern pintail *Anas acuta* - SBA: Seabird assemblage - WATR: Waterbird assemblage - A122r: Corn crake *Crex crex*
Standard data form	Available at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9005103.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/4868920422957056?category=4582026845880320
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/4868920422957056?category=4582026845880320
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/4868920422957056?category=4582026845880320

Aspect	Notes
Associated SSSIs potentially exposed	Ribble Estuary SSSI (units within estuary all in favourable condition)
Assessment – Construction	Construction will be required within the Ribble catchment, including a crossing of the river. Indirect effects (e.g. through site-derived pollutants) can be reliably avoided with established best-practice construction measures (see Appendix C). These will be sufficient to ensure that there is 'no effect' on the habitats of the SPA, and so no risk of 'in combination' effects with other plans / projects etc. **Conclusion: No adverse effects, alone or in combination.**
Assessment – Operation	The WFD assessment predicts that this option could reduce flows in the River Ribble by up to a maximum of 4% at Q95 **at the abstraction point**, with decreasing impacts downstream towards the tidal limit (over 30km downstream). The Ribble, Douglas and Crossens ALS (Environment Agency, 2013) states that water is available in the Lower Ribble; more recent water availability information provided by the Environment Agency in March 2022 indicates that this is still the case, with approximately 150Ml/d available at Q95). Consequently, the hydrological impact of this option is considered too small to be detectable at the boundary of the SPA, and the volumes lost will be inconsequential in relation to flows in the Ribble and the tidal turnover of the Ribble estuary. As a result, there will be no adverse effects on the integrity of this SPA as a result of this option. With regard to in combination effects, the approach outlined in Section 3 of this report was followed to identify other plans and projects that might interact with this option. No **Drought Plan** options have the potential to affect this SPA; and no other potential in combination effects have been identified (e.g. with Shoreline Management Plans or projects on the Planning Inspectorate's National Infrastructure Projects database). **Conclusion: No adverse effects, alone or in combination.**

WR065b – RES Whiteholme Reservoir

Option Summary

Whiteholme Reservoir was subject to an 'In The Interests Of Safety' recommendation in 2015 made under section 10 of the Reservoir Act 1975, which related to insufficient freeboard being available in flood conditions, and led to the reservoir top water level being reduced by 1.07m; this was achieved through the removal of a small concrete weir ~8m x 1.07m at the entrance to the overflow spillway (see Figure D1). This option would reinstate the reinforced concrete weir section, so restoring the previous top water level.

Figure D1 Weir being removed in 2015

Note, the topography of the reservoir and operational use ensured that this did not fundamentally alter the area of the reservoir affected by its operation.

Screening

The screening of **Option 065b** is summarised in **Table D4.** In summary, this reservoir is located within (and is covered by) the South Pennine Moors SAC and South Pennine Moors Phase 2 SPA; construction is likely to be a relatively minor undertaking (and the reverse of the weir removal works that were undertaken in 2015 without adverse effects) but this aspect is 'screened in' to avoid conflict with 'People over Wind'. With regard to operation the scheme will restore water levels to the designed capacity (which was in place when the SPA and SAC were designated); the topography of the reservoir and operational use ensured that the water level reduction did not fundamentally alter the area of the reservoir affected by its operation. No other European sites will be exposed to potentially significant effects as a result of the option; note, as the option will have 'no effects' on these sites 'in combination' effects are not possible.

Table D4 Option screening summary – WR065b – RES Whiteholme Reservoir

European sites in scope	Dist (km)*	LSE (alone?)	Notes
South Pennine Moors Phase 2 SPA	0	U*	Scheme will involve restoration of reservoir to pre-2015 levels and so breeding / foraging etc. habitat for the interest features unlikely to be affected (certainly not potentially significant areas). Construction effects

European sites in scope	Dist (km)*	LSE (alone?)	Notes
			avoidable with established measures, but requires AA.
South Pennine Moors SAC	0	U*	Scheme will involve restoration of reservoir to pre-2015 levels and so qualifying habitats unlikely to be affected in area inundated (certainly not potentially significant areas). Construction effects avoidable with established measures, but requires AA.
Rochdale Canal SAC	4.5	0	Site/features not exposed and sensitive to likely outcomes of option (distance). No effects therefore no risk of i/c effects.
Peak District Moors (South Pennine Moors Phase 1) SPA	11.1	0	Site/features not exposed and sensitive to likely outcomes of option (distance). No effects therefore no risk of i/c effects.
Mersey Estuary Ramsar	DS	0	Site is ultimate downstream receptor (~60km direct, substantially more via watercourses); alone effects will be nil / inconsequential; catchment-scale in combination effects not possible due to option characteristics (will not ultimately reduce flows to the estuary).
Mersey Estuary SPA	DS	0	Site is ultimate downstream receptor (~60km direct, substantially more via watercourses); alone effects will be nil / inconsequential; catchment-scale in combination effects not possible due to option characteristics (will not ultimately reduce flows to the estuary).

Appropriate Assessment

The appropriate assessments for **South Pennine Moors Phase 2 SPA** and **South Pennine Moors SAC** are summarised in the following tables:

Table D5 Summary of Appropriate Assessment - South Pennine Moors SAC

Aspect	Notes
Site Name	South Pennine Moors SAC
Site Code	UK0030280
Qualifying Features	- H4010: Northern Atlantic wet heaths with *Erica tetralix* - H4030: European dry heaths - H7130: Blanket bogs (* if active bog) - H7140: Transition mires and quaking bogs - H91A0: Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
Standard data form	Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030280.pdf

Aspect	Notes
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/4973604919836672?category=5758332488908800
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/4973604919836672?category=5758332488908800
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/4973604919836672?category=5758332488908800
Associated SSSIs potentially exposed	South Pennine Moors SSSI (units within / near reservoir all in unfavourable recovering condition)
Assessment – Construction	Construction will be required at the location of an existing concrete spillway / weir, with access to this available from operational areas of the reservoir and hardstanding / access tracks, and so direct effects on the qualifying habitats of the site will not occur. Indirect effects (e.g. through site-derived pollutants) can be reliably avoided with established best-practice construction measures (see Appendix C). These will be sufficient to ensure that there is 'no effect' on the habitats of the SAC, and so no risk of 'in combination' effects with other plans / projects etc. **Conclusion: No adverse effects, alone or in combination.**
Assessment – Operation	Operation of the scheme will restore the reservoir to its designed capacity and increase water levels by ~1m. However, the topography of the reservoir and operational use since 2015 has ensured that the previous water level reduction did not fundamentally alter the area of the reservoir affected by its operation – i.e. the area of the reservoir affected by the restoration of water levels does not support the qualifying features of the SAC (since most of it is still regularly inundated), nor is it a functional component of the integrity of these features. Furthermore, the restoration of water levels is consistent with the condition of the reservoir at the time of designation. Operational in combination effects are not possible through any mechanism. **Conclusion: No adverse effects, alone or in combination.**

Table D6 Summary of Appropriate Assessment - South Pennine Moors Phase 2 SPA

Aspect	Notes
Site Name	South Pennine Moors Phase 2 SPA
Site Code	UK9007022
Qualifying Features	- A098r: Merlin *Falco columbarius* - A140r: European golden plover *Pluvialis apricaria* - A222r: Short-eared owl *Asio flammeus* - BBA: Breeding bird assemblage - A040w: Pink-footed goose *Anser brachyrhynchus*

Aspect	Notes
Standard data form	Available at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9007022.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/4885083764817920?category=5758332488908800
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/4885083764817920?category=5758332488908800
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/4885083764817920?category=5758332488908800
Associated SSSIs potentially exposed	South Pennine Moors SSSI (units within / near reservoir all in unfavourable recovering condition)
Assessment – Construction	Construction will be required at the location of an existing concrete spillway / weir, with access to this available from operational areas of the reservoir and hardstanding / access tracks, and so direct effects on the supporting habitats for the qualifying species of the site will not occur. Indirect effects (e.g. through site-derived pollutants, or through disturbance of the qualifying features when breeding) can be reliably avoided with established best-practice construction measures (see Appendix C). These will be sufficient to ensure that there is 'no effect' on the habitats of the SAC, and so no risk of 'in combination' effects with other plans / projects etc. **Conclusion: No adverse effects, alone or in combination.**
Assessment – Operation	Operation of the scheme will restore the reservoir to its designed capacity and increase water levels by ~1m. However, the topography of the reservoir and operational use since 2015 has ensured that the previous water level reduction did not fundamentally alter the area of the reservoir affected by its operation – i.e. the area of the reservoir affected by the restoration of water levels does is not likely to provide potentially notable breeding / foraging habitat for the qualifying species of the site (since most of it is still regularly inundated), nor is it a functional component of the integrity of these features. Furthermore, the restoration of water levels is consistent with the condition of the reservoir at the time of designation. Operational in combination effects are not possible through any mechanism. **Conclusion: No adverse effects, alone or in combination.**

WR185 – SSO Stockport Ph. II

Option Summary

This option is a network solution that utilises spare volumes in the Manchester Ring Main through optimisation. The principal construction elements of this option are minor and comprise:

- New inline pumping station upstream of Greavefold SR (PS1)
- New inline pumping station upstream of High Lane SR (PS2)

- Analysis equipment at effluent of Greavefold SR

Screening

The screening of **Option WR185** is summarised in **Table D7.** In summary, this is a small-scale construction scheme that will have **no significant effects, alone or in combination**, on any European sites due to the distances involved and absence of pathways for site-derived pollutants to reach the sites (irrespective of mitigation, hence no risk of conflict with PoW). Note, as the option will have 'no effects' on any European sites 'in combination' effects are not possible.

Table D7 Option screening summary – WR185 SSO Stockport Ph. II

European sites in scope	Dist (km)*	LSE (alone?)	Notes
Rochdale Canal SAC	8.5	0	No effect pathways (distance, separate catchment)
Peak District Moors (South Pennine Moors Phase 1) SPA	8.7	0	No effect pathways (distance, upstream)
South Pennine Moors SAC	8.7	0	No effect pathways (distance, upstream)
Peak District Dales SAC	18.2	0	No effect pathways (distance, upstream)
South Pennine Moors Phase 2 SPA	18.8	0	No effect pathways (distance, upstream)
Rostherne Mere Ramsar	19.1	0	No effect pathways (distance, separate catchment)
Mersey Estuary Ramsar	DS	0	No effect pathways (distance, option characteristics)
Mersey Estuary SPA	DS	0	No effect pathways (distance, option characteristics)

WR191 – PRO North Lancashire

Option Summary

This option involves the construction of a new washwater treatment system at Lancaster WTW (located at Langthwaite Reservoir) to recover ~3.5Ml/d of washwater that is otherwise sent to Lancaster STW for treatment and discharge into the tidal Lune near Stodday.

Screening

The screening of **Option WR191** is summarised in **Table D8.** In summary, the estuarine components of the **Morecambe Bay Ramsar, Morecambe Bay SAC and Morecambe Bay and Duddon Estuary SPA** are downstream receptors. Construction will be a relatively minor undertaking at an existing operational site (i.e. with existing drainage and containment structures present) and so construction effects would not be anticipated (although this aspect is 'screened in' to avoid conflict with 'People over Wind'). With regard to operation the scheme will utilise washwater that would otherwise be sent to Lancaster STW for treatment and discharge into the

tidal Lune near Stodday; this is examined in a brief appropriate assessment. No other sites are exposed to the likely outcomes of the option.

Table D8 Option screening summary – WR191 PRO North Lancashire

European sites in scope	Dist (km)*	LSE (alone?)	Notes
Bowland Fells SPA	3.8	0	No effect pathways (distance, species habitat preferences)
Morecambe Bay Ramsar	4.1	U	Features sensitive to water resource permissions but magnitude of environmental change will be extremely small (relative and absolute) although this is characterised through AA, below.
Morecambe Bay SAC	4.1	U	Features sensitive to water resource permissions but magnitude of environmental change will be extremely small (relative and absolute) although this is characterised through AA, below.
Morecambe Bay and Duddon Estuary SPA	4.5	U	Features sensitive to water resource permissions but magnitude of environmental change will be extremely small (relative and absolute) although this is characterised through AA, below.
Calf Hill and Cragg Woods SAC	4.7	0	No effect pathways (distance)
Leighton Moss Ramsar	15.3	0	No effect pathways (distance)
Leighton Moss SPA	15.3	0	No effect pathways (distance)
Morecambe Bay Pavements SAC	15.7	0	No effect pathways (distance)

Appropriate Assessment

The appropriate assessments for **Morecambe Bay Ramsar, Morecambe Bay SAC** and **Morecambe Bay and Duddon Estuary SPA** are summarised in the following tables:

Table D9 Summary of Appropriate Assessment - Morecambe Bay SAC

Aspect	Notes
Site Name	Morecambe Bay SAC
Site Code	UK0013027
Qualifying Features	- H1110: Sandbanks which are slightly covered by sea water all the time - H1130: Estuaries - H1140: Mudflats and sandflats not covered by seawater at low tide - H1150: Coastal lagoons - H1160: Large shallow inlets and bays - H1170: Reefs

Aspect	Notes
	- H1220: Perennial vegetation of stony banks - H1310: *Salicornia* and other annuals colonizing mud and sand - H1330: Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) - H2110: Embryonic shifting dunes - H2120: Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") - H2130: Fixed coastal dunes with herbaceous vegetation ("grey dunes") - H2150: Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) - H2170: Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*) - H2190: Humid dune slacks - S1166: Great crested newt *Triturus cristatus*
Standard data form	Available at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0013027.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/5314736417669120?category=4582026845880320
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/5314736417669120?category=4582026845880320
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/5314736417669120?category=4582026845880320
Associated SSSIs potentially exposed	Lune Estuary SSSI (units downstream of Lancaster WwTW and Lancaster STW all in favourable condition)
Assessment – Construction	Construction will be required at the existing WwTW / reservoir site, which is between the catchments of the Lune and the River Conder (both drain to Morecambe Bay). Indirect effects (e.g. through site-derived pollutants) can be reliably avoided with established best-practice construction measures (see Appendix C). These will be sufficient to ensure that there is 'no effect' on the habitats of the SAC, and so no risk of 'in combination' effects with other plans / projects etc. **Conclusion: No adverse effects, alone or in combination.**
Assessment – Operation	Operation of the scheme will theoretically reduce the input of non-saline water to the Lune estuary by 3.5Ml/d (maximum; in practice it would be less due to process losses etc.), as washwater from the WwTW is understood to be passed to Lancaster STW for treatment and subsequently discharged into the tidal Lune at Stodday (i.e. directly to the SAC at this point). The only features potentially exposed at this location are Estuaries; Mudflats and sandflats not covered by seawater at low tide; *Salicornia* and other annuals colonizing mud and sand; and potentially Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*). With regard to water quality, the loss of the washwater will have essentially no effect on the quality of the discharges from the STW as the existing discharge permits will still be met, and the washwater is a very small component of the DWF and discharges from the STW in relation to wastewater received from Lancaster (~90% of the raw waste inputs at the Lancaster STW is of residential origin (Stantec 2022), with the remainder being from industrial sources).

Aspect	Notes
	The volume of non-saline water entering the Lune estuary would theoretically decrease by around 3.5Ml/d assuming that all of the water extracted at the WwTW would otherwise have been discharged to the estuary via the STW. This has the potential to alter the estuarine habitats in the immediate vicinity of the STW outfall depending on their sensitivity to non-saline inputs. However, this volume loss will be inconsequential in relation to (a) the volumes of non-saline water that will continue to be discharged from the STW at this location (b) the volumes of freshwater from the Lune (Q95 flows at the lowest gauging station on the Lune, approximately 13.5km upstream from the SWT, are ~282.5Ml/d); and (c) the tidal influx. It is therefore certain that any reduction of this magnitude will have no practically measurable effects on habitat condition, and so adverse effects on integrity would not occur. With regard to in combination effects, the approach outlined in Section 3 of this report was followed to identify other plans and projects that might interact with this option. Two **Drought Plan** options (River Lune LCUS abstraction; and Lake Windermere) have the potential to affect this SAC; the Drought Plan HRA concluded that there would be 'no LSE' alone or in combination. The Lake Windermere DP option will not affect the Lune; and the effects of option WR191 alone will be too small to alter the conclusion for the River Lune LCUS abstraction. There will therefore be no operational in combination effects if the DP options are utilised). No other potential in combination effects have been identified (e.g. with Shoreline Management Plans or projects on the Planning Inspectorate's National Infrastructure Projects database). **Conclusion: No adverse effects, alone or in combination.**

Table D10 Summary of Appropriate Assessment – Morecambe Bay and Duddon Estuary SPA

Aspect	Notes
Site Name	Morecambe Bay and Duddon Estuary SPA
Site Code	UK9020326
Qualifying Features	- A026w: Little egret *Egretta garzetta* - A038w: Whooper swan *Cygnus cygnus* - A040c: Pink-footed goose *Anser brachyrhynchus* - A048c: Common shelduck *Tadorna tadorna* - A130c: Eurasian oystercatcher *Haematopus ostralegus* - A137c: Ringed plover *Charadrius hiaticula* - A140w: European golden plover *Pluvialis apricaria* - A141c: Grey plover *Pluvialis squatarola* - A143c: Red knot *Calidris canutus* - A144c: Sanderling *Calidris alba* - A672c: Dunlin *Calidris alpina alpina* - A151w: Ruff *Philomachus pugnax* - A616c: Black-tailed godwit *Limosa limosa islandica* - A157w: Bar-tailed godwit *Limosa lapponica* - A160c: Eurasian curlew *Numenius arquata* - A162c: Common redshank *Tringa totanus*

Aspect	Notes
	- A169c: Ruddy turnstone *Arenaria interpres* - A176w: Mediterranean gull *Larus melanocephalus* - A183r: Lesser black-backed gull *Larus fuscus* - A184r: Herring gull *Larus argentatus* - A191r: Sandwich tern *Sterna sandvicensis* - A193r: Common tern *Sterna hirundo* - A195r: Little tern *Sterna albifrons* - A054c: Northern pintail *Anas acuta* - A183c: Lesser black-backed gull *Larus fuscus* - WATR: Waterbird assemblage - SBA: Seabird assemblage - A194r: Arctic tern *Sterna paradisaea*
Standard data form	Available at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9020326.pdf
Conservation Objectives	Available at: http://publications.naturalengland.org.uk/publication/6242841537806336?category=4582026845880320
Site Improvement Plan	Available at: http://publications.naturalengland.org.uk/publication/6242841537806336?category=4582026845880320
Supplementary advice	Available at: http://publications.naturalengland.org.uk/publication/6242841537806336?category=4582026845880320
Associated SSSIs potentially exposed	Lune Estuary SSSI (units downstream of Lancaster WwTW and Lancaster STW all in favourable condition)
Assessment – Construction	Construction will be required at the existing WwTW / reservoir site, which is between the catchments of the Lune and the River Conder (both drain to Morecambe Bay). Indirect effects (e.g. through site-derived pollutants, or through disturbance of SPA species if using the Langthwaite Reservoir (e.g. for roosting, although note that there is no evidence of a significant functional linkage between the reservoir and the SPA) can be reliably avoided with established best-practice construction measures (see Appendix C). These will be sufficient to ensure that there is 'no effect' on the habitats of the SAC, and so no risk of 'in combination' effects with other plans / projects etc. **Conclusion: No adverse effects, alone or in combination.**
Assessment – Operation	The operational assessment is as per that for the Morecambe Bay SAC; in summary, the environmental changes expected from operation of the scheme will be negligible and will not result in any substantive changes to the supporting habitats for the SPA qualifying features (i.e. such that the integrity of the qualifying species' populations might be adversely affected). **Conclusion: No adverse effects, alone or in combination.**

Table D11 Summary of Appropriate Assessment – Morecambe Bay Ramsar

Aspect	Notes
Site Name	Morecambe Bay Ramsar
Site Code	UK11045
Qualifying Features	- Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds - Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge - Crit. 5 - regularly supports 20,000 or more waterbirds
Standard data form	Available at: https://jncc.gov.uk/jncc-assets/RIS/UK11045.pdf
Conservation Objectives	As per associated SAC / SPA, or underpinning SSSI(s)
Site Improvement Plan	As per associated SAC / SPA, or underpinning SSSI(s)
Supplementary advice	As per associated SAC / SPA, or underpinning SSSI(s)
Associated SSSIs potentially exposed	Lune Estuary SSSI (units downstream of Lancaster WwTW and Lancaster STW all in favourable condition)
Assessment – Construction	Construction will be required at the existing WwTW / reservoir site, which is between the catchments of the Lune and the River Conder (both drain to Morecambe Bay). Indirect effects (e.g. through site-derived pollutants, or through disturbance of Ramsar bird species if using the Langthwaite Reservoir (e.g. for roosting, although note that there is no evidence of a significant functional linkage between the reservoir and the SPA) can be reliably avoided with established best-practice construction measures (see Appendix C). These will be sufficient to ensure that there is 'no effect' on the habitats of the SAC, and so no risk of 'in combination' effects with other plans / projects etc. **Conclusion: No adverse effects, alone or in combination.**
Assessment – Operation	The operational assessment is as per that for the Morecambe Bay SAC / Morecambe Bay and Duddon Estuary SPA; in summary, the environmental changes expected from operation of the scheme will be negligible and will not result in any substantive changes to the supporting habitats for the SPA qualifying features (i.e. such that the integrity of the qualifying species' populations might be adversely affected). **Conclusion: No adverse effects, alone or in combination.**

In combination Effects with Retained Preferred Options

The reserve options above would most likely be used to replace Option WR107a (Aughton Park), although there will be a degree of mutual exclusivity in all options; the European sites potentially exposed to the preferred options and the reserve options are summarised in **Table D12**.

Table D12 In combination Effects between Reserve and Retained Preferred Options

Site	Options	Effects alone	i/c?
Ribble and Alt Estuaries SPA	WR107a WR026b	No adverse effect No adverse effect	These options are likely to be mutually exclusive, and so i/c effects would not occur. In addition, the zones of hydrological influence will not overlap at all, and the effects of both options will be too small to create synergistic or additive effects. Conclusion: no adverse effects i/c
Ribble and Alt Estuaries SPA	WR107a WR026b	No adverse effect No adverse effect	As for Ribble and Alt Estuaries SPA
Mersey Estuary SPA	WR111 WR113 WR065b WR185	No adverse effect No adverse effect No effects No adverse effect	Construction-related effects from these options will not occur with mitigation; operational effects are only possible from WR111 and WR113, which are discussed in Section 7 where it is concluded that there will be no adverse effects on this site.
Mersey Estuary Ramsar	WR111 WR113 WR065b WR185	No adverse effect No adverse effect No effects No adverse effect	As for Mersey Estuary SPA.

Conclusion

It can be concluded that **the proposed reserve options will have no adverse effects on the integrity of any European sites, alone or in combination**, if they are required to replace one or more of the preferred options.

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