



HABITATS REGULATIONS ASSESSMENT

Final Water Resources Management Plan 2024

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

Severn Trent Water

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Front cover image:

Upper Derwent Valley, Severn Trent

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EXECUTIVE SUMMARY

Water companies in England and Wales have a statutory requirement to prepare a Water Resources Management Plan (WRMP) every five years. The purpose of these WRMPs is to set out a strategy for a particular supply area over a 25-year period (statutory minimum) to maintain a supply-demand balance. This statutory requirement is defined under the Water Act 2003. This Habitats Regulations Assessment (HRA) accompanies Severn Trent Water's final Water Resources Management Plan 24 (Severn Trent's WRMP24).

A water company must ensure its final WRMP meets the requirements of the Habitats Regulations before implementation. The requirement for a HRA is established through Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. This directive, known as the Habitats Directive, is transposed into national legislation by the Conservation of Habitats and Species Regulations 2017; commonly referred to as the Habitats Regulations. Under Regulations 63, any plan or project which is likely to have a significant effect on a European site (either alone or in-combination with other plans or projects) and is not directly connected with, or necessary for the management of the site, must be subject to a HRA to determine the implications for the site in view of its conservation objectives. Under UK Government policy, wetland sites designated under the international Ramsar Convention 1971 should also be subject to HRA, and are also referred to as 'European sites' in this context.

The HRA needs to consider whether there are any likely significant effects (LSE) arising from construction or implementation activities and/or operation of any of the options considered in the WRMP24. Ricardo was commissioned by Severn Trent to undertake a HRA of a 'feasible' list of options in its WRMP24. By considering HRA from the outset, the intention has been to seek to avoid options being included in the WRMP24 that would lead to adverse effects on European sites.

This HRA documents the initial screening review of the feasible options to support Severn Trent with the plan development, and identify those options likely to have adverse effects which cannot be easily mitigated. The HRA Stage 1 Screening for the preferred plan in the WRMP24 was completed and identifies those options with Likely Significant Effects (LSE). It also identifies those options where Stage 2 Appropriate Assessment would be needed if the option were to be included in the preferred plan of the WRMP24. This report provides the legislative background, consultation process, Plan overview, methodology for the HRA and the results of the Stage 1 Screening assessment process. Tables with the HRA Stage 1 assessments for each scheme are given in the Appendix.

All options within the preferred plan which had LSEs have been subject to Stage 2 Appropriate Assessment, in line with the Water Resources Planning Guidelines (April 2023). Those options within alternative plans required before 2035 have similarly been subject to Stage 2 Appropriate Assessments, however those required after this period have not, as there is sufficient time to complete the necessary assessments for the next cycle of the WRMP process ahead of these pathways being adopted.

Severn Trent has identified 38 options within its preferred plan, with those options required prior to 2035 being the same in the alternative plans. Of these:

- 19 preferred plan options do not require HRA Stage 2 Appropriate Assessments: This includes Option 564 which has insufficient location detail to be able to complete HRA Stage 1 screening. With the implementation of Option 564 planned to be on-line in 2060-61, there is time in the programme to further develop the option and for HRA to be undertaken as appropriate.
- 19 options have been identified as requiring a Stage 2 Appropriate Assessment for construction and/or operation, with the following sites considered (NB: SAC Special Areas of Conservation, SPA Special Protection Areas):
 - Bredon Hill SAC
 - Dixon Wood SAC
 - Humber Estuary SAC, SPA and Ramsar
 - Peak District Dales SAC
 - River Clun SAC
 - River Mease SAC
 - Severn Estuary SAC and Ramsar
 - Cannock Chase SAC
 - Fen Pools SAC
 - Pasturefields Salt Marsh SAC
 - Peak District Moors (South Pennine Moors Phase 1) SPA
 - River Dee and Bala Lake SAC
 - Rutland Water SPA and Ramsar
 - South Pennine Moors SAC

- In addition, 3 in-combinations within plan for River Mease SAC, River Derwent/Peak District Dale SAC, and Severn Estuary European Marine Site (EMS) Stage 2 Appropriate Assessments have been completed.
- Between WRMP in-combination assessments for the Humber Estuary EMS and the Severn Estuary EMS are committed to beyond the submission of WRMP24 as a full understanding of the WRMP options and Strategic Resource Option interactions is understood, and consistent approaches can be adopted to the assessments using all available tools.

The results of the assessments of the supply-side options show that there are sufficient standard and best practice mitigation measures that can be implemented during construction to avoid adverse effects. Further hydrological assessment and surveys to confirm presence and use of offsite functionally linked habitat will be required for a number of options ahead of project-level HRAs. Mitigation measures, including restrictions on abstraction licences (volumes, timings) and reviews of Hand off flow may be required to avoid adverse effects. One option is currently concluded as uncertain in terms of adverse effects, although low risk; 503 New groundwater source Middle Dee GWMU. The option is not 'on-line' until 2049-50 and therefore sufficient time, and subsequent WRMP cycles, where this option can be further investigated (feasibility and construction period currently programmed for Apr 2040 - Mar 2050). Mitigation may include relocating the borehole elsewhere in the groundwater body. A hydrogeological assessment and groundwater modelling is likely to be required to understand the impacts to the River Dee and Bala Lake SAC.

The preferred plan includes demand management measures targeted at leakage reduction, water efficiency measures and fitting of enhanced and smart meter technology. For demand-side measures that are likely to require some form of physical intervention or amendment to infrastructure (e.g. pipe repair), some instances of effect pathways might be conceivable 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. However, it is very likely that adverse and/or significant effects could be avoidable at a scheme level; 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.

1. INTRODUCTION

1.1 BACKGROUND AND PURPOSE OF REPORT

The Water Act 2003 requires that all water companies in England and 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.

Severn Trent Water (hereafter 'Severn Trent') has prepared its WRMP 2024. The draft WRMP24 was published for consultation in November 2022, and a Statement of Response to the consultation responses was published in June 2023. Following further regulatory consultation on the revised draft WRMP24 (Autumn 2023), and revised revised draft (Spring 2024) Severn Trent have now prepared their final WRMP24 and permission to publish was received by DEFRA in late January 2025. The WRMP24 sets out Severn Trent's preferred resource and demand management options ('the preferred options') for meeting predicted deficits in the water available for public water supply, and for ensuring security of supply. The WRMP24 also sets out alternative plans to meet a number of scenarios relating to alternative futures covering some key uncertainties, including the impacts of climate change, alternative phasing, changes to environmental destination and the pace of technological change (refer to the overarching WRMP24 for further details).

Severn Trent's WRMP24 was developed within a regional water resources planning framework covering all or part of the operational areas of Dŵr Cymru Welsh Water (DCWW), Severn Trent Water (Severn Trent), South Staffordshire Water (SSW) and United Utilities Water (UU)¹ that is managed by Water Resources West (WRW). WRW is currently preparing a Regional Plan² 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 companies' WRMP24s, as well as the Strategic Resource Options (SROs) being taken forward by the companies.

A water company must ensure its final WRMP meets the requirements of the Habitats Regulations before implementation. The requirement for a Habitats Regulations Assessment (HRA) is established through Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, hereby referred to as the 'Habitats Directive', in Articles 6(3) and 6(4). The Habitats Directive is transposed into national legislation by the Conservation of Habitats and Species Regulations 2017 (as amended)³, commonly referred to as the Habitats Regulations.

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 and Wales.

¹ 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.

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

³ 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.

Regulation 63 states that if a plan or project “(a) is likely to have a significant effect on a European site⁴ or a European offshore marine site⁵ (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.

This assessment process is known as HRA⁶. 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)⁷ and, if so, whether there will be any ‘adverse effects on site integrity’⁸.

1.2 CONSULTATION

Natural England and the Environment Agency were consulted on the proposed HRA methodology in April 2021 as part of the wider WRW consultation exercise. Natural England and the Environment Agency were also consulted on the SEA Scoping Report in April 2021. A number of other consultation meetings with regulators were undertaken throughout the development of the WRMP24 and WRW regional plan including on 27th July 2021 to engage on the approach to environmental appraisal and on 10th November 2021 to share a summary of key options emerging and their option-level environmental assessments.

Severn Trent’s draft WRMP24 was published for consultation in November 2022, and a Statement of Response compiled and published in June 2023. As part of the review of the regulator comments, a meeting was held with Natural England and the Environment Agency on 6 April 2023 to discuss their key concerns. Following this meeting, and as part of the review of the preferred plan and alternative programmes, the reservoir expansion component of the Upper Derwent Valley Expansion Strategic Resource Option (SRO) has now been removed.

Feedback on the draft WRMP24 was incorporated into the revised draft WRMP24 which was submitted to regulators in Autumn 2023. A second Statement of Response was published in March 2024 following feedback from Defra and the Environment Agency. Severn Trent submitted a further revised draft to the regulators in Spring 24 with additional feedback in Summer 2024. These have been taken into account, where appropriate, within this HRA to support the final WRMP24. This includes updates associated with options that are potentially supported by trade from United Utilities with release of water from Vyrnwy reservoir.

⁴ 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. 181; 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’).

⁵ ‘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.

⁶ 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.

⁷ Also referred to as the ‘test of significance’.

⁸ Also referred to as the ‘integrity test’.

1.3 STRUCTURE OF THE REPORT

The report is divided into the following sections:

Section 1: Introduction

Section 2: Methodology

Section 3: Severn Trent's WRMP24

Section 4: HRA Stage 1 Screening

Section 5: Stage 2 Appropriate Assessment: Peak District Dales SAC

Section 6: Stage 2 Appropriate Assessment: South Pennine Moors SAC

Section 7: Stage 2 Appropriate Assessment: Peak District Moors (South Pennine Moors Phase 1) SPA

Section 8: Stage 2 Appropriate Assessment: Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar

Section 9: Stage 2 Appropriate Assessment: River Clun SAC

Section 10: Stage 2 Appropriate Assessment: Cannock Chase SAC

Section 11: Stage 2 Appropriate Assessment: Pasturefields Salt Marsh SAC

Section 12: Stage 2 Appropriate Assessment: River Mease SAC

Section 13: Stage 2 Appropriate Assessment: Rutland Water SPA and Ramsar

Section 14: Stage 2 Appropriate Assessment: Bredon Hill SAC and Dixton Wood SAC

Section 15: Stage 2 Appropriate Assessment: Fen Pools SAC

Section 16: Stage 2 Appropriate Assessment: River Dee and Bala Lake SAC

Section 17: Strategic in-combination assessment

Section 18: Draft HRA conclusions

Appendix A: Effect Pathway Assumptions

Appendix B: Standard Mitigation and Avoidance Measures

Appendix C: HRA Stage 1 Screening Initial Review

2. METHODOLOGY

2.1 CONTEXT AND STAGES OF THE HRA PROCESS

The responsibility for undertaking the HRA lies with Severn Trent as the plan making authority.

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)⁹ and, if so, whether there will be any 'adverse effects on site integrity'¹⁰.

Guidance recognises four key steps in the HRA process as follows:

1. Stage 1 Screening – the identification of Likely Significant Effects (LSEs) of a plan or project on a European designated site either alone or in-combination. The test is a trigger for further assessment, and therefore the bar is set low i.e., is there a risk or possibility of an adverse effect. At this stage mitigation measures should not be taken into account, 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.
2. Stage 2 Appropriate Assessment and the 'integrity test' – which involves closer examination of the project or plan and 'screened in' European designated sites to determine whether those sites will be subject to 'adverse effects on integrity'. The scope of such assessments is not set, and some may not be particularly detailed, especially where standard mitigation measures are available which are known to be effective. The level of assessment must be sufficient to ensure that there is no 'reasonable scientific doubt' that adverse effects on site integrity will not occur.
3. Stage 3 – Alternative Solutions – where adverse effects or uncertainty remain after the inclusion of mitigation in Stage 2, alternative ways where alternative solutions that meet the plan objectives are identified and consideration of their effects are given in comparison to those in the plan. A plan or project which has adverse effects on the integrity of a European site cannot be permitted if alternative solutions are available, except where the criteria for imperative reasons of overriding public interest are met (IROPI, see Stage 4).
4. Stage 4 Imperative Reasons of Overriding Public Interest – where there are no alternatives that have no or lesser effects on European sites, and the IROPI criteria are met, compensatory measures are developed and secured.

The stages as described above, 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.**

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.

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 to the emerging or interim stages of strategic plans¹¹ is not always appropriate, reducing the clarity and usefulness of the HRA as a plan-shaping process for both plan-makers and consultees. For

⁹ Also referred to as the 'test of significance'.

¹⁰ Also referred to as the 'integrity test'.

¹¹ 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.

WRMPs this is especially true for the assessment of the emerging feasible options and the application of the 'People over Wind' (PoW)¹² case.

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 plan 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**¹³ **feasible options**, to assist Severn Trent's selection of the Preferred Plan 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 opportunities¹⁴.
- The **assessment of the preferred plan of options** against the provisions of Regulation 63, comprising formal 'screening' and an 'appropriate assessment' designed to meet the legislative tests (this report).

2.2 GUIDANCE

The HRA has been undertaken in accordance with the key guidance document UKWIR (2021). *Environmental Assessment Guidance for Water Resources Management Plans and Drought Plans*. UK Water Industry Research Limited, London.

Other relevant guidance and case-practice has been considered, as detailed in the WRW Method Statement and summarised below:

- Defra (2021). Policy paper: Changes to the Habitats Regulations 2017 [online].
- UK Government (2019). Appropriate assessment: Guidance on the use of Habitats Regulations Assessment [online].
- Tyldesley, D. & Chapman, C. (2021). The Habitats Regulations Assessment Handbook [online]. DTA Publications Limited.
- UK Government (April 2023). Water resources planning guideline [online].
- 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 and its seas: Core guidance for developers, regulators & land/marine managers [online].
- 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].

¹² *People Over Wind and Sweetman v Coillte Teoranta* (C-323/17)

¹³ 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.

¹⁴ 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 Severn Trent 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 Severn Trent and to avoid the perception of premature assessment conclusions.

2.3 APPROACH TO HRA STAGE 1 SCREENING

The objective of the HRA is to establish firstly whether any of the measures included in the draft WRMP24 are likely to have a significant effect on European sites (alone or in-combination with other supply schemes in the plan, or with other plans and projects).

For each of the preferred options, and alternatives in the draft WRMP24, the assessment has considered whether there are any LSEs arising from construction and/or operation of the option (either alone or in-combination) on one or more European sites, including Special Protection Areas (SPAs) and Special Areas of Conservation (SACs), as well as internationally-designated Ramsar sites:

- SPAs are classified under the European Council Directive 'on the conservation of wild birds' (2009/147/EC; 'Birds Directive') for the protection of **wild birds and their habitats** (including particularly rare and vulnerable species listed in Annex 1 of the Birds Directive, and migratory species).
- SACs are designated under the Habitats Directive (92/43/EEC) and target particular **habitats** (Annex 1) **and/or species** (Annex II) identified as being of European importance.
- The Government also expects, as a matter of policy, potential SPAs (pSPAs), possible/proposed SACs (pSACs), compensation habitat and Ramsar sites to be included within the assessment.
- Ramsar sites support **internationally important wetland habitats** and are listed under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention, 1971).

For ease of reference throughout the HRA process, these designations will be collectively referred to as "European sites", despite Ramsar designations being made at the international level.

The HRA Stage 1 Screening process will identify whether each option (either alone or in-combination with other plans or projects) is likely to have significant effects on European designated sites. The purpose of the screening stage is to determine whether any part of the plan is likely to have a significant effect on any European site (including areas of compensation habitat, areas of functional land, and the ability for abstractions to occur for the management of designated wetland sites). This is judged in terms of the implications of the plan for a site's conservation objectives, which relate to its 'qualifying features' (i.e. those Annex I habitats, Annex II species, and Annex I bird populations for which it has been designated¹⁵, and Ramsar criterion). Significantly, HRA is based on a rigorous application of the precautionary principle. Where uncertainty or doubt remains, an impact should be assumed, triggering the requirement for Appropriate Assessment of that scheme or plan.

The screening stage also has to conclude whether any in-combination effects would result from the various schemes within the plan itself, or from implementation of the plan in-combination with other plans and projects, and whether these would adversely affect the integrity of a European site.

2.3.1 Identifying European sites

The initial list of European sites for screening has been derived by adopting a distance-based threshold of 10km from each option component, plus exceptional, longer impact pathways. The use of a '10km threshold plus exceptional pathways' approach is based on precedent set for previous HRAs of plans through consultation with statutory consultees and the Impact Risk Zone (IRZ) mapping provided by Natural England for screening of impacts to designated sites in England. It is based on the premise that most significant effects on qualifying species and habitats will occur within a maximum 10km radius of the source of impact, except where there are exceptional pathways such as major downstream or coastal dispersion effects, or larger foraging and dispersal distances for mobile species (e.g., bats, migratory fish).

In addition, the HRA Stage 1 Screening has identified any habitat outside the designated site that also supports the qualifying species populations that use the European site in question. This off-site 'functionally linked land' (or sea) is particularly relevant to mobile qualifying species (e.g., birds, bats, invertebrates, fish, otters). The precautionary principle applies equally to functionally linked land, so where there is insufficient information to ascertain that there would be no LSE, an Appropriate

¹⁵ Annexes are contained within the relevant EC Directive.

Assessment will be required. However, this does not mean that every possible parcel of land within reach of the European site's qualifying populations must have been surveyed. The 'Boggis' case¹⁶ establishes that there must be at least credible evidence that there could be a functional link between the location of option effects and the European site.

2.3.2 Sources of information

Data on the European sites and their interest features has been collected from the Joint Nature Conservation Committee (JNCC) and Natural England websites. These data include information on the attributes of the European sites that contribute to and define their integrity, current conservation status and the specific sensitivities of the site, notably the site boundaries and the boundaries of the component SSSIs; the conservation objectives; the condition, vulnerabilities and sensitivities of the sites and their interest features; the current pressures and threats for the sites; and the approximate locations of the interest features within each site (if reported); and designated or non-designated 'functional habitats' (if identified).

The following sources of published information were used:

- Site citations.
- Site Register Entries.
- Standard Data Form (SPA/SAC) or Information Sheet (Ramsar site).
- Conservation Objectives and Supplementary Advice on Conservation Objectives (for SPAs/SACs¹⁷).
- Site Improvement Plans (SIPs).
- Regulation 33 information for European Marine Sites or Conservation Advice for Marine Protected Areas¹⁸.
- Environment Agency Review of Consents information.
- SSSI Impact Risk Zones (in England), which apply equally to European sites.
- Site condition assessment has been integrated with SSSI assessments through Common Standards Monitoring (CSM) and marine condition assessments (for SAC marine features only).
- Definitions of Favourable Conservation Status (where available for species/habitat).
- Favourable Condition Tables are set out for every SSSI that underpins a European site and can often be applicable to the European site's qualifying features.
- Article 12 (SPA) and Article 17 (SAC) status reports.

2.3.3 Thresholds

The UKWIR guidance¹⁹ includes accepted 'zones of influence' for certain impacts, as repeated in **Table 2-1**, however the best and latest information should always be used to inform an assessment. Where possible, robust universal assumptions regarding the sensitivities of European site interest features will also be specified and applied at screening, for example:

- most breeding passerines will not be water-resource dependent.
- for groundwater sources and groundwater fed habitats, the EA consider that significant effects as a result of ground water abstractions are unlikely on European sites over 5km from the abstraction²⁰.
- 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

¹⁶ Boggis and Another v Natural England: Court of Appeal, 20 Oct 2009

¹⁷ The conservation objectives for Ramsar sites are taken to be the same as for the corresponding SACs / SPAs (where sites overlap); SSSI Favourable Condition Tables will be used for those features not covered by SAC/SPA designations.

¹⁸ Natural England & the Countryside Council for Wales' advice given under Regulation 33(2)(a) of the Conservation (Natural Habitats, &c.) Regulations 1994, as amended.

¹⁹ UKWIR (2021). Environmental Assessment Guidance for Water Resources Management Plans and Drought Plans. UK Water Industry Research Limited, London.

²⁰ National EA guidance: Habitats Directive Stage 2 Review: Water Resources Authorisations – Practical Advice for Agency Water Resources Staff

sensitive and exposed to the effects of the options (except in certain relatively unique circumstances, such as some desalination schemes).

Sites over 10km from the options that are not hydrologically linked and which do not support wide-ranging mobile species are 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).

Table 2-1 Potential Impacts of Plan Options²¹ (Source: UKWIR, 2021)

Broad categories of potential impacts on European Sites, with examples	Examples of activities responsible for impacts <i>(example distance considerations in italics)</i>
Physical loss: <ul style="list-style-type: none"> • Removal • Smothering 	Development of infrastructure associated with option, e.g., new or temporary pipelines, transport infrastructure, temporary weirs. Indirect effects from a reduction in flows e.g., drying out of water-margin habitat. <i>Physical loss is likely to be significant where the boundary of the option 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 option to the site, such as through hydrological connectivity downstream of an option, long shore drift along the coast, or the option impacts the linking habitat).</i>
Physical damage: <ul style="list-style-type: none"> • Sedimentation/silting • Prevention of natural processes • Habitat degradation • Erosion • Fragmentation • Severance/barrier effect • Edge effects 	Construction activity leading to permanent and/or temporary damage of available habitat, sedimentation/siltation, fragmentation, etc. <i>Physical damage is likely to be significant where the boundary of the option 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 option to the site, such as through hydrological connectivity downstream of an option or sediment drift along the coast.</i>
Non-physical disturbance: <ul style="list-style-type: none"> • Noise • Visual presence • Human presence • Light pollution 	Noise from temporary construction or temporary pumping activities. <i>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 estuarine bird species, it is concluded that noise impacts could be significant up to 1km from the boundary of the European site^{22,23}</i>

²¹ Note that the distances given in this table are illustrative only and should be defined for each Plan option on a case by case basis.

²² 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.

²³ 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 activities responsible for impacts <i>(example distance considerations in italics)</i>
	<p>Noise from vehicular traffic during operation of an option.</p> <p><i>Noise from construction traffic is only likely to be significant where the transport route to and from the option is within 3-5km of the boundary of the European site²⁴.</i></p> <p>Plant and personnel involved in in operation of the option.</p> <p><i>These effects (noise, visual/human presence) are only likely to be significant where the boundary of the option extends within or is 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).</i></p> <p>Options that might include artificial lighting, e.g., for security around a temporary pumping station.</p> <p><i>Effects from light pollution²⁵ are more likely to be significant where the boundary of the option is within 500m of the boundary of the European site.</i></p>
<p>Water table/availability:</p> <ul style="list-style-type: none"> • Drying • Flooding/stormwater • Changes to surface water levels and flows • Changes in groundwater levels and flows • Changes to coastal water movement 	<p>Changes to water levels and flows due to increased water abstraction, reduced storage or reduced flow releases from reservoirs to river systems. Potential for changes to habitat availability, for example reductions in wetted width of rivers leading to desiccation of macrophyte beds.</p> <p><i>These effects are only likely to be significant where the boundary of the option extends within the same ground or surface water catchment as the European site. However, these effects are dependent on hydrological continuity between the option and the European site, and sometimes whether the option is up or down stream from the European site.</i></p>
<p>Toxic contamination:</p> <ul style="list-style-type: none"> • Water pollution • Soil contamination • Air Pollution 	<p>Reduced dilution in downstream or receiving waterbodies due to changes in abstraction or reduced compensation flow releases to river systems.</p> <p><i>These effects are only likely to be significant where the boundary of the option extends within the same ground or surface water catchment as the European Site. However, these effects are dependent on hydrological continuity between the option and the European Site, and sometimes whether the option is up or down stream from the European site.</i></p> <p>Air emissions associated with plant and vehicular traffic during construction and operation of options.</p> <p><i>The effect of dust is only likely to be significant where site is within or in close proximity to the</i></p>

²⁴ British Standards Institute (BSI) (2009) BS5228 - Noise and Vibration Control on Construction and Open Sites. BSI, London.
²⁵ Institute of Lighting Professionals (2020) Guidance Notes for the Reduction of Obtrusive Light GN01/20.

Broad categories of potential impacts on European Sites, with examples	Examples of activities responsible for impacts <i>(example distance considerations in italics)</i>
	<p><i>boundary of the European site^{26,27}. 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.</i></p> <p><i>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 affected²⁸.</i></p>
<p>Non-toxic contamination:</p> <ul style="list-style-type: none"> • Nutrient enrichment (e.g., of soils and water) • Algal blooms • Changes in salinity • Changes in thermal regime • Changes in turbidity • Changes in sedimentation/silting 	<p>Changes to water salinity, nutrient levels, turbidity, thermal regime due to increased water abstraction, discharges, storage, or reduced compensation flow releases to river systems.</p> <p><i>These effects are only likely to be significant where the boundary of the option extends within the same ground or surface water catchment as the European site. However, these effects are dependent on hydrological continuity between the option and the European site, and sometimes whether the option is up or down stream from the European site.</i></p>
<p>Biological disturbance:</p> <ul style="list-style-type: none"> • Direct mortality • Changes to habitat availability • Out-competition by non-native species • Selective extraction of species • Introduction of disease • Rapid population fluctuations • Natural succession 	<p>Killing or injury due to construction activity.</p> <p><i>Likely to be a risk where the boundary of the option 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).</i></p> <p>Creation of new pathway for spread of non-native invasive species.</p> <p><i>This effect is only likely to be significant where the option is situated within the European site or an upstream tributary of the European Site, but also for inter-catchment water transfers.</i></p>

2.4 APPROACH TO STAGE 2 APPROPRIATE ASSESSMENTS

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.

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).

²⁶ Highways Agency (2003) Design Manual for Roads and Bridges (DMRB), Volume 11.

²⁷ Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction v1.1.

²⁸ NE Internal Guidance – Approach to Advising Competent Authorities on Road Traffic Emissions and HRAs V1.4 Final - June 2018

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

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.

Where necessary, high level hydrological assessment using readily available flow and level data (hydrology data explorer²⁹ and NRFA³⁰) have been completed to characterise how the flow regime of the impacted rivers might change as a result of the operation of the options. The assumptions around the flow data used and abstraction rates have been set out for each assessment.

2.5 REVIEW OF POTENTIAL IN-COMBINATION EFFECTS

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.

Broadly, it is considered that the Severn Trent's WRMP24 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.

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 Environment Agency (or Natural Resources Wales) 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.

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 Severn Trent's WRMP24 is used as the basis for a high-level 'in-combination' assessment. The SEA is used to provide information on the themes, policies and objectives of the 'in-combination'

²⁹ <https://environment.data.gov.uk/hydrology/landing>

³⁰ <https://nrfa.ceh.ac.uk/>

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.

In accordance with the legislation, the following approach will be adopted for the in-combination assessment:

- STEP 1 – Does the Scheme have no discernible effect, whatsoever, on the European site? If not, then there's no need for in-combination assessment, as logic dictates it can't have in-combination effects.
- STEP 2 - Does the Scheme, alone, have an adverse effect on the European site? If so, then there's no need for in-combination assessment as consent cannot be given unless the HRA Stages 3 and 4 derogation tests are met, in which case all residual effects of the scheme acting alone will be compensated for.
- STEP 3 – Does this Scheme have a discernible effect, but one which is not 'significant' in the context of the Habitats Regulations (i.e. adverse effect on site integrity) alone? If so, then an in-combination assessment is required.
- STEP 4 – Identify the other Plans/Projects that also have discernible effects that (1) aren't an adverse effect alone but (2) might act in-combination with effects of your Project. It is normal practice to agree this list of potential in-combination Plans/Projects with the Competent Authority before doing the assessment.
- STEP 5 – Assess these other Plans/Projects in-combination with this Project.

2.6 KEY CHALLENGES AND ASSUMPTIONS

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.

2.6.1 Uncertainty and plan-level mitigation

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.

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.

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.

Case-practice in WRMP HRAs³¹ suggests it may be acceptable to include preferred programme options with residual uncertainties. The Water Resources Planning Guideline (April 2023) has confirmed the position as:

“Deferring the Appropriate Assessment for options identified in the HRA as having a ‘likely significant effect’ may be acceptable in a WRMP context only when all the following criteria have been satisfied:

- *where, due to scientific uncertainty of a novel or complex process and a need for more research, information cannot reasonably be gathered at this draft WRMP24 plan stage*
- *options are proposed for delivery late on in the plan (post 2035 for draft WRMP24) ensuring that there is time to allow for assessment and delivery of alternatives if necessary*
- *alternatives are included in the plan at company and, or regional level where the avoidance of an adverse effect on integrity of European sites is certain, and these are available, feasible and deliverable*
- *a commitment is made to pursue alternatives if an adverse effect on integrity of a European site cannot be avoided for the preferred options set”*

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.

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 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.

2.6.2 WRMP development parameters and relevance to HRA

The modelling underpinning the WRMP development and option selection process incorporates several assumptions that influence the scope of the HRA:

- The WRMP development process takes account of the existing consents regime, and any known (or reasonably anticipated) amendments that are likely to be required (e.g. following WINEP investigations or similar) since there has to be a starting point / basis for the assessment (i.e. the modelling / optioneering process cannot start with the assumption that no current consents are reliable). Any required licence amendments are factored into the supply-deficit calculations, and the Environment Agency will have confirmed that these are valid for the planning period when the WRMP modelling is undertaken. The existing consents regime (taking into account any required sustainability reductions) is therefore ‘the baseline’³² and, by extension the HRA of the WRMP necessarily focuses on the additional effects introduced by the WRMP options and does not (and cannot) reassess or reconfirm the existing consents regime.
- 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-

³¹ For example, in relation to UU's WRMP14.

³² It is recognised that, occasionally, the sustainability reductions agreed through the RoC process have been subsequently shown to be insufficient to address the effects of PWS abstraction on some sites; it is assumed that these will be identified to the water companies as part of the WRMP development process.

licensed'; it is understood that these licences have been identified to Severn Trent during the plan-development process and factored into the supply-demand balance calculations.

- The 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. 'In-combination' effects with respect to land-use plans and specific options 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. Likewise, the modelling accounts for climate change.
- Unless otherwise stated by the Environment Agency during the options development process, it is assumed that the relevant Catchment Abstraction Management Strategy (CAMS) documents are correct and reliable, and that there is 'water available' where this is confirmed by the CAMS.

2.6.3 In-combination effects with SROs

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 Severn Trent, 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.

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)³³. 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.

³³ 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.

3. SEVERN TRENT WATER'S WRMP24

3.1 INTRODUCTION

This section provides an overview of the water resources management planning process, the Severn Trent's supply system and WRMP24. For further detail, reference should be made to the overarching plan.

Water resources management planning is undertaken by all water companies in England and Wales in order to ensure reliable, resilient water supplies over the long-term planning horizon. The process includes forecasting how much water will be available and how much water customers will need over the planning period (assessing supply and demand). If a potential deficit is identified in the supply demand balance, the WRMP will determine how best to close the gap.

Water companies in England and Wales have a statutory requirement to prepare a WRMP every five years and this has been described above in **Section 1**. Severn Trent's draft WRMP24 consultation programme commenced in April 2021 and continued through its development. The draft WRMP24 was published for formal public consultation in autumn 2022, and a Statement of Response published in June 2023. The revised draft was submitted to the regulators in Autumn 2023. Further consultation with the regulators lead to a second Statement of Response and a revised revised draft WRMP24 in spring 2024. Severn Trent has identified feasible options from an unconstrained list containing a much greater breadth of options. The feasible list is a set of options that Severn Trent considers suitable to be included in the options programme appraisal process to determine the preferred mix of solutions for meeting any potential future supply deficits.

The feasible options have been assessed to understand the costs, the benefits to the supply-demand balance, the effect on carbon emissions and the environmental and social effects (through the SEA, HRA and WFD assessments). The options have subsequently been compared through a comprehensive options appraisal process to determine the 'best value' programme of options to maintain a supply-demand balance over the planning period.

3.2 SEVERN TRENT WATER'S WATER SUPPLY SYSTEM AND WATER RESOURCE MANAGEMENT PLANNING

3.2.1 Severn Trent's water supply system

Severn Trent is one of the largest water and wastewater companies in England and Wales, providing high quality water and wastewater services over an area of 21,000km² in the Midlands and the Chester area, and stretching west to east from the Bristol Channel to the Humber. Severn Trent provides water to 8 million people, supplying some 1,800 million litres of water per day (Ml/d) to homes and businesses. Water is supplied through nearly 47,000km of water mains fed from multiple sources including 28 impounding reservoirs and 181 groundwater sites. Groundwater sources, river derived sources and impounding reservoirs provide 35%, 35% and 30% respectively of the total volume of water put into supply. For water resource planning purposes, Severn Trent's water supply area is divided into 15 independent Water Resources Zones (WRZs) reflecting the different characteristics of the supply area and associated risks to meeting demand in dry weather conditions. The WRMP24 also considered a range of feasible components beyond the company's water supply area boundary, such as within parts of the upper River Severn and River Wye catchment areas, including within Wales **Figure 3.1** and **Table 3.1** present the WRZs and their characteristics, showing the zones vary widely in scale. The data in **Table 3.1** has been taken from the 'final WRMP24 Appendix A_WaterNeed' report.

Figure 3.1 Severn Trent's Water Resource Zones

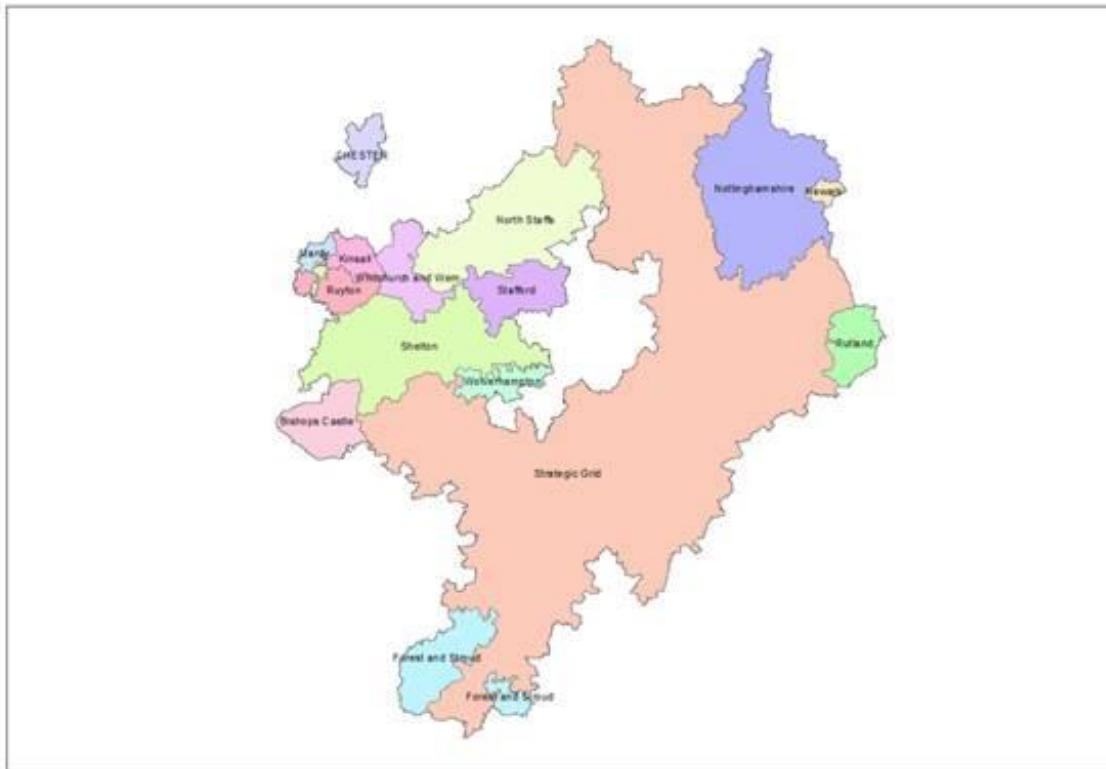


Table 3.1 Data characteristics for 2021-22 of Severn Trent's 15 Water Resource Zones

WRZ Name	WRMP24 1 in 500 Deployable Output (MI/d)	Total Properties (000's)	Total Population (000's)	Leakage (MI/d)	Distribution Input (MI/d)
Bishops Castle	4.11	3.49	6.08	1.27	2.60
Chester	28.50	49.95	105.69	2.61	23.08
Forest & Stroud	48.17	64.20	135.53	17.69	44.17
Kinsall	5.00	6.44	12.54	1.80	4.46
Mardy	3.50	3.74	7.99	1.34	3.05
Newark	3.70	23.76	49.11	2.72	11.44
North Staffordshire	104.74	257.04	542.57	26.30	124.40
Nottinghamshire	164.18	498.60	1112.66	46.85	244.33
Rutland	0.00	14.24	30.24	4.10	10.30
Ruyton	5.32	5.91	12.88	2.97	5.63
Shilton	138.00	224.75	504.31	24.48	114.49
Stafford	25.80	46.39	98.01	2.59	20.87
Strategic Grid	1219.91	2459.77	5814.03	272.27	1282.17
Whitchurch & Wem	12.73	15.01	30.13	2.53	8.84
Wolverhampton	30.00	113.44	258.78	19.68	67.58

The data presented shows that the 15 zones vary widely in scale, from the Strategic Grid zone which supplies the majority of our customers, to the small zones of Mardy and Bishops Castle, which supply

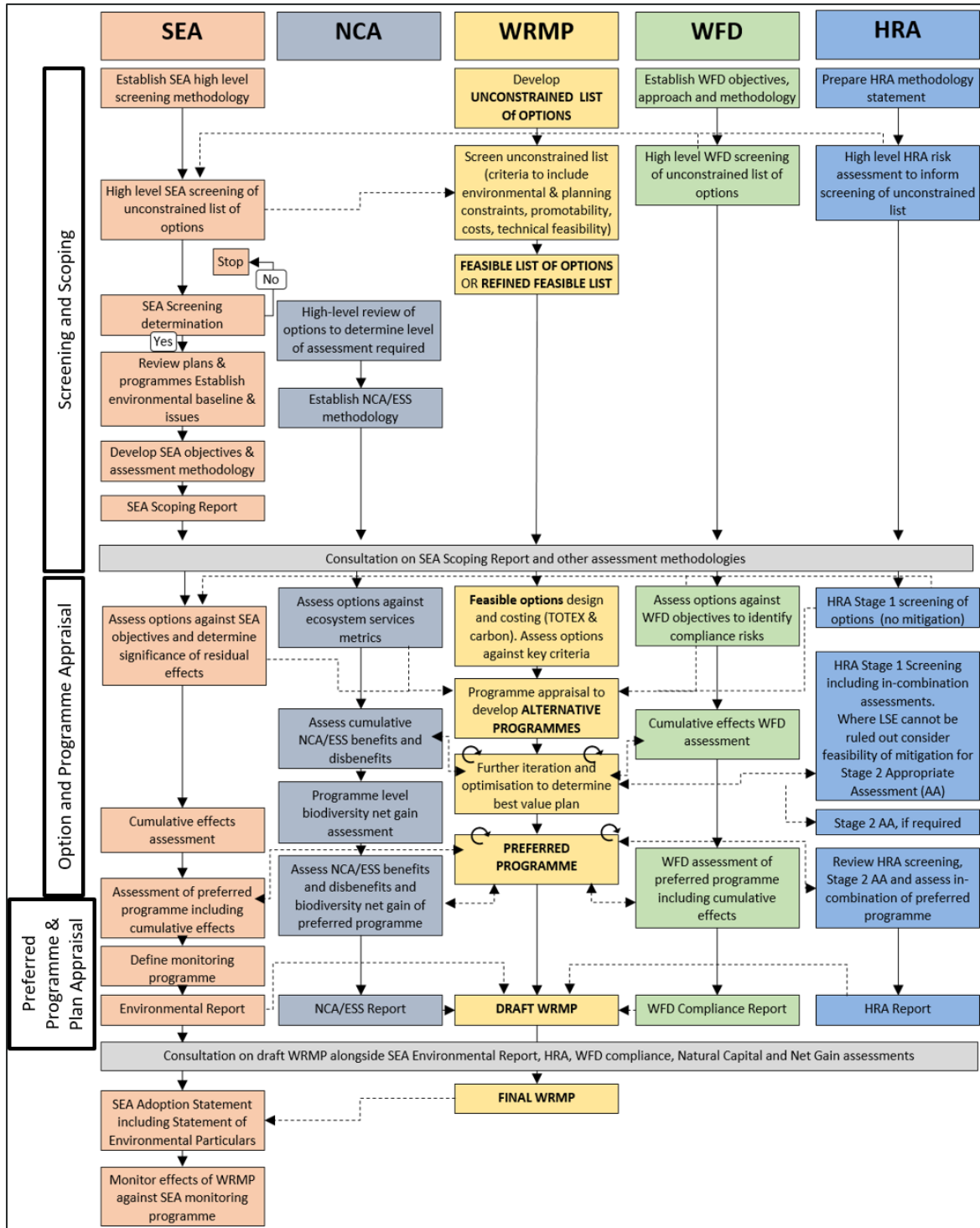
much smaller populated areas. These zones have very different water resources challenges, with some requiring significant investment in the long term to ensure secure supplies.

Further details about the Severn Trent's supply system are provided on the Severn Trent website (www.stwater.co.uk).

3.2.2 Water resource management planning

In developing its WRMP24, Severn Trent has examined the future forecast water supply/demand balance and determined how any deficit between forecast demand and reliable water supply availability should be addressed. In developing the plan, a large number of alternative options were identified and assessed to understand their costs, their benefits to the supply-demand balance, their effect on carbon emissions and their environmental and social effects (through the SEA process and associated HRA and WFD assessments). The options were subsequently compared through a comprehensive programme appraisal process to determine the 'best value' programme of options to maintain the supply-demand balance over the planning period. Decisions on the best value programme took account of a range of factors, such as the implications for water customer bills, the resilience to future risks and uncertainties, deliverability considerations and the environmental and social effects of the programme (both adverse and beneficial effects), as informed by the SEA. **Figure 3.2** below, summarises the overall approach to the evolution of the WRMP24: from the initial "unconstrained" list of options through to the consideration of alternative programmes and the development of the WRMP24.

Figure 3.2 Alignment of SEA, HRA, Water Framework Directive (WFD) and Natural Capital Assessments (NCA) to inform plan development



A total of 88 supply side options were assessed as part of the feasible options list alongside a collection of demand management measures. The demand management options in the feasible list are shown in **Table 3.2** and the supply side options are shown in **Table 3.3**.

Table 3.2 Feasible options: demand management options

Option ID	Option name	Description
173	Retrofitting indoor water efficiency devices (free and paid product requests through Get Water Fit)	Retrofitting indoor water efficiency devices
175	Home water efficiency check other (leaky loo, high user, leak alarms, metering team)	Retrofitting indoor water efficiency devices
176	Home water efficiency check with social housing	Retrofitting indoor water efficiency devices
178	Education team weff messaging	Water efficiency customer education / awareness
179	Other water efficiency education (e.g. Get Water Fit Platform)	Water efficiency customer education / awareness
180	Compulsory metering	Metering compulsory
181	Non household water efficiency (audits)	Non-household water audit
539	Water Labelling	Water efficiency customer education / awareness
554	D003 Proactive metering	Metering other selective
565	Non household metering	Metering other selective
566	Flowvalve (Innovation)	Other water efficiency
567 x, xi, xii, xiii & x1v	50% Reduction in Leakage	Leakage Options including Mains replacement (not trunk mains), pressure management, Active leakage management, trunk mains renewal/new and Other leakage control

Table 3.3 Feasible options: supply side options

WRMP24 Ref.	Option Category	Option Name
5	Trunk mains renewal/new	Derwent Valley Transfer Main
6	Reservoir enlargement	Upper Derwent Valley Reservoir Expansion (UDVRE)
22	Groundwater enhancement	Recommission Elmhurst GW source
29	Water treatment works capacity increase	Homesford WTW capacity increase
31C	New reservoir	E. Midlands Raw Water Storage (CQ)
31D	New reservoir	E. Midlands Raw Water Storage (CHQ)
33	Water treatment works capacity increase	Shelton WTW Expansion (large) partially supported by UU release from Vyrnwy (25MI/d)
33Z	Water treatment works capacity increase	Shelton WTW Expansion (small)
38	Water reuse	Minworth effluent re-use (Large scheme)

WRMP24 Ref.	Option Category	Option Name
39	Water reuse	Minworth effluent re-use (Medium scheme)
44	New surface water	New R Sow abstraction and WTW near Stafford
54	New surface water	River Soar to Cropston WTW
58	New surface water	River Weaver to New WTW at Stoke
64	Groundwater enhancement	Rehabilitation Milton GW Source
66	Water treatment works capacity increase	Strensham WTW Expansion partially supported by UU release from Vyrnwy (25Ml/d)
72	External raw water bulk supply/transfer	Rudyard Reservoir to Tittesworth
78	Aquifer recharge/aquifer storage recovery	Aquifer Storage Recovery at Whitacre Phase 2
79A	Internal potable transfer	Bham-Wolves Strategic Link Main (large)
79B	Internal potable transfer	Bham-Wolves Strategic Link Main (small)
79C	Internal potable transfer	Bham-Wolves Strategic Link Main (very large)
84A	Reservoir enlargement	Stanford Minor Dam Extension
84B	Reservoir enlargement	Lower Shustoke Minor Dam Extension
84C	Reservoir enlargement	Whitacre Minor Dam Extension
88	New surface water	River Weaver to Tittesworth WTW
95B	Water treatment works capacity increase	Ogston WTW Expansion
103	New/Enhanced pumping station	Mardy Support Link
104	Internal potable transfer	Newark Support Link
105	Internal potable transfer	Ruyton Support Link
108	Internal potable transfer	Stoke to Stafford link main
110	Internal potable transfer	Wolves to Stafford link main
111	Internal potable transfer	Melbourne to Staffs link main
121	Internal raw water transfer	Mythe to Mitcheldean main
122A	Reservoir enlargement	Draycote Reservoir WL increase (6%)
122B	Reservoir enlargement	Draycote Reservoir WL increase (25%)
122C	Reservoir enlargement	Draycote Reservoir WL increase (50%)
123A	Reservoir enlargement	Raise Dam at Tittesworth Reservoir (5%)
123B	Reservoir enlargement	Raise Dam at Tittesworth Reservoir (25%)
128	Internal raw water transfer	Carsington to Tittesworth main (large)
128Z	Internal raw water transfer	Carsington to Tittesworth main (small)
134A	Trunk mains renewal/new	Blackbrook reservoir to Cropston WTW
142	Surface water enhancement	Utilise Linacre Reservoirs
143	New reservoir	W.Midlands Raw Water Storage
144A	External raw water bulk supply/transfer	C&RT BCN Surplus to Milford

WRMP24 Ref.	Option Category	Option Name
144B	External raw water bulk supply/transfer	C&RT BCN Surplus to Rugby
144C	External raw water bulk supply/transfer	C&RT BCN Surplus to River Severn
145B	Desalination	Desalination in Dee estuary / Liverpool Bay
145C	Desalination	Desalination - Notts notional scheme
150	New surface water	Little Haywood new WTW on Upper Trent
151A	External raw water bulk supply/transfer	TCA - A Winning
152	New surface water	Hampton Loade to Sedgley SR
169	External raw water bulk supply/transfer	Terminate raw water export to Yorkshire Water
187A	Reservoir enlargement	Expand Carsington Reservoir (10000 MI)
187B	Reservoir enlargement	Expand Carsington Reservoir (16000 MI)
187C	Reservoir enlargement	Expand Carsington Reservoir (25000 MI)
190	New surface water	Eyebrook Reservoir and new WTW's
191	Groundwater enhancement	Increase Diddlebury/Munslow GW sources
303A	External raw water bulk supply/transfer	UU release from Vyrnwy (75 MI/d)
303D	External raw water bulk supply/transfer	UU release from Vyrnwy (14.5MI/d) to supply Frankley
304	Internal potable transfer	Ambergate to Mid-Notts transfer
305	Internal potable transfer	Heathy Lea to North Notts transfer (small)
305A	Internal potable transfer	Heathy Lea to North Notts transfer (large)
305B	Internal potable transfer	Heathy Lea to North Notts transfer (very large)
309Z	Internal potable transfer	Transfer from Hampton Loade WTW to Nurton DSR (small)
313	Trunk mains renewal/new	DVA capacity increase to Heathy Lea (reduce Rivelin export)
314	Trunk mains renewal/new	Expand Bamford WTW and DVA capacity increase (terminate Rivelin export)
406A	New surface water	New abstraction and WTW on River Trent with licence transfer
420	Water treatment works capacity increase	Campion Hills WTW DO Recovery
423	Water treatment works capacity increase	Draycote WTW DO Recovery
426	Water treatment works capacity increase	Little Eaton WTW DO Recovery
429	Water treatment works capacity increase	Mythe WTW DO Recovery
430	Water treatment works capacity increase	Ogston WTW DO Recovery

WRMP24 Ref.	Option Category	Option Name
434	Water treatment works capacity increase	Trimpley WTW DO Recovery
435	Water treatment works capacity increase	Whitacre WTW DO Recovery
437	Reservoir enlargement	Finham FE to expanded Draycote Reservoir and WTW
439	Reservoir enlargement	Longdon Marsh and increase Frankley output by 190 MI/d
503	New groundwater source	New GW source Middle Dee GWMU
528	New groundwater source	New GW Source Soar - PT Sandstone nr Coalville
536	New groundwater source	New GW source – Manchester and East Cheshire Carboniferous Aquifers
549A	External raw water bulk supply/transfer	Raw water transfer from Congleton to Tittesworth Reservoir (UU import)
549B	External potable bulk supply/transfer	Treated water transfer from Congleton to Tittesworth Reservoir (UU import)
556	Trunk mains renewal/new	ASL Capacity Increase - Hallgates to Oldbury
557	Trunk mains renewal/new	ASL Capacity Increase - Oldbury to Meriden
559	Internal potable transfer	Bishops Castle Transfer
560	External raw water bulk supply/transfer	UU treated water import to Chester
561	Internal potable transfer	Kinsall Transfer
562	Internal potable transfer	Mardy Transfer
563	Internal potable transfer	Whitchurch and Wem Transfer
564	New reservoir source	W Midlands raw water storage – notional option

4. HRA STAGE 1 SCREENING

4.1 EXISTING LICENCES

The WRMP24 sets out Severn Trent's long-term strategy for maintaining reliable and resilient water supplies to its customers. The strategy includes the use of existing water resources to meet demand as well as existing demand management measures to ensure sufficient supply under current baseline conditions.

The Environment Agency Review of Consents (RoC) process, undertaken in the early 2000s, considered Severn Trent's existing water source abstraction licences (at the abstraction licence limit) and the potential for adverse effects on European sites. Where adverse effects were identified, recommendations were made to change abstraction licences. Since the RoC process was completed, there have been changes to the baseline, conservation objectives and/or Supplementary Advice to Conservation Objectives, and site condition, which may require the original RoC conclusions to be revisited.

As part of the WRMP process, licences are identified between the water company and Environment Agency that are determined as valid for the planning period, or identified as requiring sustainability reductions. This informs the baseline, and provides an opportunity to flag any other licences considered to be at risk.

A number of WINEP investigations are proposed in AMP8 to identifying risks and issues associated with current activities including licenced abstractions. The River Clun SAC and River Teme SSSI have been included for investigation in AMP8, focusing on our public water supply abstractions in the upstream catchment and their contribution to meeting the favourable condition targets for flow attributes. There are also implementation activities included on the AMP8 WINEP in relation to water quality targets and catchment nutrient balancing in this catchment.

In addition, since the publication of the dWRMP24, Natural England has raised concerns relating to impacts of existing abstractions on European Sites where a material change (to the site) has occurred. Four European sites have been highlighted where the condition status has changed since WRMP19. These are as follows:

- The River Wye SAC
- The River Clun SAC
- Aqualate Mere SSSI and Ramsar Site
- Cop Mere SSSI and Ramsar Site

Subsequent discussions have taken place with Natural England to understand the actions for this WRMP24. Due to distance from these named sites, no new WRMP supply options selected for the preferred plan and alternative pathways impact these areas. i.e. these sites were not identified at HRA screening Stage 1 in this WRMP and hence no further work is required at this stage. However, a number of actions and commitments have been made associated with these sites:

- For the River Wye SAC, Natural England will be carrying out a new, full condition assessment, including a flow assessment, which will provide additional information on the pressures impacting the River Wye SAC. Natural England have agreed that they will continue to engage with Severn Trent and Welsh Water and once the full condition assessment has been completed, to add the River Wye SAC to the PR29 WINEP, if appropriate (and hence no additional work is needed as part of the 2024 WRMP HRA).
- For the Clun SAC, Aqualate Mere SSSI and Cop Mere SSSI, Severn Trent have agreed to investigate the flow related issues as part of the AMP8 WINEP programme. Severn Trent will continue to work with Natural England as a key stakeholder in those WINEP activities.

Because of the commitment to ongoing investigation at these sites in AMP8, Natural England has confirmed that no further work is required at this stage and that the HRA is supported.

Table 4-1 below outlines Severn Trent commitments to continue investigating these sites as agreed with Natural England:

Table 4-1 Agreed actions for existing abstractions near or on listed European Sites

Site	Agreed action
The River Wye SAC	Natural England acknowledge the abstraction review undertaken in 2018 and changes made to abstraction. It is understood that there are multiple pressures in catchment (Severn Trent and Dwr Cymru abstractors). Awaiting output full condition survey from Natural England. If appropriate, this will be included in future WINEP for AMP9 if changes have occurred.
The River Clun SAC	This is a new named site in the Defra Letter dated 24 January 2025. Severn Trent are investigating as part of AMP8 WINEP.
Aqualate Mere SSSI and Ramsar Site	Severn Trent are investigating as part of the AMP8 Environmental Destination driver.
Cop Mere SSSI and Ramsar Site	Severn Trent are investigating as part of the AMP8 Environmental Destination driver.

4.2 POTENTIAL LIKELY SIGNIFICANT EFFECTS OF WRMP24 FEASIBLE OPTIONS

The approach to HRA screening is described above in **Methodology** above. The Severn Trent supply area and the European sites within this area, and in proximity, are shown on **Figure 4.1**.

The HRA screening of demand management options for the WRMP24 is provided in **Section 4.2.1** and for potential water supply options in **Section 4.2.2**. Where uncertainty has been identified, this uncertainty indicates that a confident conclusion of no LSE is not yet possible. Where uncertainty remains, a Stage 2 HRA (AA) would be required to either confirm no adverse effect related to a scheme or to confirm an adverse effect and any appropriate mitigation measures.

4.2.1 Demand management options

The demand side options are summarised in **Table 3.2**, and 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;

- 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).

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 development³⁴).

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.

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. As there is insufficient locational information available at this stage, these appropriate assessments will need to be carried out at the project level.

4.2.2 Supply-side options

The initial 'risk review' of the supply-side³⁵ options, to assist Severn Trent's selection of the feasible and preferred plan options (i.e. 'HRA as a process') is provided in **Appendix C**. The HRA Stage 1 Screening of the feasible options is summarised in **Table 4-2**.

³⁴ e.g. Tyldesley, D. & Chapman, C. (2021). The Habitats Regulations Assessment Handbook [online]. DTA Publications Limited. Available at: <https://www.dtapublications.co.uk/handbook/>.

³⁵ 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.

Figure 4.1 European sites within the study area and in proximity

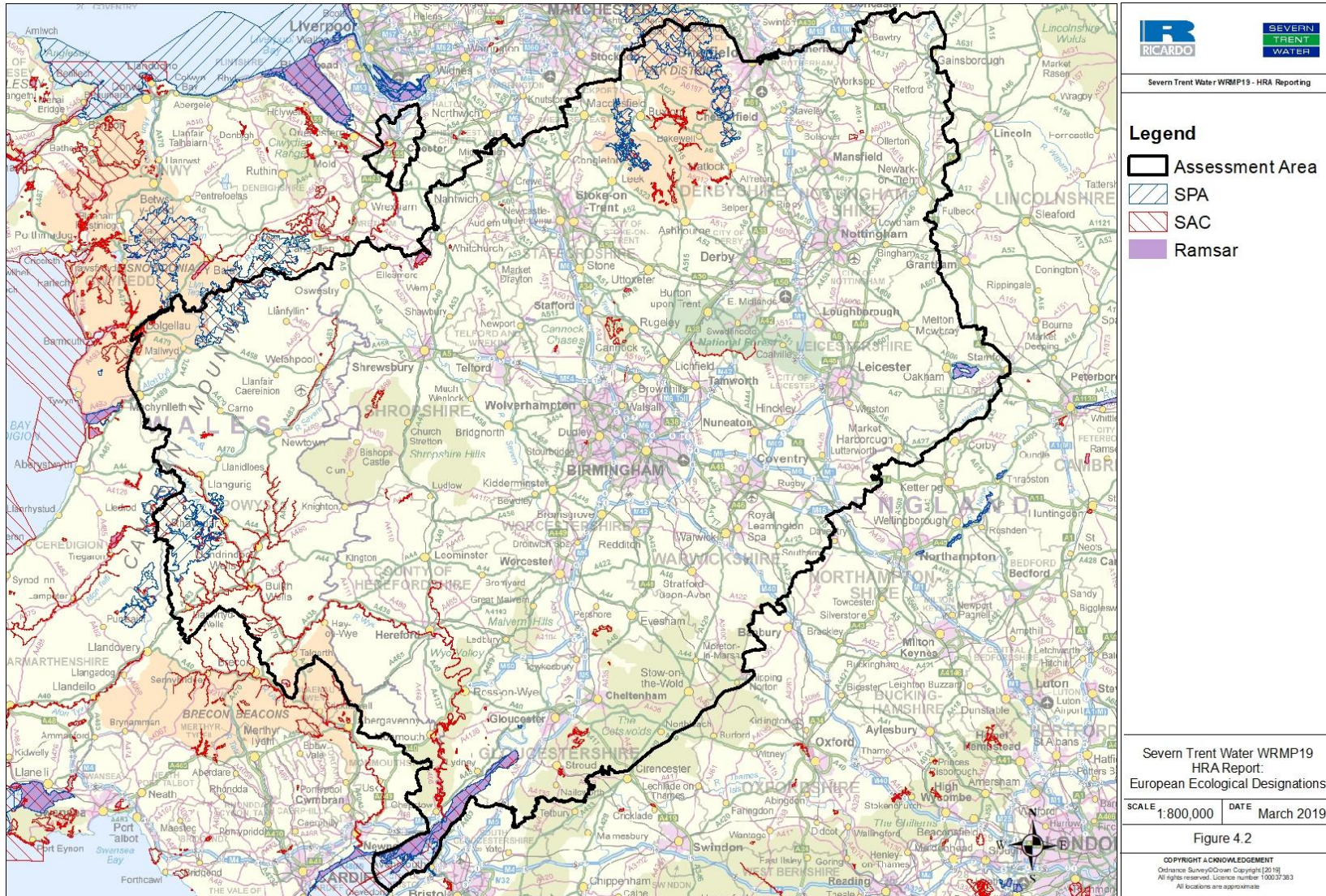


Table 4-2 High-level screening summary of feasible options for impacts on European sites

Option ID	Option Name	High level screening outcome
5	Derwent Valley Transfer Main	LSEs identified during construction and operation.
6	Upper Derwent Valley Reservoir Expansion (UDVRE)	LSEs identified with potential habitat loss within SAC and SPA.
22	Recommission Elmhurst GW source	No LSEs anticipated during construction or operation.
29	Homesford WTW capacity increase	LSEs identified as potential operational impacts to functionally linked habitat (watercourse)
31C	E.Midlands Raw Water Storage (31C)	No LSEs anticipated during construction or operation.
31D	E.Midlands Raw Water Storage (31D)	LSEs identified as potential operational impacts to functionally linked habitat (watercourse)
33	Shelton WTW Expansion (large) partially supported by UU release from Vyrnwy (25MI/d)	LSEs identified during construction and operation due to hydrological connectivity to functionally linked habitat.
33Z	Shelton WTW Expansion (small)	LSEs identified during construction and operation due to hydrological connectivity to functionally linked habitat.
38	Minworth effluent re-use (Large scheme)	LSEs identified during operation due to diversion of large proportion of flow and potential for impacts to functionally linked habitat.
39	Minworth effluent re-use (Medium scheme)	LSEs identified during operation due to diversion of proportion of flow and potential for impacts to functionally linked habitat.
44	New R Sow abstraction and WTW near Stafford	LSEs identified during construction due to proximity of components to European sites, and operation due to potential abstraction impacts to functionally linked habitat.
54	River Soar to Cropston WTW	No LSEs anticipated during construction or operation.
58	River Weaver to New WTW at Stoke	No LSEs anticipated during construction or operation.
64	Rehabilitation Milton GW Source	Uncertainty around potential increase in abstraction and hydrological connectivity to functionally linked habitat.
66	Strensham WTW Expansion partially supported by UU release from Vyrnwy (25MI/d)	LSEs identified during construction due to loss of potential offsite functionally linked habitat and during operation due to abstraction and impacts to functionally linked habitat.
72	Rudyard Reservoir to Tittesworth	No LSEs anticipated during construction or operation.
78	Aquifer Storage Recovery at Whitacre	LSEs identified during construction and operation due to impacts to functionally linked habitat.
79A	Bham-Wolves Strategic Link Main (large)	LSEs identified during construction as potential for site-derived pollutants to impact waterbodies.
79B	Bham-Wolves Strategic Link Main (small)	
79C	Bham-Wolves Strategic Link Main (very large)	
84A	Stanford Minor Dam Extension	No LSEs anticipated during construction or operation.
84B	Lower Shustoke Minor Dam Extension	
84C	Whitacre Minor Dam Extension	

Option ID	Option Name	High level screening outcome
88	River Weaver to Tittesworth WTW	No LSEs anticipated during construction or operation.
95B	Ogston WTW Expansion	LSEs identified as potential operational impacts to functionally linked habitat (watercourse)
103	Mardy Support Link	No LSEs anticipated during construction or operation.
104	Newark Support Link	No LSEs anticipated during construction or operation.
105	Ruyton Support Link	No LSEs anticipated during construction or operation.
108	Stoke to Stafford Link main	LSEs identified during construction as potential for site-derived pollutants to impact waterbodies.
110	Wolves to Stafford link main	No LSEs anticipated during construction or operation.
111	Melbourne to Staffs Link main	LSEs identified during construction as the pipeline will extend in close proximity and within potentially supporting offsite functional habitat.
121	Mythe to Mitcheldean main	LSEs identified during construction due to works within core zones for bat species. Operational impacts to functionally linked habitat (watercourse) due to change in abstraction.
122A	Draycote Reservoir WL increase (6%)	No LSEs anticipated during construction or operation.
122B	Draycote Reservoir WL increase (25%)	
122C	Draycote Reservoir WL increase (50%)	
123A	Raise Dam at Tittesworth Reservoir (5%)	LSEs identified during construction due to potential for the reservoir to be functionally linked habitat to the nearby SPA.
123B	Raise Dam at Tittesworth Reservoir (25%)	LSEs identified during construction due to potential for the reservoir to be functionally linked habitat to the nearby SPA. Operational impacts may occur due to greater change in spill regime and effects to functionally linked habitat downstream.
128	Carsington to Tittesworth main (large)	LSEs identified during construction due to site derived pollutant issues and potential disturbance to bird species using offsite functionally linked habitat.
128Z	Carsington to Tittesworth main (small)	
134A	Blackbrook reservoir to Cropston WTW	No LSEs anticipated during construction or operation.
142	Utilise Linacre Reservoirs	LSEs identified during construction due to potential disturbance issues to bird species using offsite functionally linked habitat.
143	W.Midlands Raw Water Storage	LSEs identified during construction and operation due to proximity to functionally linked habitat (watercourse) and changes to abstractions.
144A	C&RT BCN Surplus to Milford	LSEs identified during construction as the pipeline will extend in close proximity to designated sites.

Option ID	Option Name	High level screening outcome
144B	C&RT BCN Surplus to Rugby	No LSEs anticipated during construction or operation.
144C	C&RT BCN Surplus to River Severn	LSEs identified during construction and operation due to proximity to functionally linked habitat (watercourse) and changes to abstractions.
145B	Desalination in Dee estuary / Liverpool Bay	LSEs identified during construction due to landtake within/in direct proximity to designated site and during operation because of impacts of intake and wastestream.
145C	Desalination – Notts notional scheme	Scheme location not defined, therefore screening not completed.
150	Little Haywood new WTW on Upper Trent	LSEs identified during construction and operation due to proximity to functionally linked habitat (watercourse) and changes to abstractions.
151A	TCA – A Winning	LSEs identified during operation due to abstraction and wastestream in proximity to functionally linked habitat (watercourse).
152	Hampton Loade to Sedgley SR	LSEs identified during construction and operation due to proximity to functionally linked habitat (watercourse) and changes to abstractions.
169	Termination of transfer to Yorkshire Water	No LSEs anticipated during construction or operation.
187A	Expand Carsington (10,000MI)	LSEs identified during operation due to potential changes to spill regime and effects to functionally linked habitat (watercourse).
187B	Expand Carsington (16,000MI)	
187C	Expand Carsington (25,000MI)	
190	Eyebrook Reservoir and new WTW's	LSEs identified during construction and operation as Eyebrook Reservoir potentially used as offsite functionally linked habitat.
191	Increase Diddlebury/Munslow GW sources and remove network constraints	LSEs identified during operation due to changes in abstraction and impacts to functionally linked habitat (watercourse).
303A	UU release from Vyrnwy (75MI/d)	LSEs identified during operation due to impacts of release on functionally linked habitat used by migratory fish species. Strategic Resource Option dropped this volume due to concerns regarding site integrity test. Potential for bypass being investigated to avoid impact.
303D	UU release from Vyrnwy (14.5MI/d) to supply Frankley	LSEs identified during operation due to impacts of release on functionally linked habitat used by migratory fish species.
304	Ambergate to Mid-Notts transfer	No LSEs anticipated during construction or operation.
305	Heathy Lea to North Notts transfer (small)	LSEs identified during construction due to proximity of pipeline to European sites.
305A	Heathy Lea to North Notts transfer (large)	
305B	Heathy Lea to North Notts transfer (very large)	

Option ID	Option Name	High level screening outcome
309Z	Transfer from Hampton Loade WTW to Nurton DSR (small)	No LSEs anticipated during construction or operation.
313	DVA capacity increase to Heathy Lea (reduce Rivelin export)	LSEs identified during construction and operation due to proximity to European sites and changes to abstractions affecting functionally linked habitat.
314	Expand Bamford WTW and DVA capacity increase (terminate Rivelin export)	LSEs identified during construction and operation due to proximity to European sites and changes to abstractions affecting functionally linked habitat.
406A	New abstraction and WTW on River Trent - with licence transfer	No LSEs anticipated during construction or operation
420	Campion Hills WTW DO Recovery	No LSEs anticipated during construction or operation.
423	Draycote WTW DO Recovery	No LSEs anticipated during construction or operation.
426	Little Eaton WTW DO Recovery	LSEs identified during operation due to abstraction impacts to functionally linked habitat.
429	Mythe WTW DO Recovery	LSEs identified during operation due to abstraction impacts to functionally linked habitat.
430	Ogston WTW DO Recovery	No LSEs anticipated during construction or operation.
434	Trimpley WTW DO Recovery	No LSEs anticipated during construction or operation.
435	Whitacre WTW DO Recovery	No LSEs anticipated during construction or operation.
437	Finham FE to expanded Draycote Reservoir and WTW	LSEs identified during construction and operation due to site-derived pollutant issues and abstraction from functionally linked habitat (watercourse).
439	Longdon Marsh and increase Frankley output by 190 MI/d	LSEs identified during construction and operation due to site-derived pollutant issues and large new abstraction from functionally linked habitat (watercourse).
503	New GW source Middle Dee GWMU	LSEs identified during construction and operation due to uncertainty over location of boreholes and proximity to hydrologically connected European sites.
528	New GW Source Soar - PT Sandstone nr Coalville	No LSEs anticipated during construction or operation.
536	New GW Source Manchester and East Cheshire Carboniferous Aquifers	No LSEs anticipated during construction or operation.
549A	Raw water transfer from Congleton to Tittesworth Reservoir (UU import)	No LSEs anticipated during construction or operation.
549B	Treated water transfer from Congleton to Tittesworth Reservoir (UU import)	No LSEs anticipated during construction or operation.
556	ASL Capacity Increase - Hallgates to Oldbury	LSEs identified during construction due to site-derived pollutant issues.
557	ASL Capacity Increase - Oldbury to Meriden	No LSEs anticipated during construction or operation.

Option ID	Option Name	High level screening outcome
559	Bishops Castle transfer	LSEs identified during construction due to site-derived pollutant issues.
560	UU treated water import to Chester	No LSEs anticipated during construction or operation.
561	Kinsall Transfer	No LSEs anticipated during construction or operation.
562	Mardy Transfer	No LSEs anticipated during construction or operation.
563	Whitchurch & Wem Transfer	No LSEs anticipated during construction or operation.
564	W. Midlands Raw Water Storage – notional option	Scheme location not defined, therefore screening not completed.

4.3 HRA STAGE 1 SCREENING CONCLUSIONS FOR PREFERRED PLAN OPTIONS

Severn Trent have presented five plans all together. The following section provides the conclusions for the preferred plan, and **Section 4.4** summarises the alternative plans.

4.3.1 Demand side options

No further assessment has been carried out on the demand side options given the conclusions of the review undertaken during the feasible options stage, see **Section 4.2.1**.

4.3.2 Supply side options

The initial 'alone' screening assessments have been completed for each preferred option, and are proportionate to immediacy of the option being required. 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, 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.

The options included within the preferred plan, along with their first year of use, are provided in **Table 4-3**. The full HRA Stage 1 Screening is provided in **Table 4-4**.

Table 4-3 Severn Trent Water's WRMP24 preferred plan

Option ID	Option Name	First year of option use in preferred programme
122A	Draycote Reservoir WL increase (6%)	2026-27
423	Draycote WTW DO Recovery	2029-30
128	Carsington to Tittesworth main (large)	2030-31
426	Little Eaton WTW DO Recovery	2030-31
33	Shelton WTW Expansion (large) partially supported by UU release from Vyrnwy (25MI/d)	2030-31 <i>note 1</i>
66	Strensham WTW Expansion partially supported by UU release from Vyrnwy (25MI/d)	2030-31 <i>note 1</i>
305A	Heathy Lea to North Notts transfer (large)	2030-31
169	Terminate raw water export to Yorkshire Water	2035-36

Option ID	Option Name	First year of option use in preferred programme
559	Bishops Castle Transfer	2035-36
72	Rudyard Reservoir to Tittesworth	2035-36
143	W.Midlands Raw Water Storage	2040-41
79B	Bham-Wolves Strategic Link Main (small)	2040-41
44	New R Sow abstraction and WTW near Stafford	2045-46
304	Ambergate to Mid-Notts transfer	2045-46
123B	Raise Dam at Tittesworth Reservoir (25%)	2049-50
503	New GW source Middle Dee GWMU	2049-50
536	New GW Source Manchester and East Cheshire Carboniferous Aquifers	2049-50
58	River Weaver to New WTW at Stoke	2049-50
434	Trimpley WTW DO Recovery	2049-50
435	Whitacre WTW DO Recovery	2049-50
557	ASL Capacity Increase - Oldbury to Meriden	2049-50
562	Mardy Transfer	2049-50
22	Recommission Elmhurst GW source	2049-50
128Z	Carsington to Tittesworth main (small)	2049-50
84C	Whitacre Minor Dam Extension (84C)	2049-50
95B	Ogston WTW Expansion	2049-50
406A	New abstraction and WTW on River Trent - with licence transfer	2055-56
429	Mythe WTW DO Recovery	2055-56
29	Homesford WTW capacity increase	2055-56
64	Rehabilitation Milton GW Source	2055-56
134A	Blackbrook reservoir to Cropston WTW	2055-56
105	Ruyton Support Link	2059-60
564	W.Midlands Raw Water Storage - Notional option	2060-61
190	Eyebrook Reservoir and new WTW's	2065-66
528	New GW Source Soar - PT Sandstone nr Coalville	2065-66
420	Campion Hills WTW DO Recovery	2065-66
556	ASL Capacity Increase - Hallgates to Oldbury	2065-66
187C	Expand Carsington Reservoir (25000 MI)	2070-71

Key: WTW - Water Treatment Works, AMP – Asset Management Period, WL – Water Level, DO - Deployable Output, W – West, R – River, GWMU – Ground Water Management Unit, GW – Ground Water, ASL – Avon Soar Link, PT – Permo Triassic.

Note 1: Options 33 and 66 are forecast for construction and operation by 2030-31. However, since preparation of Severn Trent's rdWMP24, it is understood from United Utilities that the 'backfill' option to enable a release of water from Vyrnwy reservoir is not due for delivery until 2033 (subject to the usual

capital delivery feasibility). Environmental assessment is based on both Shelton and Strensham WTW expansion schemes being in operation and utilising the full benefit with release from Vyrnwy Reservoir to support abstraction at low flows. The operational detail will be developed further as the scheme progresses alongside the required environmental assessment.

It is worth noting that the Strensham expansion scheme does not necessarily need to include support from a Vyrnwy reservoir release - it can utilise headroom in the Mythe WTW license to support the abstraction under low flow conditions and there is also potential for a license transfer from the Canals and Rivers Trust.

Table 4-4 Preferred plan: supply side options screening of 'Likely Significant Effects' (LSE)

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation)?
22	Recommission Elmhurst groundwater source	Recommission the disused Elmhurst groundwater source and upgrade Elmhurst WTW (Nitrate + UV) with water being deployed via new main into the network.	South Pennine Moors SAC	7km	<p>Construction</p> <p>The recommissioning of the groundwater sources and associated pipeline construction are c. 7km from the South Pennine Moors SAC and Peak District Moors (South Pennine Moors Phase 1) SPA. The construction works are sufficiently distant from the designated sites (based on standard distance thresholds for noise, visual etc) that no LSEs are anticipated.</p> <p>Operation</p> <p>The WFD assessment has concluded that there is limited connectivity between the groundwater and surface water, and therefore impacts to the latter are considered to be low. The designated site is also >5km from the groundwater source location, as such is not considered to be adversely affected by drawdown. As such, no LSEs are anticipated during operation.</p>	No	No
			Peak District Moors (South Pennine Moors Phase 1) SPA	7km		No	No
29	Homesford WTW capacity increase	Increase capacity of Homesford WTW to 54Ml/d to enable treatment of the high flows (primarily spring/summer), before deployment into DVA via a new booster.	Peak District Dales SAC	3.7km	<p>Construction:</p> <p>The increase in capacity of Homesford WTW will require construction work, assumed to be within the existing site boundaries. The site is within close proximity to the River Derwent, and downstream of the Peak District Dales SAC which supports the following fish populations; brook lamprey and bullhead. As such, pollution incidents and suspended sediment releases could adversely affect the mobile species of the SAC. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases downstream.</p> <p>Operation:</p> <p>An existing condition of abstraction at Homesford is that that abstraction is restricted to 45Ml/d when the Derwent flows at Derby are less than 340Ml/d. This trigger flow is rarely hit and a previous investigation has indicated that there is the potential to take peak flows for certain periods of the year (assumed to primarily be during spring/summer). The WFD assessment has assessed the reduction in flows at Q50 in the River Derwent. A reduction in maximum flow of 2.4% is considered to be a major impact, and is estimated to affect the reach between the abstraction point and downstream to Duffield. The CAMS indicates that water is not available for licensing in the River Derwent.</p> <p>LSEs cannot be ruled out due uncertainty over the operational regime and how this may affect fish species movement to the upstream designations (Peak District Dales SAC), and the extent of functionally linked habitat to be affected.</p> <p>Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>	Yes	Yes
			Gang Mine SAC	8.4km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Bee's Nest and Green Clay Pits SAC	3.7km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Humber Estuary SAC, SPA and Rams	Downstream receptor (c.96km)	<p>Construction:</p> <p>The Humber Estuary is considered sufficiently distant at construction impacts will not result in an adverse effect, with the SACO stating that the River Trent does not support sea or river lamprey (Cromwell Weir impassable).</p> <p>Operation:</p> <p>Although hydrologically linked to the Humber Estuary SAC, the qualifying features not known to be present on River Trent (sea and river lamprey). The SACO states the following:</p> <ul style="list-style-type: none"> - Sea lamprey: Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable. - River lamprey: Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey. <p>The reduction in flow is not considered to adversely affect the Humber Estuary SAC fish and estuaries feature (SACO target for freshwater input) alone (based on WFD impact assessment) however catchment wide in-combination effects will need to be considered.</p>	No	No
33	Shelton WTW Expansion (large) partially supported by UU release from Vyrnwy (25Ml/d)	Construction of a new river intake and new 18Ml/d process stream adjacent to Shelton WTW to utilise the full river abstraction licence.	Midlands Meres and Mosses Phase 1 Ramsar	3.3km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Severn Estuary/Môr Hafren SAC	Downstream receptor (>100km)/functional habitat	<p>Construction</p> <p>It is unclear whether the existing raw water intake from the River Severn will be used, or whether a new structure will be required. There is therefore potentially an impact pathway</p>	Yes	Yes

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
		This will enable additional River Severn water, supported by releases from Vyrnwy Reservoir, to be treated and supplied to the network.			to the Severn Estuary/Môr Hafren SAC and functionally linked habitat within the River Severn itself. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases. Construction of a new intake may require bespoke mitigation to avoid adverse effects to functionally linked habitat and migration period. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken. Operation: The proposed scheme involves an additional 10Ml/d abstraction from the River Severn. The scheme is also partially reliant on the 25Ml/d release from Lake Vyrnwy. LSEs therefore cannot be ruled out due to uncertainty over the operational regime and how this may affect migratory fish species of the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar and the extent of functionally linked habitat that could be affected for migratory fish. This includes the Annex II species listed under the SAC (sea lamprey (<i>Petromyzon marinus</i>), river lamprey (<i>Lampetra fluviatilis</i>) and twaite shad (<i>Alosa fallax</i>)) but also the fish assemblage under the Estuaries feature which includes the following migratory species; salmon, eel, sea trout and allis shad (also part of Ramsar criterion). The installation of a new intake will also require screening etc to avoid impingement and entrainment issues. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.		
			Severn Estuary SPA and Ramsar	Downstream receptor (>100km)/functional habitat	Construction Based on available information in the Regulation 33 package, offsite functionally linked habitat for the qualifying bird features is not considered to be present in proximity to the site, therefore no LSEs have been identified for the SPA. The Ramsar is designated for the estuary feature and migratory fish species, and as such the information contained for the Severn Estuary SAC is also relevant. Operation: The SPA qualifying features are not considered to be highly sensitive to changes in freshwater input. However, the Ramsar estuary and migratory fish species features are considered to be sensitive, and as such, the information contained for the Severn Estuary SAC is also relevant.	Yes – Ramsar	Yes - Ramsar
			River Clun SAC	Downstream receptor/functional habitat	Changes in the volume of water and flow into the Severn Estuary could also impact salmon movement to the River Clun SAC, designated for freshwater pearl mussel (<i>Margaritifera margaritifera</i>). Salmon provides a key role in the life-cycle of the freshwater pearl mussel. The River Clun discharges to the River Teme which joins the River Severn downstream of Worcester.	Yes	Yes
44	New R Sow abstraction and WTW near Stafford	Construction of new river intake, new treatment works and pumping mains to deploy potable water into the network.	Cannock Chase SAC	0km - directly adjacent (despite re-routing, new pipeline route is located along Cannock SAC for a length of 565m)	Construction: The pipeline construction will extend in close proximity to Cannock Chase SAC and within potentially supporting offsite functional habitat (uncertain). Significant construction effects cannot obviously be excluded with standard measures and construction may require bespoke mitigation or detailed design inputs at the WRMP level. Operation: There is no hydrological connectivity to the site, as such operation impacts are not anticipated.	Yes	No
			Pasturefields Saltmarsh SAC	1.4km, possible functional habitat closer	Construction: The pipeline extends c1.4km to the south west of Pasturefields Saltmarsh SAC. The SAC is groundwater fed and therefore the pipeline is unlikely to alter flows. However, there are potentially functionally linked areas of saltmarsh at: Ingestre (SJ980247) and Lion Lodge (SJ989239). The pipeline and proposed WTW come into closer proximity to these offsite areas. Consideration will need to be given to positioning and routing of these structures to ensure changes to local hydrology do not adversely affect these areas of saltmarsh. Operation: There is no hydrological connectivity to the site, as such operation impacts are not anticipated.	Yes	No
			West Midlands Mosses SAC, and Midlands Meres and Mosses Phase 1 Ramsar	5.5km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Midlands Meres and Mosses Ramsar - Phase 2	9.9km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
			River Mease SAC	Downstream receptor (c.21km)/functional habitat (River Trent)	<p>Construction: The new river abstraction is located on the River Sow, and the pipelines require c.3 crossings of the watercourse. The River Sow is a tributary of the River Trent, and the River Mease SAC discharges into the River Trent further downstream at Croxhall. Three of its qualifying features; otter, bullhead and spined loach, are likely to be found in the wider catchment. Standard measures and best practice mitigation would be implemented during construction, including installation using a trenchless technology if necessary, to reduce the risk of pollution incidents and suspended sediment releases.</p> <p>Operation: The scheme requires additional abstraction from the River Sow, a tributary of the River Trent. The new 25Ml/d intake on the River Sow could lead to a 18.4% and 22.9% reduction in Q70 and Q50 flows respectively. A major hydrological impact has been identified downstream on the River Trent to Drakelow Park, and a minor impact further downstream to Colwick. This is below the confluence of the River Trent and River Mease SAC. Low flow conditions are protected by a Hands-Off-Flow condition at Yoxall which has been set at an appropriate level to safeguard the aquatic environment. Based on the predicted changes in flow, movement of the three mobile qualifying aquatic species (bullhead, spined loach and WCC) within the wider catchment could be impeded. LSEs cannot be ruled out due to uncertainty over the operational regime and how this may affect fish species, and the extent of functionally linked habitat to be affected.</p>	Yes	Yes
			Humber Estuary SAC, SPA and Ramsar	Downstream receptor (>100km)	<p>Construction: The River Trent is hydrologically connected to the Humber Estuary SAC. However, the watercourse has not been identified as supporting the migratory fish species, and as such are not considered to be functionally linked habitat.</p> <p>Operation: Although hydrologically linked to the Humber Estuary SAC, qualifying features not known to be present on River Trent (sea and river lamprey). The SACO states the following: - Sea lamprey: Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable. - River lamprey: Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey The reduction in flow is not considered to adversely affect the Humber Estuary SAC estuaries feature (SACO target for freshwater input) alone (based on WFD impact assessment), however catchment wide in-combination effects will need to be considered.</p>	No	No
58	River Weaver to New WTW at Stoke	Construction of new intake on the River Weaver, bankside storage and treatment works near Nantwich. New pipelines and pumping facilities will convey treated water into supply, reducing demand on existing sources.	Midlands Meres and Mosses Phase 1 Ramsar	4.5km	<p>Construction: There are two European designated sites within 10km; West Midlands Mosses SAC, and Midlands Meres and Mosses- Phase 1 Ramsar. The closest component is 4.5km to the south east. As such, there is considered to be sufficient distance between the designation and scheme components (based on standard distance thresholds e.g. noise, visual etc) such that no LSEs are anticipated.</p> <p>Operation: There is no hydrological connectivity to the site, as such operation impacts are not anticipated.</p>	No	No
			West Midlands Mosses SAC	4.5km	<p>Construction: There are two European designated sites within 10km; West Midlands Mosses SAC, and Midlands Meres and Mosses- Phase 1 Ramsar. The closest component is 4.5km to the south east. As such, there is considered to be sufficient distance between the designation and scheme components (based on standard distance thresholds e.g. noise, visual etc) such that no LSEs are anticipated.</p> <p>Operation: There is no hydrological connectivity to the site, as such operation impacts are not anticipated.</p>	No	No
			Mersey Estuary SPA and Ramsar	42km	<p>Construction: The River Weaver discharges downstream into the Mersey Estuary SPA and Ramsar, with the scheme abstraction at c.42km upstream. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases. As such, no LSEs are anticipated.</p> <p>Operation:</p>	No	No

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
					The River Weaver discharges to the Manchester Ship Canal, with a set of sluices allowing excess water into the Mersey Estuary. The Mersey Estuary SPA and Ramsar is designated for saltmarsh and mudflats, and overwintering waterfowl. A reduction in flow within the River Weaver is estimated to be detectable downstream to Northwich. The downstream flows however would be protected by the hands-off flow constraint (17.3 Ml/d at Beam Bridge). The qualifying features of the SPA and Ramsar are not considered to be highly sensitive to changes in freshwater flows, which are currently managed by the sluice arrangement on the River Weaver into the Manchester Ship Canal. As such, no LSEs are anticipated.		
64	Rehabilitation Milton GW Source	Recommissioning of the Milton groundwater source and use the raw water to support Melbourne WTW to supply the Strategic Grid WRZ. The option involves rehabilitation and/or redrilling of boreholes at Milton and abandonment of the Stanton by Bridge source, plus new pipelines, pumping station and service reservoir.	River Mease SAC	20km upstream receptor/ functionally linked habitat	<p>Construction:</p> <p>The component requires the recommissioning of Milton groundwater source and new pipeline to connect Milton BPS and Melbourne WTW, and abandoning Stanton by Bridge. No construction works within the River Trent located 1.1km from Milton BPS would be required. No abstraction of surface water would be required. The River Mease SAC is located 11km from the component and despite being designated for mobile species (otter <i>Lutra lutra</i>), the option is not considered to have a major negative effect upon the River Mease SAC and therefore no LSE are anticipated due to sufficient distance between the SAC and the component.</p> <p>Operation:</p> <p>The component requires the recommission of the Milton groundwater source already licensed for abstraction (4.11Ml/d annual average) from three groundwater sources, a well and a heading. The component would require a licence variation if any of the groundwater sources need redrilling at Milton BPS.</p> <p>Depending on the licence variation required, there may be a requirement to consider impact to water level upstream of the abstraction (20km), impacts upon the River Mease SAC and functionally linked habitats within the River Trent, and it's use by the mobile species of the River Mease SAC (bullhead, spined loach, WCC and otter) which are unknown at this stage. LSEs cannot be ruled out due uncertainty over the operational regime and how this may affect fish species, and the extent of functionally linked habitat to be affected. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p> <p>Construction:</p> <p>Operation:</p>	No	Yes
			Humber Estuary SAC, SPA and Ramsar	Downstream receptor (>100km)	<p>Construction:</p> <p>Although the River Trent is hydrologically linked to the Humber Estuary SAC, the qualifying features are not known to be present in the watercourses, and as such the River Tame is not considered to be functionally linked habitat. The Humber Estuary SAC is >100km downstream and therefore considered to be sufficiently distanced such that construction related issues (increases in suspended sediments) would not adversely affect the site.</p> <p>Operation:</p> <p>Although functionally linked to the Humber Estuary SAC, the qualifying features are not known to be present on the River Tame or River Trent. The SACO states the following:</p> <ul style="list-style-type: none"> - Sea lamprey: Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable. - River lamprey: Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey. <p>The reduction in flow is not considered to adversely affect the Humber Estuary SAC estuaries feature (SACO target for freshwater input) alone (based on WFD impact assessment). Consideration will need to be given to in-combination effects.</p>	No	No
66	Strensham WTW Expansion partially supported by UU release from Vyrnwy (25Ml/d)	Expand capacity of Strensham WTW by 30Ml/d and construct a new intake at Upton-upon-Severn. River flows will be supported by United Utilities' release from Vyrnwy Reservoir or by utilising a proportion of the Mythe WTW abstraction licence (located further downstream). Additional raw	Bredon Hill SAC	2km	<p>There is one European designated site within 10km; Bredon Hill SAC which is designated for Violet click beetle <i>Limoniscus violaceus</i>. The closest component is located c.2km to the west of the site. Dixon Wood SAC is considered to be a linked SAC, and therefore woodland between the two sites should be maintained. The pipeline and Strensham WTW expansion do not occur within this zone, however little is known about the dispersal dynamics of the species (SACO). Priority habitat mapping shows areas of woodland around the existing Strensham WTW and within proximity to the pipeline route.</p> <p>LSEs cannot be ruled out, and appropriate siting of infrastructure and the pipeline routing to avoid woodland removal, especially any ancient trees, may be required. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>	Yes	No
			Dixton Hill SAC	Functionally linked to Dixton Hill SAC			

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
		water will be abstracted predominantly in winter when there is greater water availability in the Severn.	Severn Estuary/Môr Hafren SAC	Downstream receptor (>100km)/functional habitat	<p>Construction</p> <p>A new river intake is required at Upton-upon-Severn as part of the WTW expansion. There is therefore potentially an impact pathway to the Severn Estuary/Môr Hafren SAC and functionally linked habitat within the River Severn itself. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases. Construction of a new intake may require bespoke mitigation to avoid adverse effects to functionally linked habitat and migration period. The installation of a new intake will also require screening etc to avoid impingement and entrainment issues. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p> <p>Operation:</p> <p>The proposed scheme involves an additional 30Ml/d abstraction from the River Severn. The scheme is also partially reliant on the 25Ml/d release from Lake Vyrnwy. LSEs therefore cannot be ruled out due uncertainty over the operational regime and how this may affect migratory fish species of the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar and the extent of functionally linked habitat that could be affected for migratory fish. This includes the Annex II species listed under the SAC (sea lamprey (<i>Petromyzon marinus</i>), river lamprey (<i>Lampetra fluviatilis</i>) and twaite shad (<i>Alosa fallax</i>)) but also the fish assemblage under the Estuaries feature which includes the following migratory species; salmon, eel, sea trout and allis shad (also part of Ramsar criterion). Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>	Yes	Yes
			Severn Estuary SPA and Ramsar	Downstream receptor (>100km)/functional habitat	<p>Construction</p> <p>Based on available information in the Regulation 33 package, offsite functionally linked habitat for the qualifying bird features is not considered to be present in proximity to the site, therefore no LSEs have been identified for the SPA. The Ramsar is designated for the estuary feature and migratory fish species, and as such the information contained for the Severn Estuary SAC is also relevant.</p> <p>Operation:</p> <p>The SPA qualifying features are not considered to be highly sensitive to changes in freshwater input. However, the Ramsar estuary and migratory fish species features are considered to be sensitive, and as such, the information contained for the Severn Estuary SAC is also relevant.</p>	Yes – Ramsar	Yes - Ramsar
			River Clun SAC	Downstream receptor/functional habitat	<p>Changes in the volume of water and flow into the Severn Estuary could also impact salmon movement to the River Clun SAC, designated for freshwater pearl mussel (<i>Margaritifera margaritifera</i>). Salmon provides a key role in the life-cycle of the freshwater pearl mussel. The River Clun discharges to the River Teme which joins the River Severn downstream of Worcester.</p>	Yes	Yes
72	Rudyard Reservoir to Tittesworth	Transfer of raw water from the Canal and River Trust (C&RT) owned Rudyard Reservoir to the River Churnet, enabling raw water in Tittesworth Reservoir to be conserved and used at Tittesworth WTW, thus operating at a higher output for longer in the year.	South Pennine Moors SAC	1.3km	<p>Construction:</p> <p>The construction of the pipeline between Rudyard Lake and Tittesworth will not adversely affect the qualifying features of either site, being routed through predominantly arable land, and sufficiently distant such that noise and air quality impacts are unlikely.</p> <p>Operation:</p> <p>There will be no impacts during operation.</p>	No	No
			Peak District Moors (South Pennine Moors Phase 1) SPA	1.3km	<p>Construction:</p> <p>The construction of the pipeline between Rudyard Lake and Tittesworth will not adversely affect the qualifying features of either site, being routed through predominantly arable land, and sufficiently distant such that noise, lighting effects etc will not cause disturbance.</p> <p>Operation:</p> <p>There will be no impacts during operation.</p>	No	No
			Peak District Dales SAC	Downstream receptor – hydrologically connected via River Churnet	<p>Construction:</p> <p>Standard good practice construction measures and adherence to pollution prevention measures would avoid any downstream effects to the Peak District Dales SAC. As such, no LSEs have been identified during construction.</p> <p>Operation:</p> <p>The WFD has concluded that the additional abstraction would not significantly change the outflow regime from either Rudyard Lake (which has a small compensation flow to the River Churnet) or the water quality of the compensation flow from the Tittesworth Reservoir.</p>	No	No

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
					Therefore no LSEs have been identified on mobile species of the Peak District Dales SAC which could be using the lower reaches of the River Churnet.		
79B	Bham-Wolves Strategic Link Main (small)	Connect Frankley WTW in the Strategic Grid WRZ to Tettenhall Pumping Station in the Wolverhampton WRZ via new pipelines and using the existing network. To enable the 10Ml/d transfer, both existing and new assets will be utilised and some modification and recommissioning will be carried out of existing assets.	Fen Pools SAC	4km	<p>Construction: The pipeline route is located c.4.1km to the north west of Fen Pools SAC. There are a number of waterbodies situated between the SAC and the pipeline route, and therefore there is the potential that these, and the surrounding terrestrial habitat, are used to support the GCN population. As such, LSEs to functionally linked habitat cannot be ruled out, however standard measures and best practice mitigation for GCN should avoid adverse effects.</p> <p>Operation: There will be no hydrological impact to the Fen Pools SAC. The scheme involves the transfer of treated water in the network from the upgrade of an existing reservoir.</p>	Yes	No
84C	Whitacre Minor Dam Expansion	Increase storage capacity of Whitacre Reservoir by 7.8MI, by increasing Top Water Level (TWL) by 0.17m. Minor works consisting of modifications to spillways, embankments, over flow weir and pipework.	River Mease SAC	c.28km Functionally linked via River Tame and Trent	<p>Construction: The reservoir is c.28km upstream of the River Mease SAC. Construction works are not required in the watercourse and will be contained on site. As such, pollution incidents and suspended sediment releases would be controlled using standard measures and best practice mitigation.</p> <p>Operation: The operation of this component will only result in small changes to the operational pattern of existing abstractions. As a result, there are expected to be no discernible effects on river flows or groundwater levels associated with the operational activities of this component. Therefore no LSEs are anticipated.</p>	No	No
			Humber Estuary SAC, SPA and Ramsar	Downstream receptor (>100km)	<p>Construction: Although the River Tame is hydrologically linked to the Humber Estuary SAC, via the River Trent, the qualifying features are not known to be present in the watercourses, and as such the River Tame is not considered to be functionally linked habitat. The Humber Estuary SAC is c.130km downstream and therefore considered to be sufficiently distanced such that construction related issues (increases in suspended sediments) would not adversely affect the site.</p> <p>Operation: Although functionally linked to the Humber Estuary SAC, the qualifying features are not known to be present on the River Tame or River Trent. The SACO states the following: - Sea lamprey: Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable. - River lamprey: Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey. The reduction in flow is not considered to adversely affect the Humber Estuary SAC estuaries feature (SACO target for freshwater input) alone (based on WFD impact assessment).</p>	No	No
95B	Ogston WTW Expansion	Expand and upgrade existing WTW through new third process stream. Enhance raw water pumps at Ambergate (to ensure reliable transfer from Carsington), and install pipelines and boosters to transfer additional output from Ogston WTW to the receiving network.	Bee's Nest and Green Clay Pits SAC	9.8km	<p>Construction: The proposed works are contained within the existing site boundaries and are therefore at sufficient distance (based on standard distance thresholds e.g. noise, visual etc) that construction impacts are unlikely. As such, no LSEs are anticipated.</p> <p>Operation: No pathways for impact nor is the site hydrologically connected and/or qualifying features sensitive to changes in volumes of water.</p>	No	No
			Gang Mine SAC	5.8km	<p>Construction: The proposed works are contained within the existing site boundaries and are therefore at sufficient distance (based on standard distance thresholds e.g. noise, visual etc) that construction impacts are unlikely. As such, no LSEs are anticipated.</p> <p>Operation: No pathways for impact nor is the site hydrologically connected and/or qualifying features sensitive to changes in volumes of water.</p>	No	No
			Peak District Dales SAC	6.1km and functional habitat (River Derwent)	<p>Construction: The proposed works are contained within the existing site boundaries and are therefore at sufficient distance (based on standard distance thresholds e.g. noise, visual etc) that construction impacts are unlikely. As such, no LSEs are anticipated.</p>	No	Yes

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
					<p>Operation: The scheme will increase abstraction from the River Derwent by c.40Ml/d, with potential changes to the flow regime of the lower reaches of the river which could affect geomorphological processes and aquatic habitat function. The River Derwent is likely to be functionally linked habitat to the Peak District Dales SAC for the fish species and WCC. Significant operational effects cannot be obviously excluded, and further detailed design and scheme level investigations would need to be undertaken.</p>		
			South Pennine Moors SAC	9.6km	<p>Construction: The proposed works are contained within the existing site boundaries and are therefore at sufficient distance (based on standard distance thresholds e.g. noise, visual etc) that construction impacts are unlikely. As such, no LSEs are anticipated.</p> <p>Operation: No pathways for impact nor is the site hydrologically connected and/or qualifying features sensitive to changes in volumes of water.</p>	No	No
			Peak District Moors (South Pennine Moors Phase 1) SPA	9.6km	<p>Construction: The proposed works are contained within the existing site boundaries and are therefore at sufficient distance (based on standard distance thresholds e.g. noise, visual etc) that construction impacts are unlikely. As such, no LSEs are anticipated.</p> <p>Operation: There is no pathway for impact to the SPA through changes in the River Derwent. As such, no LSEs are anticipated.</p>	No	No
105	Ruyton Support Link	Transfer of treated water from Shelton WRZ to Ruyton WRZ, via a new pipeline connection.	Midlands Meres and Mosses Phase 1 Ramsar	5.4km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Midlands Meres and Mosses Phase 2 Ramsar	9.1km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Severn Estuary/Môr Hafren SAC	Downstream receptor (>100km)/functional habitat	<p>Construction: The pipeline crosses the Great Ness which discharges into the River Severn, and there is therefore hydrological connectivity with the Severn Estuary SAC and functionally linked habitat within the River Severn itself. Standard measures and best practice mitigation would be implemented during construction, including installation using a trenchless technology if necessary, to reduce the risk of pollution incidents and suspended sediment releases.</p> <p>Operation: The scheme does not involve any additional abstractions or discharges, as a result no LSEs are anticipated.</p>	No	No
			Severn Estuary SPA and Ramsar	Downstream receptor (>100km)/functional habitat		No	No
122A	Draycote Reservoir WL increase (6%)	Increase storage capacity by raising Top Water Level by 0.6m, through various modifications. A 6% capacity increase equates to additional storage of 1400MI, which will be treated at Draycote WTW before deployment to the Strategic Grid WRZ.	Severn Estuary/Môr Hafren SAC	Downstream receptor (>100km)/functional habitat	<p>There are no European designated sites within 10km of the scheme components, or impact pathways over a greater distance.</p> <p>There are unlikely to be any impacts on the downstream water bodies as Draycote Reservoir only has a small catchment area and the only outflow is compensation flow which will remain unchanged by this component. As such freshwater flows downstream and to the Severn Estuary EMS will not be affected. Therefore no LSEs are anticipated.</p>	No	No
			Severn Estuary SPA and Ramsar	Downstream receptor (>100km)/functional habitat		No	No
			River Clun SAC	Downstream receptor/functional habitat		No	No
123B	Raise dam at Tittesworth Reservoir (25%)	Increase storage capacity by raising Top Water Level by 2.3m through various modifications. A 25% capacity increase corresponds to an additional 1610MI of storage, enabling Tittesworth WTW to operate at higher capacity longer into dry seasons.	South Pennine Moors SAC	1.3km	<p>Construction: The expansion of the reservoir given the distance, will not adversely affect local hydrology supporting the habitats.</p> <p>Operation: There will be no impacts during operation.</p>	No	No
			Peak District Moors (South Pennine Moors Phase 1) SPA and Ramsar	1.3km	<p>Construction: The expansion of the reservoir given the distance, will not adversely affect local hydrology supporting the habitats. The surrounding habitat may be functionally linked, and used by the SPA qualifying features. The new footprint of the reservoir to account for the 25% increase has not been confirmed, and therefore it is uncertain as to what type of habitat will be flooded. As such, significant construction effects cannot obviously be excluded with standard measures and construction may require bespoke mitigation or detailed design inputs at the WRMP level. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p> <p>Operation:</p>	Yes	No

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
					There will be no impacts during operation.		
			Peak District Dales SAC	Functional habitat (River Churnet)	<p>Construction: Standard good practice construction measures and adherence to pollution prevention measures would avoid any downstream effects to the Peak District Dales SAC. As such, no LSEs have been identified during construction.</p> <p>Operation: The WFD has concluded an uncertain impact on flows in the River Churnet due to the reservoir expansion. The River Churnet is a tributary of the River Dove, the confluence being c.30km downstream. As the flow changes are uncertain, and the potential use of the lower reaches of the River Dove by the mobile species of the Peak District Dales SAC uncertain. LSEs cannot be ruled out. As such, should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>	No	Yes
128	Carsington to Tittesworth main (large)	New raw water pipeline from the River Derwent and Carsington Reservoir to Tittesworth WTW. Transfer of additional raw water (max 30MI/d) will enable an enhanced Tittesworth WTW to operate longer into dry seasons. Once treated, potable water will be deployed into the North Staffs WRZ through existing and new pipeline infrastructure.	Bee's Nest and Green Clay Pits SAC	2.8km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Gang Mine SAC	5.9km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Peak District Dales SAC	4.03km/functional habitat (River Dove)	<p>Construction: There will be no impacts to the qualifying habitat features given the distance and features not sensitive to hydrological changes, nor hydrologically connected.</p> <p>The River Dove is part of the Peak District Dales SAC and supports white-clawed crayfish, bullhead and brook lamprey. The proposed pipeline crosses the River Dove 4.83km downstream of the designation. The white clawed crayfish and bullhead populations are not likely to be impacted as they do not undertake migrations. Brook lamprey undertake migrations to spawning grounds upstream and whilst they undertake shorter migrations than river lamprey, their use of remainder of the River Dove watercourse cannot be ruled out. Standard measures and best practice mitigation would be implemented during construction, including installation using a trenchless technology if necessary, to reduce the risk of pollution incidents and suspended sediment releases. Bespoke mitigation such as timing the works to avoid key sensitive periods may also be required.</p> <p>Operation: The scheme is the transfer of water between two reservoirs via a new pipeline connection. There may be changes in the downstream flow contribution from the reservoirs due to changes in spill pattern, but these are considered as minor hydrological impacts which are WFD compliant. As such, no LSEs are anticipated.</p>	Yes	No
			South Pennine Moors SAC	2.9km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Peak District Moors (South Pennine Moors Phase 1) SPA	2.9km	<p>Construction: The Peak District Moors (South Pennine Moors Phase 1) SPA is within 2.9km of the pipeline connection to Tittesworth Reservoir. The presence of functionally linked offsite habitat through which the pipeline passes is uncertain (e.g. Solomon's Wood). Therefore bespoke mitigation may be required when completing this section of the pipeline route e.g. avoid sensitive bird periods, and habitat reinstatement.</p> <p>Operation: The scheme is the transfer of water between two reservoirs via a new pipeline connection. There may be changes in the downstream flow contribution from the reservoirs due to changes in spill pattern, but these are considered as minor hydrological impacts which are WFD compliant. As such, no LSEs are anticipated.</p>	Yes	No
128Z	Carsington to Tittesworth main (small)	New raw water pipeline from the River Derwent and Carsington Reservoir to Tittesworth WTW. Transfer of additional raw water (max 14MI/d) will enable an enhanced Tittesworth WTW to operate longer into dry seasons. Once treated, potable water will be deployed into the North Staffs WRZ through existing and new pipeline infrastructure.	Bee's Nest and Green Clay Pits SAC	2.8km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Gang Mine SAC	5.9km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Peak District Dales SAC	4.03km/functional habitat (River Dove)	<p>Construction: There will be no impacts to the qualifying habitat features given the distance and features not sensitive to hydrological changes, nor hydrologically connected.</p> <p>The River Dove is part of the Peak District Dales SAC and supports white-clawed crayfish, bullhead and brook lamprey. The proposed pipeline crosses the River Dove 4.83km downstream of the designation. The white clawed crayfish and bullhead populations are not likely to be impacted as they do not undertake migrations. Brook lamprey undertake migrations to spawning grounds upstream and whilst they undertake shorter migrations than river lamprey, their use of remainder of the River Dove watercourse cannot be ruled</p>	Yes	No

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
					<p>out. Standard measures and best practice mitigation would be implemented during construction, including installation using a trenchless technology if necessary, to reduce the risk of pollution incidents and suspended sediment releases. Bespoke mitigation such as timing the works to avoid key sensitive periods may also be required.</p> <p>Operation: The scheme is the transfer of water between two reservoirs via a new pipeline connection. There may be changes in the downstream flow contribution from the reservoirs due to changes in spill pattern, but these are considered as minor hydrological impacts which are WFD compliant. As such, no LSEs are anticipated.</p>		
			South Pennine Moors SAC	2.9km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Peak District Moors (South Pennine Moors Phase 1) SPA	2.9km	<p>Construction: The Peak District Moors (South Pennine Moors Phase 1) SPA is within 2.9km of the pipeline connection to Tittesworth Reservoir. The presence of functionally linked offsite habitat through which the pipeline passes is uncertain (e.g. Solomon's Wood). Therefore bespoke mitigation may be required when completing this section of the pipeline route e.g. avoid sensitive bird periods, and habitat reinstatement.</p> <p>Operation: The scheme is the transfer of water between two reservoirs via a new pipeline connection. There may be changes in the downstream flow contribution from the reservoirs due to changes in spill pattern, but these are considered as minor hydrological impacts which are WFD compliant. As such, no LSEs are anticipated.</p>	Yes	No
134A	Blackbrook reservoir to Cropston WTW	Recommissioning of existing intakes at Blackbrook reservoir and conveyance of up to 8Ml/d raw water to Cropston WTW inlet via new pipeline. The existing Cropston WTW will be upsized to make additional capacity for treatment.	Humber Estuary SAC, SPA and Ramsar	Downstream receptor (>100km)	<p>Construction: The proposed works are at sufficient distance (based on standard distance thresholds e.g. noise, visual etc) that construction impacts are unlikely. As such, no LSEs are anticipated.</p> <p>Operation: The scheme is the transfer of water between two reservoirs via a new pipeline connection. There may be changes in the downstream flow contribution from the reservoirs due to changes in spill pattern, but these are considered as minor hydrological impacts which are WFD compliant. Although hydrologically linked to the Humber Estuary SAC (via River Stour and River Trent), qualifying features not known to be present on the watercourses (based on SACO), and therefore they are not considered to be functionally linked habitat.</p>	No	No
143	W.Midlands Raw Water Storage	Purchase and convert an existing third-party owned quarry to a pumped raw water storage reservoir. A new abstraction on the River Severn will take raw water either directly to a new treatment works or for storage in the new reservoir, for use during times when river abstraction is restricted.	Midland Meres and Mosses Phase 2 Ramsar	3.7km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Severn Estuary/Môr Hafren SAC	Downstream receptor (c.28km)/functional habitat (River Severn)	<p>Construction A new river intake is required as part of the scheme. There is therefore potentially an impact pathway to the Severn Estuary/Môr Hafren SAC and functionally linked habitat within the River Severn itself. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases. Construction of a new intake may require bespoke mitigation to avoid adverse effects to functionally linked habitat and migration period. The installation of a new intake will also require screening etc to avoid impingement and entrainment issues. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p> <p>Operation: The proposed scheme involves an additional 100Ml/d abstraction from the River Severn. LSEs therefore cannot be ruled out due uncertainty over the operational regime and how this may affect migratory fish species of the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar and the extent of functionally linked habitat that could be affected for migratory fish. This includes the Annex II species listed under the SAC (sea lamprey (<i>Petromyzon marinus</i>), river lamprey (<i>Lampetra fluviatilis</i>) and twaite shad (<i>Alosa fallax</i>)) but also the fish assemblage under the Estuaries feature which includes the following migratory species; salmon, eel, sea trout and allis shad (also part of Ramsar criterion). Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>	Yes	Yes
			Severn Estuary SPA and Ramsar	Downstream receptor (c.28km)/functional habitat (River Severn)	<p>Construction Based on available information in the Regulation 33 package, offsite functionally linked habitat for the qualifying bird features is not considered to be present in proximity to the site, therefore no LSEs have been identified for the SPA. The Ramsar is designated for the estuary feature and migratory fish species, and as such the information contained for the Severn Estuary SAC is also relevant.</p> <p>Operation:</p>	Yes – Ramsar	Yes - Ramsar

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
					The SPA qualifying features are not considered to be highly sensitive to changes in freshwater input. However, the Ramsar estuary and migratory fish species features are considered to be sensitive, and as such, the information contained for the Severn Estuary SAC is also relevant.		
			River Clun SAC	Functional link (salmon)	Changes in the volume of water and flow into the Severn Estuary could also impact salmon movement to the River Clun SAC, designated for freshwater pearl mussel (<i>Margaritifera margaritifera</i>). Salmon provides a key role in the life-cycle of the freshwater pearl mussel. The River Clun discharges to the River Teme which joins the River Severn downstream of Worcester.	Yes	Yes
169	Termination of transfer to Yorkshire Water	Terminate export agreement. This will provide additional raw water in Derwent Reservoirs - to be stored and utilised during dry periods, enabling Bamford WTW to operate at higher capacity during dry seasons.	Peak District Dales SAC	10.7km/functionally linked habitat	<p>Construction:</p> <p>The component will not require construction works as it involves stopping a transfer of water to Yorkshire for the water to be used into Severn Trent's supply at Bamford WTW. Therefore extra water will be contained within the Howden/Derwent/Ladybower reservoirs, located approximately 2.6km upstream of Bamford WTW. The component doesn't require construction works, treatment and deployment will be via existing assets and therefore there are no impact pathways.</p> <p>Operation:</p> <p>The Peak District Dales SAC is likely to be hydrologically connected to the River Derwent and the River Wye (a tributary of the River Derwent, approximately 27km from the reservoirs), the component has the potential to impact mobile species (brook lamprey, bullhead, WCC) which may be present within the River Derwent, potential functionally linked habitat. Engineering feedback has confirmed no change to the existing spill regime into the River Derwent, and therefore no LSEs anticipated.</p>	No	No
			South Pennine Moors SAC	0.06km (adjacent)	<p>Construction:</p> <p>The component does not require construction works.</p> <p>Operation:</p> <p>The component will allow for extra water to be stored within the existing Howden/Derwent/Ladybower reservoirs until abstraction and therefore no adverse effects are anticipated upon South Pennine Moors SAC and Peak District Moors SPA (South Pennine Moors Phase 1).</p>	No	No
			Peak District Moors SPA (South Pennine Moors Phase 1)	0.06km (adjacent)	<p>Construction:</p> <p>The component does not require construction works.</p> <p>Operation:</p> <p>The component will allow for extra water to be stored within the existing Howden/Derwent/Ladybower reservoirs until abstraction and therefore no adverse effects are anticipated upon South Pennine Moors SAC and Peak District Moors SPA (South Pennine Moors Phase 1).</p>	No	No
			Humber Estuary SAC, SPA and Ramsar	Downstream receptor (>200km)	<p>Construction:</p> <p>The component does not require construction works.</p> <p>Operation:</p> <p>Engineering feedback has confirmed no change to the existing spill regime into the River Derwent, and therefore no LSEs anticipated on ultimate flows into the Humber Estuary.</p>	No	No
187C	Expand Carsington (25,000MI)	Raising Carsington Reservoir full level by approximately 6.4m to provide an additional 25,000MI storage.	Bee's Nest and Green Clay Pits SAC	1.7km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Gang Mine SAC	3.3km	No pathways for construction or operation related effects (distance and no hydrological connectivity).	No	No
			Peak District Dales SAC	Upstream receptor (c.4.9km)/functional habitat (River Dove)	<p>Construction:</p> <p>Carsington Reservoir supplies the Scow Brook to the south west, which discharges to the River Dove. The River Dove at Dove Valley and Biggin Dale SSSI, is protected as part of the Peak District Dales SAC. Although this section is upstream of the discharge, the mobile species (bullhead, brook lamprey, WCC) are likely to use other reaches of the River Dove as functionally linked habitat. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases downstream. As such, no LSEs are anticipated.</p> <p>Operation:</p> <p>The expansion of the reservoir (for the three different volumes) would not give rise to any adverse effects. It is uncertain whether additional abstraction would be required at Ambergate, on the River Derwent, and whether there would be a change in releases to Scow Brook which is hydrologically linked to the River Dove. Both the River Dove and River Derwent are likely to support functionally linked habitat for the mobile species of the</p>	No	Uncertain

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
					Peak District Dales SAC (bullhead, brook lamprey and WCC), and therefore it is uncertain as to whether the abstraction would result in AEoI.		
190	Eyebrook Reservoir and new WTW's	Agree purchase of Eyebrook Reservoir near Corby, which historically supplied local industry. Raw water would be treated at a new WTW constructed close to the reservoir, with potable water deployed to the trunk main system and also towards customers in Market Harborough via two new pipelines.	Rutland Water SPA and Ramsar	2.9km	<p>Construction: Based on the proximity of Eyebrook Reservoir to Rutland Water SPA, it is considered to provide offsite functionally linked habitat (both qualifying features have been recorded (WeBS online data)). As such, consideration will need to be given to potential noise and visual disturbance, and possibly restricted timings of the works to avoid the overwintering period if necessary. Should this option be taken forward to the preferred options stage, identification of the WTW site and possible scheme level investigations will be required, with a Stage 2 Appropriate Assessment to be undertaken.</p> <p>Operation: The use of Eyebrook Reservoir as offsite functionally linked habitat will need to be considered further, depending on the proximity of the new WTW and associated infrastructure, should noise and visual disturbance become a permanent impact.</p>	Yes	Yes
			The Wash and North Norfolk Coast SAC	Downstream receptor (c.62km)	<p>Construction: The Wash is c.62km downstream, connected via the River Welland. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases downstream.</p> <p>Operation: An understanding of the potential impacts of changes in flows from the scheme into The Wash has been undertaken. The catchment area of Eyebrook Reservoir at the base of the dam covers ~59km². Compared to the catchment of the River Welland (within which the reservoir is located and Eye Brook is a tributary of) of 1,274km², the Eyebrook Reservoir covers 4.6% of this area. Considering the wider catchment area draining into The Wash of 15,547km² (the seaward extent of The Wash being defined by the Ramsar boundary), the Eyebrook Reservoir catchment represents only 0.4% of this total area. Combining data from 23 flow gauges within the contributing catchment to The Wash indicates a total mean daily flow of ~64m³/s (5,529MI/d). When compared to the proposed 0.21m³/s (18MI/d) reservoir abstraction this is only 0.3% of the total daily mean flow.</p> <p>Although these data only present a broad understanding of flow relations, it is clear that the catchment area of the reservoir and the planned abstraction volume represent a very minor component of flows passed into The Wash. It is therefore concluded that there would be no potential hydrological impacts on The Wash from the implementation of the scheme at the reservoir.</p> <p>Given this and no freshwater attribute in the SACO, no LSEs on The Wash are anticipated.</p>	No	No
			The Wash SPA and Ramsar	Downstream receptor (c.62km)	<p>Construction: The Wash is c.62km downstream, connected via the River Welland. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases downstream.</p> <p>Operation: An understanding of the potential impacts of changes in flows from the scheme into The Wash has been undertaken. The catchment area of Eyebrook Reservoir at the base of the dam covers ~59km². Compared to the catchment of the River Welland (within which the reservoir is located and Eye Brook is a tributary of) of 1,274km², the Eyebrook Reservoir covers 4.6% of this area. Considering the wider catchment area draining into The Wash of 15,547km² (the seaward extent of The Wash being defined by the Ramsar boundary), the Eyebrook Reservoir catchment represents only 0.4% of this total area. Combining data from 23 flow gauges within the contributing catchment to The Wash indicates a total mean daily flow of ~64m³/s (5,529MI/d). When compared to the proposed 0.21m³/s (18MI/d) reservoir abstraction this is only 0.3% of the total daily mean flow.</p> <p>Although these data only present a broad understanding of flow relations, it is clear that the catchment area of the reservoir and the planned abstraction volume represent a very minor component of flows passed into The Wash. It is therefore concluded that there would be no potential hydrological impacts on The Wash from the implementation of the scheme at the reservoir.</p> <p>Given this and no freshwater attribute in the SACO, no LSEs on The Wash are anticipated.</p>	No	No
304	Ambergate to Mid-Notts transfer	Transfer of surplus treated water in the Strategic Grid WRZ to Nottinghamshire	Gang Mine SAC	6.9km	<p>Construction: The site is at sufficient distance (>6km) such that construction related impacts are considered unlikely.</p> <p>Operation:</p>	No	No

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
		WRZ, via new pipeline and pumping station.			This component involves the transfer of treated water in the network, with no changes in abstraction or discharges. As such, no LSEs are anticipated.		
			Peak District Dales SAC	7.3km	<p>Construction: The site is at sufficient distance (>6km) such that construction related impacts are considered unlikely.</p> <p>Operation: This component involves the transfer of treated water in the network, with no changes in abstraction or discharges. As such, no LSEs are anticipated.</p>	No	No
305A	Heathy Lea to North Notts transfer (large)	Transfer of surplus treated water in the Strategic Grid WRZ to Nottinghamshire WRZ, via new pipeline and pumping station.	Peak District Dales SAC	4.2km/ hydrological connectivity	<p>Construction: The Peak District Dales SAC is c.4.2km to the north west, however the pipeline crosses a number of watercourses that discharge to the River Derwent. The River Derwent is likely to provide offsite functionally linked habitat for brook lamprey and bullhead. Standard measures and best practice mitigation would be implemented during construction, including installation using a trenchless technology if necessary, to reduce the risk of pollution incidents and suspended sediment releases. As per PoW, a Stage 2 Appropriate Assessment is required.</p> <p>Operation: This component involves the construction of a new link main from the Strategic Grid WRZ into the Nottinghamshire WRZ, with no changes in abstraction or discharges. As such, no LSEs are anticipated.</p>	Yes	No
			South Pennine Moors SAC	<0.1km	<p>Construction: The routing of the pipeline comes within c.20m of the South Pennine Moors SAC and Peak District Moors (South Pennine Moors Phase 1) SPA, utilising the A619 and B6050 gap. Construction works are therefore in direct proximity to the designation at this point. The pipeline is within 1km of the sites for approximately 4km. The pipeline also crosses watercourses that drain into the sites, and the potentially for the pipeline to result in the temporary loss of offsite functionally linked habitat is unknown.</p> <p>Significant construction effects cannot obviously be excluded with standard measures and construction may require bespoke mitigation or detailed design inputs at the WRMP level.</p> <p>Operation: This component involves the construction of a new link main from the Strategic Grid WRZ into the Nottinghamshire WRZ, with no changes in abstraction or discharges. As such, no LSEs are anticipated.</p>	Yes	No
			Peak District Moor (South Pennine Moors Phase 1) SPA	<0.1km	<p>Construction: As above for South Pennine Moors SAC.</p> <p>Operation: This component involves the construction of a new link main from the Strategic Grid WRZ into the Nottinghamshire WRZ, with no changes in abstraction or discharges. As such, no LSEs are anticipated.</p>	Yes	No
406A	New abstraction and WTW on the River Trent - with licence transfer	New river intake on the River Trent and new raw water bank side storage reservoir near to Stoke Bardolph to supply raw water to a new WTW near to the abstraction site. New pipeline/pumping station to deploy treated water. An opportunity to acquire an existing licence from a third party will provide increased surety of licensed raw water availability.	<p>None within 10km</p> <p>Humber Estuary SAC, SPA and Ramsar</p>	Downstream receptor (>100km)	<p>Construction: Although the River Trent is hydrologically linked to the Humber Estuary SAC the qualifying features are not known to be present in the watercourses, and as such the River Trent is not considered as functionally linked habitat. The Humber Estuary SAC is c.130km downstream and therefore considered to be sufficiently distanced such that construction related issues (increases in suspended sediments) would not adversely affect the site. Standard measures and best practice mitigation would be implemented during construction to reduce the risk.</p> <p>Operation: The WFD has concluded that in Q95 conditions there would be a flow reduction of c.3% and the CAMS indicates that there is water available for abstraction in this catchment under all flow conditions. Although hydrologically linked to the Humber Estuary SAC, qualifying features not known to be present on the River Trent. The SACO states the following: - Sea lamprey: Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable. - River lamprey: Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey</p>	No	No

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
					The reduction in flow is not considered to adversely affect the Humber Estuary SAC estuaries feature (SACO target for freshwater input) alone (based on WFD impact assessment).		
420	Campion Hills WTW DO Recovery	Removal of constraints at treatment works to increase capacity, enabling better use of the abstraction licence.	Severn Estuary/Môr Hafren SAC	Downstream receptor (c.77km)/functional habitat (River Severn)	<p>Construction:</p> <p>The Severn Estuary is considered to be sufficiently distanced such that construction related issues (increases in suspended sediments) would not adversely affect the site. Standard measures and best practice mitigation would be implemented during construction to reduce the risk.</p> <p>Operation:</p> <p>The WFD assessment has concluded that there is limited connectivity between the groundwater and surface water, and therefore impacts to the latter are considered to be low. Impacts to the River Leam, a tributary of the River Severn and therefore hydrologically linked to the Severn Estuary EMS, are considered unlikely. As such, no LSEs are anticipated.</p>	No	No
			Severn Estuary SPA and Ramsar	Downstream receptor (c.77km)/functional habitat (River Severn)		No	No
423	Draycote WTW DO Recovery	Removal of constraints at treatment works to increase capacity, enabling better use of the abstraction licence.	Severn Estuary/Môr Hafren SAC	Downstream receptor (>150km)	<p>Construction:</p> <p>The Severn Estuary is considered to be sufficiently distanced such that construction related issues (increases in suspended sediments) would not adversely affect the site. Standard measures and best practice mitigation would be implemented during construction to reduce the risk.</p> <p>Operation:</p> <p>The Severn Estuary EMS is the ultimate downstream receptor (>150km downstream via the River Leam and hence River Severn). The scheme involves the use of available water from a reservoir and it is therefore assumed that all licence requirements (e.g. compensation releases, if required) will be maintained, so there should be no LSEs alone.</p>	No	No
			Severn Estuary SPA and Ramsar	Downstream receptor (>150km)		No	No
			River Clun SAC	Functional link (salmon)		No	No
426	Little Eaton WTW DO Recovery	Removal of constraints at treatment works to increase capacity, enabling better use of the abstraction licence.	Peak District Dales SAC	Upstream receptor (c.17.6km)/functional habitat	<p>Construction:</p> <p>The Peak District Moors SAC is located c.17.6km upstream, with mobile species likely to use reaches of the River Derwent. No construction works are required outside the WTW site, with the additional capacity to be achieved through upgrades to various process streams. As such, no LSEs are anticipated.</p> <p>Operation:</p> <p>The scheme upgrades to increase deployable output are unlikely to require additional abstraction beyond existing licenced volumes, however an increase (from c.78MI/d to 88MI/d, within the existing average daily licence of 90MI/d) is required and the CAMS suggests that there is limited water available at Q30 and none for flows below this. The reduction in flow could therefore impact the mobile species of the Peak District Dales SAC (bullhead, brook lamprey and WCC). LSEs cannot be ruled out due uncertainty over the operational regime and how this may affect mobile species movement to the upstream designations in particular, and the extent of functionally linked habitat to be affected. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>	No	Yes
			Humber Estuary SAC, SPA and Rams	Downstream receptor (c.96km)	<p>Construction:</p> <p>The Humber Estuary is considered sufficiently distant at construction impacts will not result in an adverse effect, with the SACO stating that the River Trent does not support sea or river lamprey (Cromwell Weir impassable).</p> <p>Operation:</p> <p>Although hydrologically linked to the Humber Estuary SAC, the qualifying features not known to be present on River Trent (sea and river lamprey). The SACO states the following:</p> <ul style="list-style-type: none"> - Sea lamprey: Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable. - River lamprey: Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey. <p>The reduction in flow is not considered to adversely affect the Humber Estuary SAC fish and estuaries feature (SACO target for freshwater input) alone (based on WFD impact assessment) however catchment wide in-combination effects will need to be considered.</p>	No	Yes – other WRMPs
429	Mythe WTW DO Recovery	Removal of constraints at treatment works to increase	Severn Estuary/Môr Hafren SAC	Downstream receptor (>40km)	<p>Construction:</p> <p>The Severn Estuary is considered to be sufficiently distanced such that construction related issues (increases in suspended sediments) would not adversely affect the site. Standard</p>	No	Yes

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
		capacity, enabling better use of the abstraction licence.	Severn Estuary SPA and Ramsar	Downstream receptor (>40km)	<p>measures and best practice mitigation would be implemented during construction to reduce the risk.</p> <p>Operation: The scheme will involve treatment upgrades to allow increased abstraction, although this will be within the existing licensed volumes and is a relatively modest increase (treatment will increase to 125Ml/d from c.104Ml/d, within the existing average daily licence of 136Ml/d) and CAMS suggests water is available to Q50 at least.</p> <p>LSEs therefore cannot be ruled out due uncertainty over the operational regime and how this may affect migratory fish species of the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar and the extent of functionally linked habitat. This includes the Annex II species listed under the SAC (sea lamprey (<i>Petromyzon marinus</i>), river lamprey (<i>Lampetra fluviatilis</i>) and twaite shad (<i>Alosa fallax</i>)) but also the fish assemblage under the Estuaries feature which includes the following migratory species; salmon, eel, sea trout and allis shad (also part of Ramsar criterion).</p> <p>Changes in the volume of water and flow into the Severn Estuary could also impact salmon movement to the River Clun SAC, designated for freshwater pearl mussel (<i>Margaritifera margaritifera</i>). Salmon provide a key role in the life-cycle of the freshwater pearl mussel. The River Clun discharges to the River Teme which joins the River Severn downstream of Worcester.</p> <p>Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>	No	Yes
			River Clun SAC	Functional link (salmon)		No	Yes
434	Trimpley WTW DO Recovery	Removal of constraints at treatment works to increase capacity, enabling better use of the abstraction licence.	Severn Estuary/Môr Hafren SAC	Downstream receptor (c.90km)/functional habitat	<p>The Severn Estuary EMS is the ultimate downstream receptor (>90km downstream via the River Severn), and migratory fish species associated with the SAC and Ramsar sites may pass the abstraction point during migration and utilise downstream reaches. The scheme involves an upgrade to increase deployable output from a reservoir, within licenced volumes and so does not require additional abstraction and is simply the utilisation of available water. As such, it is assumed that all licence requirements (e.g. compensation releases, if required) will be maintained so that should be no LSEs alone.</p>	No	No
			Severn Estuary SPA and Ramsar	Downstream receptor (c.90km)/functional habitat		No	No
435	Whitacre WTW DO Recovery	Removal of constraints at treatment works to increase capacity, enabling better use of the abstraction licence. For business planning purposes, option is combined with separate water quality project at Whitacre.	River Mease SAC	Downstream receptor (c.30km)/functional habitat	<p>The confluence of the River Mease SAC with the River Trent is approximately 30km downstream of Whitacre via the River Tame. The scheme does not require additional abstraction and is simply the utilisation of available water, with all operations within the existing licence. Therefore no LSEs are anticipated.</p> <p>Although hydrologically linked to the Humber Estuary SAC, qualifying features are not known to be present on the River Trent. The SACO states the following: - Sea lamprey: Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable. - River lamprey: Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey.</p> <p>The scheme involves an upgrade to increase deployable output, within licenced volumes and so does not require additional abstraction and is simply the utilisation of available water. As such, it is assumed that all licence requirements (e.g. compensation releases, if required) will be maintained so that should be no LSEs alone.</p>	No	No
			Humber Estuary SAC,SPA and Ramsar	Downstream receptor (>100km)		No	No
503	New GW source Middle Dee GWMU	Construction of a new groundwater source, new treatment works and pipeline, to enable potable water to be deployed to Shelton WRZ.	Meres and Mosses Ramsar Phase 2	3.9km	<p>The qualifying features rely on the appropriate hydrological regime being maintained, with changes in inflows and groundwater resulting in changes in flushing rates for example. The new abstraction point itself is over 5km from these sites, and separated by a number of watercourses. Therefore impacts from construction and operation are not anticipated (based on standard distance thresholds).</p>	No	No
			Meres and Mosses Ramsar Phase 1	3.4km		No	No
			West Midland Mosses SAC	3.9km		No	No
			Fenn's, Whixall, Wem and Cadney Mosses SAC	6.5km		No	No
			River Dee and Bala Lake SAC	5.1km	<p>Construction: The pipeline requires the crossing of the Llangollen Canal, which is not hydrologically connected to the River Dee and Bala Lake SAC. As such, no LSEs are anticipated for this site.</p> <p>Operation:</p>	No	Uncertain

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
					<p>The proposed BPS location is situated on the southern section of the GWMU. The nearest receptors that might be impacted by the proposed abstraction are likely to be the River Dee and Bala Lake SAC and the River Dee SSSI. Although the nearest flow gauge for the River Dee at Manley Hall indicates average flows much larger than the proposed abstraction (2708 MI/d) vs 5 MI/d) it is unclear whether the abstraction could adversely impact the SSSI and SAC, and as such it recommended that further assessment is undertaken to confirm whether there could be an adverse on the environmental receptors.</p> <p>It also noted that the superficial geology across the area largely comprises thick glacial till deposits which could locally limit the surface water / groundwater interaction pathway, and this will need to be considered in any further stages of the assessment.</p>		
528	New GW sources Soar – PT Sandstone nr Coalville	Construction of a new groundwater source in the Soar - PT Sandstone groundwater body, located to north of Coalville. Approximately 5MI/d raw water will be abstracted from the new boreholes and transferred to Melbourne WTW for treatment, prior to deployment into the Strategic Grid WRZ.	River Mease SAC	8.8km	<p>Construction: No impact pathway as construction and site are in separate surface water catchments and sufficiently distant.</p> <p>Operation: Operational impacts to the River Mease SAC are considered unlikely as in a separate surface water catchment, and very unlikely to be exposed to effects associated with groundwater drawdown due to the distance and topography.</p>	No	No
			Humber Estuary SAC, SPA and Ramsar	Downstream receptor (>200km)	<p>Construction: No LSEs are anticipated upon Humber Estuary SAC, SPA and Ramsar due to the distance (over 200km) and employment of standard good practice construction methods and pollution prevention control measures.</p> <p>Operation: Although hydrologically linked to the Humber Estuary SAC, qualifying features not known to be present on River Trent (sea and river lamprey). The SACO states the following: - Sea lamprey: Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable. - River lamprey: Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey.</p> <p>An LSE to the Humber Estuary alone, from changes in freshwater volume, is considered unlikely, based on the volumes and CAMS data indicating water availability from the aquifer.</p>	No	No
536	New GW Source - Manchester and East Cheshire Carboniferous Aquifers	Construction of a new groundwater source in the Manchester and East Cheshire Carboniferous Aquifers groundwater body. Raw water will be transferred to Elmhurst WTW, which is currently disused and will need to be recommissioned, or to a new WTW.	Meres and Mosses Ramsar Phase 1	9.6km	<p>Construction: The construction works are sufficiently distant from the designated sites (based on standard distance thresholds for noise, visual etc) that no LSEs are anticipated.</p> <p>Operation: The scheme is considered to be sufficiently distant from the sites that operational impacts will not arise.</p>	No	No
			Peak District Moors (South Pennine Moors Phase 1)	8.1km		No	No
			South Pennine Moors SAC	8.1km		No	No
556	ASL Capacity Increase - Hallgates to Oldbury	Pipeline and pumping station construction to increase capacity between Melbourne WTW and Oldbury SSR (Strategic Service Reservoir), enabling a surplus of potable water in the east to be transferred south.	River Mease SAC	2.4km	<p>Construction: Construction of the pipeline will require the crossing of Ashby-de-la-Zouch Canal upstream of the confluence with the River Mease (approximately 1.3km) and upstream of the River Mease SAC (approximately 5.4km); the River Sence and the River Anker both tributaries of the River Trent, through the River Tame (confluence located upstream of the River Mease confluence with the River Trent). The crossing on the River Anker and the Coventry Canal is also located downstream of Ensor's Pool.</p> <p>Construction works may have an impact upon the River Mease SAC through loss of functionally habitat for otters, damaging of functionally habitat for spined loach, bullhead, white-clawed crayfish and otter, construction disturbance through noise, light, pollution incidents, sediment.</p> <p>Operation: The option will not require additional abstraction and therefore operational activities are not considered to have a significant impact upon the SACs.</p>	Yes	No
			Ensor's Pool SAC	5.1km	<p>Construction: Ensor's Pool SAC is described as isolated from river systems and is therefore a 'refuge' for white-clawed crayfish, therefore and due to the distance between the proposed pipeline and the SAC (5.1km), no LSE are anticipated on Ensor's Pool SAC.</p>	No	No

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)	
					<p>Operation: The option will not require additional abstraction and therefore operational activities are not considered to have a significant impact upon the SACs.</p>			
			Humber Estuary SAC, SPA and Ramsar	Downstream receptor (>200km)	<p>Construction: No LSEs are anticipated upon Humber estuary SAC, SPA and Ramsar due to the distance (over 200km) and construction impacts located on distant tributaries to the River Trent.</p> <p>Operation: The option will not require additional abstraction and therefore operational activities are not considered to have a significant impact upon the SACs.</p>	No	No	
557	ASL Capacity Increase - Oldbury to Meriden	Pipeline and pumping station construction to increase capacity between Oldbury SSR (Strategic Service Reservoir) and Meriden DSR, enabling a surplus of potable water in the east to be transferred south (and vice versa).	Ensor's Pool SAC	4.4km	<p>Construction: Ensor's Pool SAC is described as isolated from river systems and is therefore a 'refuge' for white-clawed crayfish, therefore and due to the distance between the proposed pipeline and the SAC (4.4km) and lack of hydrological connectivity, no LSE are anticipated on Ensor's Pool SAC.</p> <p>Operation: The option will not require additional abstraction and therefore operational activities are not considered to have a significant impact upon the SAC.</p>	No	No	
			Humber Estuary SAC, SPA and Ramsar	Downstream receptor (>200km)	<p>Construction: The option would require crossing rivers/streams, two tributaries of the River Bourne which flows towards the River Tame and the River Trent; and Pickford Brook, a tributary of the River Sherbourne which flows towards the River Avon and the River Severn. No LSEs are anticipated upon Humber estuary SAC, SPA and Ramsar and Severn Estuary SAC/SPA/Ramsar due to the distance (over 200km) and construction impacts located on distant tributaries to the River Trent.</p> <p>Operation: The option will not require additional abstraction and therefore operational activities are not considered to have a significant impact upon the SAC, SPA and Ramsar.</p>	No	No	
			Severn Estuary SAC, SPA and Ramsar	Downstream receptor (>150km)	<p>Construction: The option would require crossing rivers/streams, two tributaries of the River Bourne which flows towards the River Tame and the River Trent; and Pickford Brook, a tributary of the River Sherbourne which flows towards the River Avon and the River Severn. No LSEs are anticipated upon Humber estuary SAC, SPA and Ramsar and Severn Estuary SAC/SPA/Ramsar due to the distance (over 200km) and construction impacts located on distant tributaries to the River Trent.</p> <p>Operation: The option will not require additional abstraction and therefore operational activities are not considered to have a significant impact upon the SAC, SPA and Ramsar.</p>	No	No	
559	Bishops Castle transfer	Transfer of potable water from the Strategic Grid WRZ to Bishops Castle WRZ, with the construction of a new pipeline and pumping station.	Downton Gorge SAC	1.8km	<p>Construction: Downton Gorge SAC is hydrologically linked to the River Clun, which is crossed by the pipeline at Clungunford, via the River Teme. The site is designated for H9180 <i>Tilio-Acerion</i> forests of slopes, screes and ravines. Via the watercourse, the site is c.4km. As such, assuming the employment of standard good practice construction methods and pollution prevention control measures, no LSEs are anticipated.</p> <p>The option will not require additional abstraction and therefore operational activities are not considered to have a significant impact upon the SAC.</p>	No	No	
			River Clun SAC	1.9km	<p>Construction: The River Clun SAC is downstream of the pipeline crossing at Clungford, and is designated for freshwater pearl mussel (<i>Margaritifera margaritifera</i>). Construction works may also have an impact upon the River Teme as a pipeline crossing is required at Bromfield. Construction works at both points could impact salmon movement to the River Clun SAC, and cause water quality deterioration. Salmon provide a key role in the life-cycle of the freshwater pearl mussel.</p> <p>Operation: The option will not require additional abstraction and therefore operational activities are not considered to have a significant impact upon the SAC.</p>	Yes	No	
562	Mardy Transfer	Transfer of potable water from Shelton WRZ to Mardy WRZ, through construction of a new pipeline and pumping station.	Meres and Mosses Ramsar Phase 2	6.5km	<p>Construction: The construction works are sufficiently distant from the designated sites (based on standard distance thresholds for noise, visual etc) that no LSEs are anticipated.</p> <p>Operation: The option will not require additional abstraction and therefore operational activities are not considered to have a significant impact upon the SACs/SPAs..</p>	No	No	
			Berwyn a Mynyddoedd De Clwyd / Berwyn and South Clwyd Mountains SAC	9.2km		No	No	
			Berwyn SPA	9.4km	No	No		
			River Dee and Bala Lake SAC	2.8km	There is no hydrological connectivity between the site and River Dee and Bala SAC. Therefore no LSEs are anticipated.	No	No	
564	West Midlands raw water storage - notional option	Notional option to convert an existing third-party owned quarry site to a pumped raw water storage reservoir.						

4.4 HRA STAGE 1 SCREENING CONCLUSIONS FOR ALTERNATIVE PROGRAMMES

In addition to the preferred plan, the following alternative programmes have been considered by Severn Trent:

- Ofwat Core Programme
- Environmental Stretch
- Climate Adjustment
- Demand difference

These comprise a mixture of the Preferred Plan options, as well as several additional options from the feasible list. However, the preferred plan and alternative programmes are the same for AMP8 and AMP9, and therefore no additional assessment has been completed for the options in later AMPs, as another WMRP cycle will be able to assess these. as follows:

4.5 HRA STAGE 1 SCREENING FOR DROUGHT OPTIONS

The WRMP24 feasible options list has included two drought options (Temporary Use Bans and Non-Essential Use Bans). The options were previously assessed in the Drought Plan (April 2022) and the HRA that supported the plan. No drought order or permits have been included in the feasible list. These drought options have been made available as part of the WRMP modelling, such that they are assumed to be available for selection after the current period of the Drought Plan if required. These options have not been selected as part of the preferred plan, therefore no further assessment has been completed. The potential for in-combination effects between the WRMP24 and Drought Plan are considered in **Section 17**.

4.6 SCREENING CONCLUSIONS

The screening has concluded that significant effects are either likely or uncertain for the following sites and options; these are therefore taken forward to an appropriate assessment stage.

- | | |
|--------------------------------------|---|
| ▪ Bredon Hill SAC | ▪ Cannock Chase SAC |
| ▪ Dixton Wood SAC | ▪ Fen Pools SAC |
| ▪ Humber Estuary SAC, SPA and Ramsar | ▪ Pasturefields Salt Marsh SAC |
| ▪ Peak District Dales SAC | ▪ Peak District Moors (South Pennine Moors Phase 1) SPA |
| ▪ River Clun SAC | ▪ River Dee and Bala Lake SAC |
| ▪ River Mease SAC | ▪ Rutland Water SPA and Ramsar |
| ▪ Severn Estuary SAC and Ramsar | ▪ South Pennine Moors SAC |

Table 4-5 Summary of supply-side options and sites requiring Stage 2 Appropriate Assessment

European site	Options	Alone or in-combination with other WRMP options?
Bredon Hill SAC	66: Strensham WTW Expansion partially supported by UU release from Vyrnwy (25MI/d)	Yes – alone (construction)
Cannock Chase SAC	44: New R Sow abstraction and WTW near Stafford	Yes – alone (construction)
Dixton Wood SAC	66: Strensham WTW Expansion partially supported by UU release from Vyrnwy (25MI/d)	Yes – alone (construction)
Fen Pool SAC	79B: Bham-Wolves Strategic Link Main (small)	Yes – alone (construction)
Humber Estuary SAC and Ramsar ³⁶	29: Homesford WTW capacity increase	In-combination with other water company WRMPs

³⁶ Functionally linked habitat for the SPA is considered sufficiently distant to construction works such that won't be affected. Features not considered to be highly sensitive to changes in abstractions given distance from impact and lack of functionally linked habitat.

European site	Options	Alone or in-combination with other WRMP options?
	64: Rehabilitation Milton GW source	In-combination with other water company WRMPs
	426: Little Eaton WTW DO Recovery	In-combination with other water company WRMPs
Pasturefields Salt Marsh SAC	44: New R Sow abstraction and WTW near Stafford	Yes – alone (construction)
Peak District Dales SAC	29: Homesford WTW capacity increase	Yes – alone and IC (construction and operation)
	95B: Ogston WTW Expansion	Yes – alone and IC (operation)
	128: Carsington to Tittesworth main (large)	Yes – alone and IC (construction)
	128Z: Carsington to Tittesworth main (small)	Yes – alone and IC (construction)
	187C: Expand Carsington Reservoir (25000 MI)	Uncertain – alone and IC (operation)
	305A: Heathy Lea to North Notts transfer (large)	Yes – alone and IC (construction)
	426: Little Eaton WTW DO Recovery	Yes – alone and IC (operation)
Peak District Moors (South Pennine Moors Phase 1) SPA	123B: Raise Dam at Tittesworth Reservoir (25%)	Yes – alone and IC (construction)
	128: Carsington to Tittesworth main (large)	Yes – alone and IC (construction)
	128Z: Carsington to Tittesworth main (small)	Yes – alone and IC (construction)
	305A: Heathy Lea to North Notts transfer (large)	Yes – alone and IC (construction)
River Clun SAC	33: Shelton WTW Expansion (large) partially supported by UU release from Vyrnwy (25MI/d)	Yes – alone and IC (construction and operation)
	66: Strensham WTW Expansion partially supported by UU release from Vyrnwy (25MI/d)	Yes – alone and IC (construction and operation)
	143: W.Midlands Raw Water Storage	Yes – alone and IC (construction and operation)
	429: Mythe WTW DO Recovery	Yes – alone and IC (operation)
River Dee and Bala Lake SAC	503: New GW source Middle Dee GWMU	Yes – alone (operation)
River Mease SAC	44: New R Sow abstraction and WTW near Stafford	Yes – alone and IC (operation)
	64: Rehabilitation Milton GW source	Yes – alone and IC (operation)
	556: ASL Capacity Increase - Hallgates to Oldbury	Yes – alone and IC (operation)
Rutland Water SPA and Ramsar	190: Eyebrook Reservoir and new WTW's	Yes – alone (construction)
Severn Estuary/Môr Hafren SAC and Ramsar ³⁷	33: Shelton WTW Expansion (large) partially supported by UU release from Vyrnwy (25MI/d)	Yes – alone and IC (construction and operation)
	66: Strensham WTW Expansion partially supported by UU release from Vyrnwy (25MI/d)	Yes – alone and IC (construction and operation)
	143: W.Midlands Raw Water Storage	Yes – alone and IC (construction and operation)
	429: Mythe WTW DO Recovery	Yes – alone and IC (operation)
South Pennine Moors SAC	305A: Heathy Lea to North Notts transfer (large)	Yes – alone (construction)

*IC – 'In combination'

³⁷ Functionally linked habitat for the SPA is considered sufficiently distant to construction works such that won't be affected. Features not considered to be highly sensitive to changes in abstractions given distance from impact and lack of functionally linked habitat.

5. STAGE 2 APPROPRIATE ASSESSMENT: PEAK DISTRICT DALES SAC

5.1 INTRODUCTION

The following preferred plan options have been screened in as potentially impacting the Peak District Dales SAC:

- 29 Homesford WTW capacity increase: **construction and operation**
- 95B Ogston WTW Expansion: **operation only**
- 123B Raise Dam at Tittesworth Reservoir (25%): **operation only**
- 128 Carsington to Tittesworth main (large): **construction only**
- 128Z Carsington to Tittesworth main (small): **construction only**
- 187C Expand Carsington (25,000MI): **operation (uncertain)**
- 305A Heathy Lea to North Notts transfer (large): **construction only**
- 426 Little Eaton WTW DO Recovery: **operation only**

Theoretical pathways for effects exist through:

- potential construction-related impacts on off-site supporting habitat that will rely on project-level mitigation (and so cannot be 'screened out');
- reduced freshwater input to the wider river catchment, therefore causing potential deterioration of off-site supporting habitat, reduction in accessibility and reduction in prey.

The Peak District Dales SAC is designated for the following features, however on the basis of the above pathways, only those qualifying features in bold have been taken through to the appropriate assessment:

- H4030 European dry heaths
- H6130 Calaminarian grasslands of the *Violetalia calaminariae*
- H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco-Brometalia*), (note that this includes the priority feature "important orchid rich sites")
- H7230 Alkaline fens
- H8120 Calcareous screes of the montane to alpine levels
- H8210 Calcareous rocky slopes with chasmophytic vegetation
- H9180 Tilio-Acerion forests of slopes, screes and ravines
- **S1092 Freshwater crayfish, *Austropotamobius pallipes***
- **S1096 Brook lamprey, *Lampetra planeri***
- **S1163 Bullhead, *Cottus gobio***

5.2 SITE SUMMARY

5.2.1 Site description

The Carboniferous Limestone massif of the Peak District is one of the most important in Britain, lying in latitude and altitude between the Mendips and the Craven area of Yorkshire. The limestone is cut by valleys, the 'dales', which contain a wide range of wildlife habitats, particularly woodland, scrub and grassland. Taken together the ravine woods of the ravines and slopes of the Dales comprise the largest area of this habitat in Great Britain. There is also a great physical diversity due to rock outcrops, cliffs, screes and a variety of slope gradients and aspects. This mosaic of habitats and the transitions between them are of exceptional interest for a wide range of characteristic, rare and uncommon flora and fauna.

The SAC encompasses 13 Sites of Special scientific Interest and is encapsulated within the White Peak National Character Area (NCA). It also lies mostly (but not entirely) within the Peak District National

Park. The SAC is visited and accessed by many thousands of visitors and locals for its spectacular scenery and wildlife, with famous iconic sites such as Dovedale, Lathkill Dale and Monsal Dale³⁸.

5.2.2 Qualifying features screened into Stage 2 Appropriate Assessment: baseline

5.2.2.1 S1092 White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*

The white-clawed crayfish (WCC) is the only native species of freshwater crayfish in Britain, and is the largest freshwater crustacean³⁹. WCC populations in the UK are fragmented and have rapidly declined since the 1970s. Specific areas with WCC cited as the primary reason for SAC site selection occurring mainly in the north and west of England⁴⁰. Populations are known within South Wales, Suffolk, East Midlands, Dorset, Somerset, Gloucestershire, Exmoor and the North York Moors⁴¹.

WCC can live for more than 10 years⁴². Breeding occurs in the autumn and early winter when the water temperature drops below 10°C for an extended period. The breeding time may vary with latitude and altitude. Females over winter with a clutch of eggs. Hatched eggs release from the female and become independent in June (south of England) and August (north of England). Migration into deeper water may occur in the winter. WCC have been known to burrow into riverbanks, particularly in the winter months⁹⁸. WCC occur in areas with hard, mineral-rich waters on calcareous and rapidly weathering rocks. It is found in both still and running water and is typically associated with watercourses of 0.75 m to 1.25 m, but has also been found in shallow streams (as low as 5 cm), and in deeper slow-flowing rivers (2.5 m). Water chemistry figures suitable for white-clawed crayfish include calcium at 5 mg/l, and pH between 6.5-9.0⁹⁸.

Barriers to crayfish movement can include major weirs, dams or waterfalls; a length of highly modified channel lacking suitable refuges; fast-flowing flume or culvert; dried-up section of a channel; or poor water quality within a reach. It is worth noting that barriers for white-clawed crayfish may not necessarily be barriers for signal crayfish *Pacifastacus leniusculus* as this species can walk over land and are less vulnerable to desiccation⁹⁵.

5.2.2.2 S1096 Brook lamprey *Lampetra planeri*

The brook lamprey is a primitive, jawless fish resembling an eel, and is the smallest of the lampreys found in the UK. It is a non-migratory freshwater species, occurring in streams and occasionally in lakes in north-west Europe. Like other lamprey species, the brook lamprey requires clean gravel beds for spawning and soft marginal silt or sand for the ammocoete larvae. It spawns mostly in parts of the river where the current is not too strong. The species has been recorded within the River Derwent.

5.2.2.3 S1163 Bullhead *Cottus gobio*

The bullhead is the only freshwater cottid species found in the UK, and is adapted to benthic habitats. This species predominantly occurs in stony streams and rivers where the flow is moderate, water is cool, and oxygen-rich. The bullhead spawn from February to June, and are territorial and tied to their nest. Shade and cover are important for this species which actively hides from light. The bulk of their diet is benthic invertebrates, particularly crustaceans. Their habitat requirements are variable depending on the life stage. Coarse substrates are essential for breeding, with shallow stony riffles used by young fish. Sheltered areas with woody debris and leaf litter are preferred by adult fish. The upper pH tolerance levels of 9.0 and lower limit of oxygen concentration of 40% is associated with

³⁸ Natural England (2019) European Site Conservation Objectives: Supplementary advice on conserving and resorting site features. Peak District Special Area of Conservation (SAC) Site Code: UK0019859.

³⁹ Peay, S. (2002). *Guidance on Habitat for White-clawed Crayfish and its Restoration*. English Nature and the Environment Agency.

⁴⁰ JNCC. (2022). *1092 White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes** [White-clawed \(or Atlantic stream\) crayfish \(*Austropotamobius pallipes*\) - Special Areas of Conservation \(jncc.gov.uk\)](#) Accessed in August 2022.

⁴¹ Buglife. (2015). *Crayfish Identification, Distribution and Legislation*. Environment Agency.

⁴² Holdich, D. (2003). *Ecology of the White-clawed Crayfish*. Conserving Natura 2000 Rivers. Ecology Series No. 1. English Nature.

bullhead. Water depth is not critical to this species, but high temperatures and/or low dissolved oxygen are likely to be fatal in shallow waters⁴³. The species has been recorded within the River Derwent.

5.2.3 Condition, threats, and pressures

The Peak District SAC is legally underpinned by 13 SSSIs;

- Ballidon Dales SSSI (NGR: SK 205555)- There are two Units present within the site, last assessed in 2009 as favourable calcareous grassland lowland.
- Coombs Dale SSSI (NGR: SK 224744) – There are nine active units present within the SSSI encompassing a range of habitats including calcareous grassland lowland, acid grassland lowland (favourable), broadleaved, mixed and yew woodland upland – last assessed between 2011 to 2021 as 18.92% favourable, 44.28% unfavourable recovering, 18.93% unfavourable no change and 17.88% unfavourable declining. Both agriculture and overgrazing have been highlighted as reasons for adverse conditions.
- Cressbrook Dale SSSI (NGR: SK 173738) –There are two active units present within the SSSI encompassing a range of habitats including calcareous grassland- lowland, acid grassland-lowland and broadleaved mixed and yew woodland- upland- last assessed between 2006 to 2011 as 66.61% favourable and 33.39% unfavourable- recovering.
- Dove Valley and Biggin Dale SSSI (NGR: SK 157506, SK 147595) –There are 43 active units within the site encompassing a range of habitats including; calcareous grassland- lowland, broadleaved mixed and yew woodland- upland and neutral grassland- lowland last assessed between 2006 to 2014 as 72.94% as favourable, 23.35% unfavourable- recovering and 0.38% unfavourable- declining with agriculture and under grazing identified as reasons for adverse conditions within Unit 019 (calcareous grassland- lowland).
- Hamps and Manifold Valleys SSSI (NGR: SK 100540)- There are 90 active units within the site encompassing a range of habitats including earth heritage, broadleaved mixed and yew woodland- upland and calcareous grassland- lowland, last assessed between 2006 to 2014 as 68.86% as favourable, 25.70% unfavourable- recovering, 3.76% unfavourable- no change and 1.68% unfavourable- declining with inappropriate scrub control, lack of corrective works, agriculture and under grazing identified as reasons for adverse conditions within the site.
- Lathkill Dale SSSI (NGR: SK 187658) –The are 22 live units within the site encompassing a range of habitats including rivers and streams, broadleaved mixed and yew woodland- upland, calcareous grassland- lowland, earth heritage and acid grassland- lowland last assessed between 2008 to 2021 as 68.18% favourable, 4.32% unfavourable- recovering, 17.94% unfavourable- no change and 9.56% unfavourable- declining with inappropriate water levels, game management, disease, water abstraction, inappropriate weirs, dams and others and forestry and woodland management identified as reasons for adverse conditions within the site.
- Long Dale & Gratton Dale SSSI (NGR: SK 202596) – There are six live units within the site and include two main habitats; acid grassland- lowland and calcareous grassland- lowland last assessed between 2009 to 2021 as 57.95% favourable and 42.05% unfavourable- recovering with scrub clearance identified as reasons for adverse conditions within the site.
- Matlock Woods SSSI (NGR: SK 296593, SK 296580)- There are three live units within the site, all of which are broadleaved mixed and yew woodland- upland last assessed in 2011 as unfavourable- recovering.
- Monk's Dale SSSI (NGR: SK 135745)- There are 22 live units within the site including calcareous grassland- lowland, broadleaved mixed and yew woodland- upland and acid grassland- lowland last assessed between 2006 to 2021 as 47.96% favourable and 52.04% unfavourable recovering.
- The Wye Valley SSSI (NGR: SK 154722) – The are 71 live units present within the site including calcareous grassland- lowland, broadleaved mixed and yew woodland- upland and neutral

⁴³ Tomlinson, M. L., & Perrow, M. R. (2003). *Ecology of the Bullhead*. Conserving Natura 2000 Rivers Ecology Series No. 4 English Nature, Peterborough.

grassland- lowland last assessed between 2006 and 2019 as 60.07% favourable, 37.34% unfavourable – recovering, 2.27% unfavourable – no change and 0.32% unfavourable – declining with under grazing and inappropriate scrub control identified as reasons for adverse conditions within the site.

- Topley Pike & Deep Dale SSSI (NGR: SO 099717) – There are 12 live units within the site all of which are designated as calcareous grassland- lowland which have been assessed between 2005 and 2020 as 64.97% favourable, 15.61% unfavourable recovering and 19.43% unfavourable- no change with overgrazing identified as reasons for adverse conditions within the site.
- Via Gellia Woodlands SSSI (NGR: SK 245574 to SK 292570)- There are 36 live units within the site which range between calcareous grassland- lowland, broadleaved mixed yew woodland-upland and neutral grassland- lowland which have been assessed between 2005 and 2013 as 55.45% favourable, 39.49% unfavourable- recovering, 2.59% unfavourable- no change and 2.47% unfavourable- declining with undergrazing, inappropriate scrub control and overgrazing identified as reasons for adverse conditions within the site.

The following are pressures / threats with the outlined measures required to improve the condition of the feature which are listed within the Peak District SAC Site Improvement Plan and specifically associated with white-clawed crayfish, bullhead and brook lamprey:

- Fertiliser use– Reduce nutrient input to the SAC from agricultural sources
- Water Pollution- Reduce phosphate inputs from Sewage Treatment Works
- Inappropriate weirs dams and other structures- Develop and implement the River Restoration Strategy
- Inappropriate water levels- implementation of hydrological restoration solutions
- Disease- Crayfish investigation / research / monitoring
- Invasive species- Signal crayfish investigation / research / monitoring
- Air pollution- Control, reduce and ameliorate atmospheric nitrogen impacts

5.3 ASSESSMENT OF EFFECTS

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 5-1**.

Crayfish are considered keystone species, and the white-clawed crayfish is Britain's only native species⁴⁴. Since the early 1980s, many populations have been eradicated through crayfish plague, with most now concentrated in northern and central England (particularly Cumbria, and parts of the Midlands). Distribution is largely dependent on geology and water quality (alkaline, calcium-rich, clean, well-oxygenated), with individuals typically found in river depths of 0.75 m to 1.25 m, however, they may also occur in very shallow streams (<0.05 m) and deep, slow-flowing rivers (2.5 m). Populations exist in both still and flowing water, and across a range of substrates (although hard substrates are preferred) with individuals capable of surviving in strong flow, provided suitable refuge is available (e.g., weirs, boulders, water-saturated logs, tree roots, holes in banks, beds of aquatic vegetation). While they can occur in shallow water (less than a few centimetres), natural drought or over-abstraction can be devastating, owing to the increased vulnerability to predation (from fish, mammals and birds). Similarly, land-use change draining of lakes or ponds, and lowering or widening of streams and riverbeds can increase siltation and reduce flow, creating unsuitable conditions for crayfish.

The sensitivity of brook lamprey to flow is life-stage dependent. Brook lamprey ammocoete larvae, occur in suitable silt beds, mainly in running water. The deposition of mud, sand and silt in which larval nursery beds are typically found at the edges of streams and rivers (~0.1 m – 0.5 m depth⁴⁵), are very

⁴⁴ Holdich D (2003). Ecology of the White-clawed Crayfish. Conserving Natura 2000 Rivers Ecology Series No. 1. English Nature, Peterborough.

⁴⁵ Entec (2000). Generically acceptable flows for British lamprey. Environment Agency, Penrith.

slow (records: 0.07 m s⁻¹ to 0.4 m s⁻¹^{46,47}), and are often within backwaters (i.e., in reverse to the main channel velocity). Metamorphosed adults emerge from the silts (late March to early May), and move a considerable distance (up to 2 km⁴⁸) upstream into suitable spawning grounds, however, complete life-cycle requirements of the species are often found in quite short stretches of river⁴⁹. These areas are composed of stones and gravel within shallow, flowing, clear water. Increasing temperature and decreasing stream discharge are the most important factors associated with the brook lamprey spawning migration. Current velocities recorded at spawning sites vary within the literature and range from 1.0 m s⁻¹ – 4.0 m s⁻¹⁵⁰(note: assumed to be surface velocities), to a more probable 0.3 m s⁻¹ – 0.5 m s⁻¹⁵¹, while depth is less than 0.4 m. During breeding season (March – June, when water temperatures reach 10 – 11 °C), individuals begin communal nest building activities. Females produce approximately 1500 eggs, and after larvae hatch, they leave the nest and drift downstream before burrowing into silty sand.

The bullhead is the sole freshwater cotid found in the UK. Bullhead spawning takes place between February and June, typically once in upland streams⁵². Upland streams typically support lower densities of bullhead. Habitat requirements differ according to life-stage. Coarse substrates with large stones are essential for breeding⁵³ (alternative media may also be used, e.g., woody debris), under which males excavate a suitable nest, and females deposit adhesive eggs to the underside. Bullheads exhibit parental care, using the nest as a protected environment, and are reliant on slow current conditions within the nest to aid external fertilisation of eggs⁵⁴. Shallow, stony riffles are used by young-of-the-year fish⁵⁵, whereas adults show preference for sheltered regions⁵⁶. A minimal acceptable flow is likely to exist for bullheads to ensure the preferred hard stony substrate, critical to their reproductive cycle, is not covered by fine sediment deposits, with individuals rarely found in water of velocities less than 0.1 m s⁻¹⁵⁷ and many preferring velocities greater than 0.6 m s⁻¹⁵⁸. Subsequently, siltation is a major threat to bullhead populations. All age classes seek slack-water refuge under high flow conditions owing to their weak swimming capabilities. Although assumed to be a sedentary species, bullhead movement occurs over early summer in both the upstream and downstream directions, reflecting the wide distribution of the species within headwaters throughout Europe. While the exact range over which individuals traverse is unknown, it is known to be negatively density dependent, with larger distances favoured at lower densities⁵⁹.

⁴⁶ Hjulstrom F (1935). Studies in the morphological activity of rivers as illustrated by the River Fyris. Geological Institute of the University of Uppsala Bulletin 25, 221–528.

⁴⁷ Schroll F (1959). Zur Ernährungsbiologie der steirischen Ammocoten *Lampetra planeri* (Bloch) und *Eudontomyzon danfordi* (Regan). Int. Rev. ges. Hydrobiol. Hydrogr. 44, 395–429.

⁴⁸ Malmqvist B (1980). The spawning migration of the brook lamprey *Lampetra planeri* Bloch in a south Swedish stream. J Fish Biol. 16, 105-114.

⁴⁹ Maitland PS (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

⁵⁰ Lohnisky K (1966). The spawning behaviour of the brook lamprey, *Lampetra planeri* (Bloch, 1784). Vest. Cesk. Spol. Zool. 30, 289–307.

⁵¹ Hardisty MW & Potter IC (eds) (1971). The biology of lampreys. Academic Press, London.

⁵² Fox PJ (1978a). Preliminary observations on different reproductive strategies in the bullhead (*Cottus gobio* L.) in northern and southern England. Journal of Fish Biology 12, 5–11.

⁵³ Crisp DT (1963). A preliminary survey of brown trout (*Salmo trutta* L) and bullheads (*Cottus gobio* L) in high-altitude becks. Salmon and Trout Magazine 167, 45–59.

⁵⁴ Tomlinson ML & Perrow MR (2003). Ecology of the Bullhead. Conserving Natura 2000 Rivers Ecology Series No. 4. English Nature, Peterborough.

⁵⁵ Punchedard NT, Perrow MR & Jowitt AJD (2000). Fish habitat associations, community structure, density and biomass in natural and channelized lowland streams in the catchment of the River Wensum, UK. In: Cowx IG (ed). Management and Ecology of River Fisheries. Blackwell Science, Oxford, 143–157.

⁵⁶ Perrow MR, Punchedard NT & Jowitt AJD (1997). The habitat requirements of bullhead (*Cottus gobio*), and brown trout (*Salmo trutta*) in the headwaters of selected Norfolk rivers: implications for conservation and fisheries. Report to the Environment Agency, Eastern Area, Anglian Region, Ipswich. 61 pp.

⁵⁷ Gubbels REMB (1997). Preferred hiding places of the bullhead (*Cottus gobio* L., 1758) in the Zieversbeek brook. Natuurhistorisch Maandblad 86, 201–206.

⁵⁸ Rousset JM & Bardonnet A (1996). Differences in habitat use by day and night for brown trout (*Salmo trutta*) and sculpin (*Cottus gobio*) in a natural brook: multivariate and multi-scale analyses. Cybium 20, 45–53.

⁵⁹ Neuenschwander S, Largiadèr CR, Ray, N, Currat, M, Vonlanthen, P, Excoffier L (2008). Colonization history of the Swiss Rhine basin by the bullhead (*Cottus gobio*): inference under a Bayesian spatially explicit framework. Molecular Ecology. 17. 757-772.

5.4 UNCERTAINTIES

There is limited understanding of the distribution of the qualifying features within the wider River Derwent catchment, passability of existing weirs, and therefore extent of offsite functionally linked habitat. Baseline surveys of the affected reaches (habitat and barriers) should be undertaken to support the project-level HRAs.

There is uncertainty as to the operation of Option 95 and the interaction between the transfers between the Ambergate intake, Carsington Reservoir, Ogston Reservoir and Ogston WTW are complex and it is not clear by how much the abstraction from the Ambergate intake would increase by (noting any increase would be within the existing license). For the purpose of this hydrological assessment, the assumption has been made that the entire increase in output at Ogston WTW is achieved through increased abstraction from the River Derwent at the Ambergate intake which is precautionary as other sources have been ignored. As such, an increased abstraction of 51Ml/d from the River Derwent at Ambergate is used for this assessment.

A hydrological model of the River Derwent watercourse is not available within which to model the impacts of the changes/additional abstractions and confirm likely changes to flows at a variety of points on the hydrograph. The assessment completed to date has indicated that few of the options would cause significant changes in the hydrological regime of the impacted reaches, however this will need to be verified for the project-level HRA.

Table 5-1 Information to inform an assessment of adverse effects on Peak District Dales SAC: brook lamprey, bullhead and white-clawed crayfish

Attribute	Target	Potential Effect	Mitigation	Effect on site integrity?
CONSTRUCTION PHASE				
Supporting habitat: structure/function): Supporting off-site habitat	Maintain the quality of any supporting habitat present beyond the site boundary upon which the [qualifying feature] population of the site depend	<p><i>Option 29</i></p> <p>The construction of Option 29 will involve upgrades within the existing site boundaries of Homesford WTW, located at the nearest 3.7km east of the Peak District Dales SAC. The WTW borders the River Derwent and is approximately 4.5km downstream of the Peak District Dales SAC. This section of the SAC is terrestrial-focussed and underpinned by Matlock Woods SSSI. There are potential off-site supporting habitat pollution impacts due to the proposed works within Homesford WTW which borders the River Derwent.</p> <p>Due to the WTW being downstream of the SAC, it is unlikely that pollution incidents will impact the designation.</p> <p>There is one barrier to fish (or white-clawed crayfish) movements on the River Derwent between the nearest SAC boundary and the existing WTW boundary; Cromford Weir. The weir is present approximately 4.7km downstream of the WTW (SK295574) and separates any white-clawed crayfish populations up and downstream of the weir from each other. The weir also prevents movement of lamprey and bullhead, and it is therefore unlikely that the brook lamprey and bullhead associated with the Peak District Dales SAC is associated with off-site supporting habitat within the River Derwent section of the Option 29, due to a small area of the River Derwent (200m) upstream of the weir and adjacent to the SAC.</p> <p>Construction activities have the potential to cause or facilitate the spread of invasive non-native species. Invasive plant species can colonise new areas of land from seeds contained in the parent plant or the soil, or from fragments of living root or stem. Such reproductive materials can be inadvertently transferred to enabling works areas from outside of the scheme boundary if they adhere to vehicles, machinery, tools or clothing. They can also be inadvertently transferred in waste. Although there are no works proposed within the SAC boundary, seeds and plant fragments could be transported through the wider River Derwent catchment and potential off-site supporting habitats.</p> <p>Once present, invasive species can spread rapidly and out-compete the native vegetation that characterises the notable non-designated habitat. Habitat loss and fragmentation can also encourage the colonisation of invasive species by providing a pathway of suitable environmental conditions for invasive species to move closer to areas currently free from these species, this could affect the conservation status of the qualifying habitat.</p> <p>Standard best practice mitigation measures are considered to be available to prevent the introduction of aquatic or riparian invasive species to the SAC or supporting habitats.</p> <p>Taking into account the proposed mitigation no adverse effects on site integrity are anticipated due to invasive species or pollution incidents.</p>	<ul style="list-style-type: none"> ▪ A suitably qualified and experienced Environment Clerk of Work (EnvCoW) would be appointed by the Contractor to oversee the implementation of mitigation and monitoring of the water environment. ▪ Adhere to relevant Environment Agency Pollution Prevention Guidance Notes for works in proximity to water. ▪ Where any INNS are identified as a risk of being introduced, spread within, or moved off site, ensure mitigation measures are considered at the early planning stage, and ensure enough time is given to implement them. ▪ Consider phasing construction to allow time to deal with the presence and/or risk of spread of INNS. ▪ Ensure INNS and locations (mapped) are incorporated within all relevant site method statements, including the site Ecological Protection Plan and Species Protection Plans, where appropriate. 	No adverse effects on conservation objectives or site integrity
		<p><i>Option 128 and 128Z</i></p> <p>Construction of Option 128 will involve the installation of a new pipeline between Carsington Reservoir and Tittesworth Reservoir which crosses the River Dove. The River Dove is part of the Peak District Dales SAC and the proposed crossing is approximately 4.8km downstream of the designation.</p> <p>Due to the proposed pipeline crossing being downstream of the SAC, it is unlikely that pollution incidents will impact the designation.</p> <p>There is potential off-site supporting habitat loss due to the pipeline crossing on the River Dove which may be located at suitable habitat for white-clawed crayfish, brook lamprey and bullhead. It is assumed that large watercourses will be crossed using a trenchless technology, thereby minimising impacts.</p> <p>There are five barriers (four unnamed and Okeover Hall weir) to fish and WCC movement between the pipeline crossing and the nearest boundary of the Peak District Dales SAC. The presence of weirs will limit WCC movement upstream from the SAC towards the pipeline crossing, and is likely to separate the populations up and downstream of the weirs. Similarly the presence of weirs will limit the ability of lamprey⁶⁰, and bullhead⁶¹ to move into habitats upstream from the SAC towards the pipeline crossing. Literature for bullhead also suggests that the bottom-dwelling habit, 'nesting'/burrowing and territorial behaviours, and poor swimming ability limits the distances over which the species will range, and therefore confines the population extent. It is therefore unlikely the location of the pipeline crossing is within supporting habitat of WCC, brook lamprey or bullhead populations associated with the Peak District Dales SAC.</p>	<ul style="list-style-type: none"> ▪ Pipeline sections crossing the River Dove to utilise trenchless technology. ▪ Develop a precautionary working methodology (PWM) with regards to white-clawed crayfish which minimises the footprint of the proposed works within habitats which are suitable for the species. ▪ A suitably qualified and experienced Environment Clerk of Work (EnvCoW) would be appointed by the Contractor to oversee the implementation of mitigation and monitoring of the water environment. ▪ Adhere to relevant Environment Agency Pollution Prevention Guidance Notes for works in proximity to water. 	
		<p><i>Option 305A</i></p> <p>Construction of Option 305A will involve the installation of a new pipeline from Derwent Valley Aqueduct (DVA) to Sunnyside Distribution Reservoir (DSR). This route crosses several watercourses which discharge into the River Derwent, which could provide functionally linked habitat for white-clawed crayfish qualifying species of the Peak District Dales SAC.</p> <p>There is potential off-site supporting habitat loss due to the pipeline crossings which may be located at suitable habitat for white-clawed crayfish. It is assumed that large watercourses will be crossed using a trenchless technology, thereby minimising impacts.</p> <p>The nearest pipeline crossing is approximately 5.6km upstream of the confluence with the River Derwent. There are several weirs present within the River Derwent and other smaller watercourses between the pipeline crossings and the area of the River Derwent which is</p>	<ul style="list-style-type: none"> ▪ Avoidance of suitable habitat to support white-clawed crayfish within the footprint of the works. ▪ Pipeline sections crossing the River Dove to utilise trenchless technology. ▪ Develop a precautionary working methodology (PWM) with regards to white-clawed crayfish which minimises the footprint of the proposed works within habitats which are suitable for the species. 	

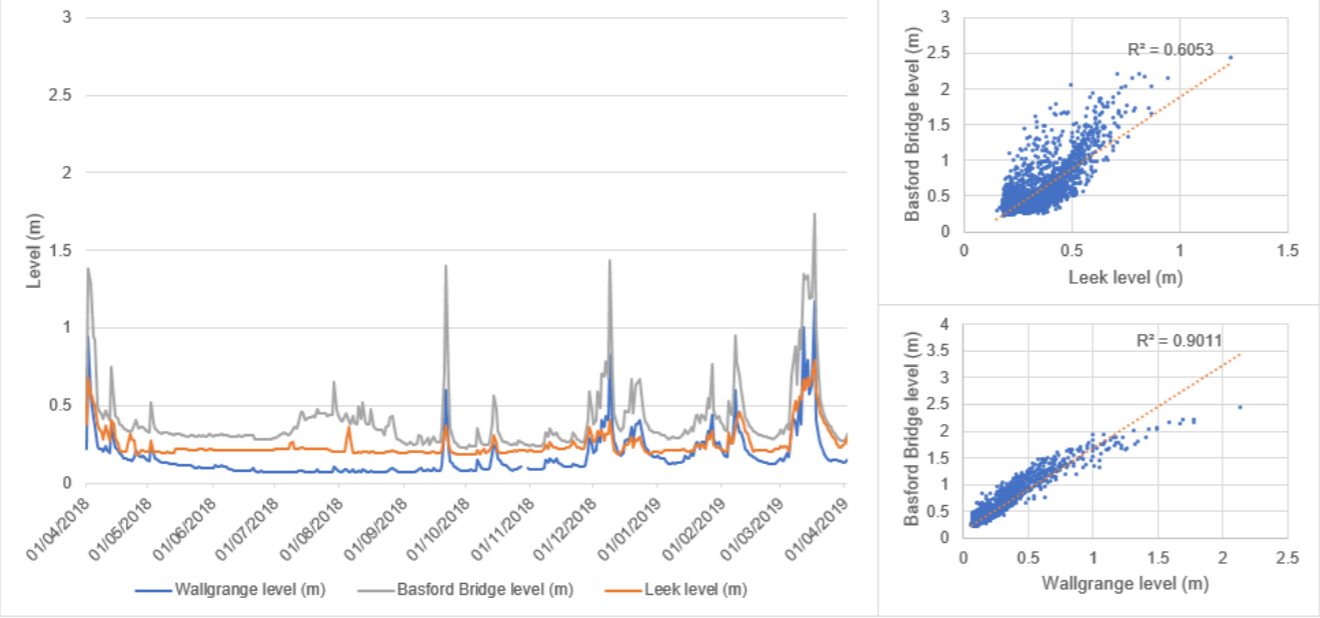
⁶⁰ Maitland PS (2003) *Ecology of the River, Brook and Sea Lamprey*. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough,

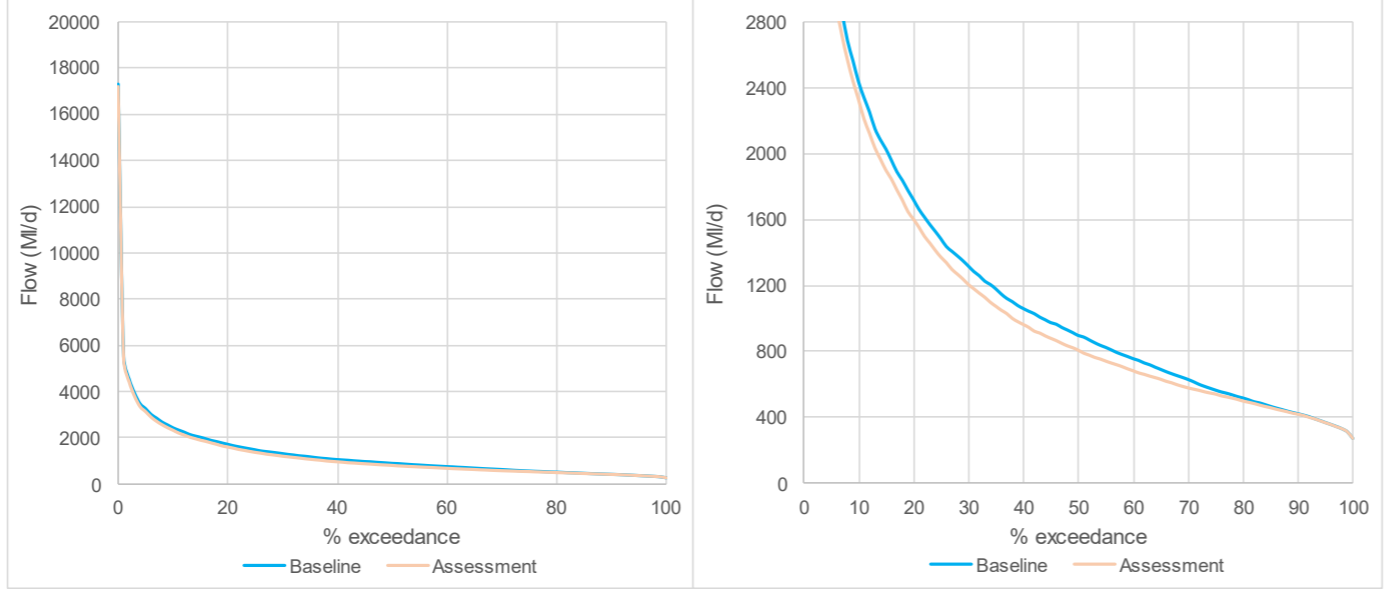
⁶¹ Tomlinson ML & Perrow MR (2003). *Ecology of the Bullhead*. Conserving Natura 2000 Rivers Ecology Series No. 4. English Nature, Peterborough.

Attribute	Target	Potential Effect	Mitigation	Effect on site integrity?
		<p>associated with the Peak District Dales SAC. The presence of weirs will limit the ability of lamprey⁶², and bullhead⁶³ to move upstream from the SAC towards the pipeline crossings. It is therefore unlikely that the WCC, brook lamprey and bullhead populations associated with the SAC is found within suitable supporting habitats of watercourse crossings.</p> <p>The qualifying feature may be exposed to site-derived pollutants (principally oils and other contaminants) and sediment entering the River Derwent, hence affecting potential off-site supporting habitats. An increase in fine sediments has potential to negatively affect the habitat suitability for white-clawed crayfish. The aquatic communities within the River Derwent are highly sensitive to sedimentation and are typically associated with habitats dominated by fast flows and coarse sediments. Additional fine sediments could settle on macrophyte beds and coarse substrates downstream of the WTW, changing habitat suitability or smothering the plants, which could result in a reduction in the availability of suitable refuge areas for white-clawed crayfish.</p> <p>Construction activities have the potential to cause or facilitate the spread of invasive non-native species. Invasive plant species can colonise new areas of land from seeds contained in the parent plant or the soil, or from fragments of living root or stem. Such reproductive materials can be inadvertently transferred to enabling works areas from outside of the scheme boundary if they adhere to vehicles, machinery, tools or clothing. They can also be inadvertently transferred in waste. Although there are no works proposed within the SAC boundary, seeds and plant fragments could be transported through the wider River Derwent catchment and potential off-site supporting habitats.</p> <p>Once present, invasive species can spread rapidly and out-compete the native vegetation that characterises the notable non-designated habitat. Habitat loss and fragmentation can also encourage the colonisation of invasive species by providing a pathway of suitable environmental conditions for invasive species to move closer to areas currently free from these species, this could affect the conservation status of the qualifying habitat.</p> <p>Standard best practice mitigation measures are considered to be available to prevent the introduction of aquatic or riparian invasive species to the SAC or supporting habitats.</p>	<ul style="list-style-type: none"> A suitably qualified and experienced Environment Clerk of Work (EnvCoW) would be appointed by the Contractor to oversee the implementation of mitigation and monitoring of the water environment. Adhere to relevant Environment Agency Pollution Prevention Guidance Notes for works in proximity to water. 	
Supporting habitat: structure/function): Supporting off-site habitat	Maintain the quality of any supporting habitat present beyond the site boundary upon which the [qualifying feature] population of the site depend	<p><i>In-combination: Options 29, 123B, 128, 128Z and 305A</i></p> <p>Options 128 and 305A are required for 2030/3, and 123B and 128Z by 2049-50, and therefore there is potential for multiple sources of site-derived pollutants to enter the watercourse. Options 128 and 305 are pipeline crossings, and should be installed using a trenchless technique thereby minimising direct impacts to the watercourses. All options increase the potential for spread of INNS within the catchment.</p> <p>The extent over which the impacts can occur simultaneously is therefore considered to be greater with all options being constructed at the same time, however implementation of best practice construction techniques and standard mitigation measures as previously detailed for the options alone is considered to be sufficient to avoid an adverse effect.</p>	<ul style="list-style-type: none"> Implementation of mitigation measures as identified for options individually. Coordination of construction programmes and sharing of best practice techniques to minimise impacts. 	No adverse effects to conservation objectives or site integrity
OPERATION PHASE				
Supporting habitat: structure/function): Supporting off-site habitat	Maintain the quality of any supporting habitat present beyond the site boundary upon which the [qualifying feature] population of the site depend	<p><i>Option 29</i></p> <p>Homesford Water Treatment Works (WTW) in Derbyshire receives raw water from the nearby Meerbrook Sough which is an overflow from an old mine drainage system that drains the surrounding limestone hills. Water that is not taken for abstraction overflows to the River Derwent adjacent to the site. The water treatment works capacity is currently limited to 45MI/d and it deploys water into the DVA and customers in the adjacent Control Group. The site is licenced to abstract 55MI/d average and 65MI/d peak, with a condition that abstraction is restricted to 45MI/d when the Derwent flows at Derby are less than 340MI/d. This scheme would increase the capacity of Homesford WRW to 54MI/d, enabling 9MI/d more of the inflow from Meerbrook Sough to the River Derwent to be captured.</p> <p>The 28117 - Derwent at Whatstandwell flow gauge, located 1.5km downstream of the Meerbrook Sough confluence, indicates that the Q95 flows are 384MI/d. If an additional 9MI/d was to be captured from the Meerbrook Sough then this would lead to a reduction of flow by ~2%. It is worth noting that, at Q95 conditions, it is likely that all of the water from Meerbrook Sough is already collected so, in reality, only moderate/high flows would be reduced. This hydrological change is negligible and would not introduce any pathways to impacting the aquatic environment in the River Derwent.</p> <p><i>Option 95B</i></p> <p>Ogston Water Treatment Works (WTW) is located adjacent to the impounding reservoir which supplies raw water for the works. Ogston Reservoir is filled from River Derwent via a pumped intake at Ambergate with river flows being supported by releases from Upper Derwent Reservoirs and Carsington Reservoir. The current capacity of Ogsten WTW is ~69MI/d which would be increased to 120MI/d. The interaction between the transfers between the Ambergate intake, Carsington Reservoir, Ogston Reservoir and Ogston WTW are complex and it is not clear by how much the abstraction from the Ambergate intake would increase by (noting any increase would be within the existing license). For the purpose of this hydrological assessment, the assumption has been made that the entire increase in output at Ogston WTW is achieved through increased abstraction from the River Derwent at the Ambergate intake which is precautionary as other sources have been ignored. As such, an increased abstraction of 51MI/d from the River Derwent is used for this assessment</p>	<p>None required</p> <p>None required.</p>	<p>No adverse effects on conservation objectives or site integrity</p> <p>No adverse effects on conservation objectives or site integrity</p>

⁶² Maitland PS (2003) *Ecology of the River, Brook and Sea Lamprey*. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough,

⁶³ Tomlinson ML & Perrow MR (2003). *Ecology of the Bullhead*. Conserving Natura 2000 Rivers Ecology Series No. 4. English Nature, Peterborough.

Attribute	Target	Potential Effect	Mitigation	Effect on site integrity?
		<p>Abstraction from the River Derwent at Ambergate is restricted when flows at St. Mary's Bridge, Derby are below 680l/d which would limit abstraction under Q95 conditions. The 28117 – Derwent at Whatstandwell flow gauge, located 500m downstream of Ambergate intake, indicates that the Q70 flows are 629MI/d. If an additional 51MI/d was to be captured from the Ambergate intake then this would lead to a reduction in Q70 flows by ~8%. This hydrological change is not expected to introduce any pathways to impacting the aquatic environment in the River Derwent, particularly as these reductions only impact moderate-low flow conditions which are of limited importance. Due to the complexity of the operation of this option, this assessment is low confidence and likely precautionary.</p>		
		<p>Option 123B</p> <p>There is the potential for the raising of Tittesworth Reservoir by 25% to result in a change in the flow regime of the River Churnet in the following ways:</p> <ul style="list-style-type: none"> • Decrease the magnitude, frequency and/or timing of overtopping events from the reservoir. • Increase the duration of time that the flows from the reservoir are at the compensation flow value. <p>There would be no change in low flows in the River Churnet as a result of the raising of the dam due to the compensation flow requirement of 14.8 MI/d from Tittesworth Reservoir and Soloman's Hollow (~500m downstream of the Tittesworth Reservoir outfall). This compensation flow requirement would not change as a result of the scheme.</p> <p>It is difficult to characterise the changes to the flow regime in the River Churnet compared to the reference scenario without undertaking a modelling exercise to compare a reference flow regime in the River Churnet to the flow regime under a scenario where the dam has been raised. Despite this, it is likely that the flow in the River Churnet is completely dominated by the outflow from Tittesworth Reservoir up to the Endon Brook with there being no significant tributaries between the reservoir and the Endon Brook.</p> <p>Downstream of the Endon Brook confluence the catchment area of Tittesworth Reservoir (28.87 km²) only makes up 20% of total catchment area (130.52 km²) with the Endon Brook (50.58 km²) accounting for 39% of the catchment area. As a result, the flow in the River Churnet is no longer dominated by the outflow of Tittesworth Reservoir. This is demonstrated in the figure below comparing the river levels at the Leek level gauge – 4143 (~500m downstream of the Tittesworth Reservoir outflow, noting that this is downstream of the inflow from Soloman's Hollow) and the Wallgrange level gauge – 4895 (on the Endon Brook prior to the confluence with the River Churnet) to the levels at Basford Bridge – 4061 (on the River Churnet downstream of the Endon Brook confluence). This illustrates that the flow regime in the River Churnet downstream of the Endon Brook is dominated by the Endon Brook so the influence of the River Churnet on the flow variability downstream of the Endon Brook is limited.</p>	<p>None required.</p>	<p>No adverse effects on conservation objectives or site integrity</p>
	<p><i>Figure 5.1 relationship between level data at the Leek (4143) and Wallgrange level (4895) compared to the Basford Bridge (4061) level gauges based on data between May 2012 to May 2022. A timeseries plot is also presented for the 2018 hydrological year (based on this having the lowest total flow at the Basford Bridge gauge over the period).</i></p> 			
		<p>Option 187C</p> <p>This option would result in an additional 130 MI/d of water being abstracted from the River Derwent at Ambergate between November and March inclusive (on top of the 70 MI/d currently abstracted), and another 210 MI/d for 35 days outside of this period. This is a significant increase in abstraction against the recent actual abstraction rates, however, is still within the annual (62100 MI) and daily maximum (320 MI/d) license conditions for the Ambergate abstraction. The abstraction at Ambergate is restricted to 15 MI/d when the flow at St. Mary's Bridge (28085) in Derby is less than 680 MI/d (~Q73) and no water can be abstracted when flows are below 340 MI/d (~Q99). As a</p>	<p>None required.</p>	<p>No adverse effects on conservation objectives or site integrity</p>

Attribute	Target	Potential Effect	Mitigation	Effect on site integrity?
		<p>result, this option would not have any impact on low flows but would lead to additional abstraction of moderate and high flows through the winter period.</p> <p>To characterise the flow in the River Derwent at Ambergate the River Derwent at Whatstandwell flow gauge (28117) can be used. Using the flows at the Whatstandwell flow gauge (between 01/01/1997 to 30/09/2022), a baseline and assessment scenario have been developed:</p> <ul style="list-style-type: none"> • Baseline – abstraction of 70MI/d between November and March inclusive • Assessment – abstraction of 210MI/d between November and March inclusive as well as the succeeding 35 days after the end of March (noting that this is an assumption for assessment purposes based on the available scheme descriptions and may not be how the additional abstraction would be operated in reality) • Each of these scenarios abide to the HOF restriction at St. Mary's Bridge. <p>The flow duration curves in the figure below illustrate that low flows of roughly Q80 and below would remain un-impacted by the additional abstraction due to the St. Mary's Bridge HOF protecting these low flows. The most significant changes would occur under moderate flow conditions with the flow duration curves illustrating a notable change in flows between ~Q10 and Q70, although unlikely to significantly affect the qualifying features. High flows are only subject to a small relative reduction, illustrating that the additional abstraction would be insufficient to significantly alter the magnitude of peak flows. There would be no change in timing or frequency of high flow events in the River Derwent as a result of this scheme.</p> <p><i>Figure 5.2 Flow duration curve for the flow downstream of the abstraction at Ambergate under a baseline and assessment scenario. The right graph displays the section of the flow duration curve that is most sensitive to the flow changes as a result of the option.</i></p> 		
		<p>Option 426</p> <p>Little Eaton Water Treatment Works (WTW) is sourced by water abstracted from the River Derwent. This option would increase the capacity of the WTW allowing for additional water to be abstracted from the River Derwent. There would be an increase abstraction, and therefore decrease in flows, up to a maximum of 10MI/d.</p> <p>There are no NRFA flow gauges near Little Eaton WTW. As such a baseline hydrological understanding for the abstraction point on the River Derwent has been derived from a combination of the following NRFA gauges:</p> <ul style="list-style-type: none"> • 28117 – Derwent at Whatstandwell • 28055 – Ecclesbourne at Duffield • 28048 – Amber at Wingfield Park <p>Based on this, Q95 flows for the abstraction point would be 417MI/d and Q70 flows would be 693MI/s. A 10 MI/d reduction in this flow would account for a 2.4% reduction in Q95 flows and a 1.4% reduction in Q70 flows. This hydrological change is negligible and would not introduce any pathways to impacting the aquatic environment in the River Derwent. It is also worth noting that the River Derwent flows are protected by a hands-off flow condition at St. Mary's Bridge, Derby which would restrict abstraction under low flow conditions so, in reality, the 2.4% reduction in Q95 flows would not be realised.</p>	<p>None required.</p>	<p>No adverse effects on conservation objectives or site integrity</p>
		<p>In-combination: Options 29, 95B, 187C and 426</p> <p>There are four options within the preferred plan that have the potential to impact the river flows in the River Derwent, with the first year of use listed:</p> <ul style="list-style-type: none"> • 426 – 2030-31 	<p>None required for Option 29 and Option 426.</p> <p>Hydrological modelling should be undertaken to fully assess the impacts of the options. There is a sufficient period between Option 426 coming online in AMP8, and the options in AMP12 to complete</p>	<p>No adverse effects on conservation objectives or site integrity</p>

Attribute	Target	Potential Effect	Mitigation	Effect on site integrity?
		<ul style="list-style-type: none"> • 95B – 2049-50 • 29 – 2055-26 • 187C – 2070-71 <p>Option 29 is the furthest upstream of this reduction and could lead to a 9MI/d reduction in flows in the River Derwent at Matlock, which is deemed a negligible flow change in the River Derwent, especially as the abstraction would not impact low flows. This option would not introduce any pathways to impacting the aquatic environment in the River Derwent.</p> <p>With the Option 95B and Option 187C not required until after 2049-50 and 2070-71 respectively, it is currently unclear how these options would be operated in-combination with both options relying on the Ambergate intake and the raw water network between the intake, Carsington Water and Ogston WTW. Without a greater understanding of the options operating at the same time, it is difficult to assess the seasonality of the flow changes as a result of the additional abstraction. Once Option 187C is operational the maximum additional abstraction from the River Derwent at Ambergate would be 210MI/d. Combined with the flow reduction associated with Option 29, this would be a total reduction downstream of the Ambergate intake by 219MI/d. For an abstraction of this quantity to occur, flows would have to be significantly greater than the hands-off flow value at St. Mary's Bridge (28085) in Derby to ensure that the abstraction does not result in flows reducing beneath the hands-off flow value of 680MI/d (~Q73 at the St. Marys Bridge gauge).</p> <p>To characterise the flow in the River Derwent at Ambergate the River Derwent at Whatstandwell flow gauge (28117) can be used. The Q73 at this gauge is ~590MI/d so its assumed flows below this would be protected by the hands-off flow. As such, for flows to be reduced by the full 219MI/d the flow at Whatstandwell should be ~809MI/d. At this flow, the 219MI/d flow reduction would be a 25% reduction. This indicates that there would be a major reduction in moderate-low flows. Despite this, the additional abstraction would be insufficient to significantly alter the magnitude of high flow events with Q10 flows (2523MI/d) reducing by 8% and Q5 flows (3387MI/d) by 6%. The timing and frequency of high flows would remain unchanged.</p> <p>Option 426 would increase the capacity of Little Eaton Water Treatment Works (WTW) which is source by water abstracted from the River Derwent allowing an increase in abstraction by 10MI/d (once again, constrained by the hands-off flow at St. Mary's Bridge). When operated in combination with the other option on the River Derwent, there is the potential for a total reduction of 229MI/d downstream of Little Eaton WTW.</p> <p>There are no NRFA flow gauges near Little Eaton WTW. As such a baseline hydrological understanding for the abstraction point on the River Derwent has been derived from a combination of the following NRFA gauges:</p> <ul style="list-style-type: none"> • 28117 – Derwent at Whatstandwell • 28055 – Ecclesbourne at Duffield • 28048 – Amber at Wingfield Park <p>Based on this, Q73 flows would be 650MI/s. For the full 229MI/d to be abstracted, the flows at Little Eaton WTW would have to be 879MI/d. With the full amount abstracted this would account for a 26% reduction in flows, again indicating a major reduction in moderate-low flows. As with the impact upstream, the flow reduction would not significantly impact the magnitude of high flows with Q10 (2912MI/d) and Q5 (3911MI/d) being reduced by 8% and 6% respectively. The timing and frequency of high flows would remain unchanged.</p>	<p>this, identify any changes to abstraction volumes and licence conditions, and incorporate into the next WRMP cycle.</p>	

6. STAGE 2 APPROPRIATE ASSESSMENT: SOUTH PENNINE MOORS SAC

6.1 INTRODUCTION

The following preferred plan options have been screened in as potentially impacting the South Pennine Moors SAC:

- 305A Heathy Lea to North Notts transfer (large): **construction only**.

The South Pennine Moors SAC is designated for the following features, with all being screened in for assessment:

- H4010 Northern Atlantic wet heaths with *Erica tetralix*; Wet heathland with cross-leaved heath
- H4030 European dry heaths
- H7130 Blanket bogs
- H7140 Transition mires and quaking bogs
- H91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles

6.2 SITE SUMMARY

6.2.1 Site description

This site covers the key moorland blocks of the Southern Pennines from Ilkley Moor in the north to the Peak District in the south. The moorlands are on a rolling dissected plateau formed from rocks of Millstone Grit at altitudes of between 300m – 600m and a high point of over 630m at Kinder Scout. The greater part of the gritstone is overlain by blanket peat with the coarse gravely mineral soils and shales occurring only on the lower slopes. The moorlands as a whole support a breeding bird community of national and international importance.

This site is characterised by extensive areas of blanket bog although the bog vegetation communities are botanically poor, impoverished by pollution, grazing and burning. Hare's-tail cotton grass *Eriophorum vaginatum* is, often, overwhelmingly dominant and the usual bog-building Sphagnum mosses are scarce. Where the blanket peats are slightly drier, heather *C. vulgaris*, crowberry *Empetrum nigrum* and bilberry *V. myrtillus* become more prominent. The cranberry *Vaccinium oxycoccus* and the uncommon cloudberry *Rubus chamaemorus* is locally abundant in bog vegetation. Bog pools provide diversity and are often characterised by common cottongrass *E. angustifolium*. Substantial areas of the bog surface are eroding, and there are extensive areas of bare peat. In some areas erosion may be a natural process reflecting the great age (up to 9000 years) of the South Pennine peats, but the picture is complex with a number of factors contributing to peat loss.

The site is representative of upland dry heath which covers extensive areas, occupies the lower slopes of the moors on mineral soils or where peat is thin, and occurs in transitions to acid grassland, wet heath and blanket bogs. The upland heath of the South Pennines is strongly dominated by *Calluna vulgaris*-*Deschampsia flexuosa* heath and *C. vulgaris* – *Vaccinium myrtillus* heath with the *Vaccinium vitis-idaea* sub-community evident on the eastern slopes. More rarely *C. vulgaris* – *Ulex gallii* heath and *C. vulgaris* – *Erica cinerea* heath are found. On the higher, more exposed ground *V. myrtillus* – *D. flexuosa* heath becomes more prominent. The smaller area of wet heath is characterised by cross-leaved heath *Erica tetralix* and purple moor grass *Molinia caerulea*. The site also supports extensive areas of acid grassland largely derived from both dry and wet heath. In the cloughs, or valleys, which extend into the heather moorlands, a greater mix of dwarf shrubs can be found together with more lichens and mosses. The moors support a rich invertebrate fauna, especially moths, and important bird assemblages.

Around the fringes of the upland heath and areas of bog are blocks of old sessile oak woods, usually on slopes and particularly cloughs. These tend to be drier than those further north and west, such that the bryophyte communities are less developed (although this lowered diversity may in some instances have been exaggerated by the effects of air pollution from the early 1800's to the 1970's). Other

components of the ground flora such as grasses, dwarf shrubs and ferns are common. Small areas of alder woodland along stream-sides add to the overall richness of the woods.

The moorland also supports a range of flush and fen habitats associated with bogs, cloughs, rivers and streams. Although generally small scale features, they have a specialised flora and fauna, which makes a great contribution to the overall biodiversity of the moors. Acid flushes are the most common type and these include transition mires and quaking bogs characterised by a luxuriant carpet of bog mosses *Sphagnum* spp., rushes and sedges.

The South Pennine Moors SAC is largely enclosed on two sides by large industrial urban areas, which means that large numbers of people use the area for recreational activities. Around two-thirds of the site is within the Peak District National Park. Land management is primarily driven by drinking water collection (reservoirs are frequent in and around the site), rough grazing for sheep (and some cattle), and grouse-shooting and, more recently, recreational activities including rambling, rock climbing mountain biking and paragliding.

6.2.2 Qualifying features screened into Stage 2 Appropriate Assessment: baseline

6.2.2.1 H4030 European dry heaths

The site is representative of upland dry heath at the southern end of the Pennine range, the habitat's most south-easterly upland location in the UK. Dry heath covers extensive areas, occupies the lower slopes of the moors on mineral soils or where peat is thin, and occurs in transitions to acid grassland, wet heath and 7130 blanket bogs. The upland heath of the South Pennines is strongly dominated by heather *Calluna vulgaris*. Its main NVC types are H9 *Calluna vulgaris* – *Deschampsia flexuosa* heath and H12 *Calluna vulgaris* – *Vaccinium myrtillus* heath. More rarely H8 *Calluna vulgaris* – *Ulex gallii* heath and H10 *Calluna vulgaris* – *Erica cinerea* heath are found. On the higher, more exposed ground H18 *Vaccinium myrtillus* – *Deschampsia flexuosa* heath becomes more prominent. In the cloughs, or valleys, which extend into the heather moorlands, a greater mix of dwarf shrubs can be found together with more lichens and mosses. The moors support a rich invertebrate fauna, especially moths, and important bird assemblages.

6.2.2.2 H7130 Blanket bogs

These extensive peatlands have formed in areas where there is a climate of high rainfall and a low level of evapotranspiration, allowing peat to develop not only in wet hollows but over large expanses of undulating ground. Blanket bogs show a complex pattern of variation related to climatic factors, particularly illustrated by the variety of patterning of the bog surface in different parts of the UK. Such climatic factors also influence the floristic composition of bog vegetation. Many of the bogs in the Hebrides and Northern Ireland have affinities to types in western Ireland and thus exhibit more oceanic aspects of the range of variation, while those sites towards the eastern limit of blanket bog formation show more continental affinities.

This site represents blanket bog in the south Pennines, the most south-easterly occurrence of the habitat in Europe. The bog vegetation communities are botanically poor. Hare's-tail cottongrass *Eriophorum vaginatum* is often overwhelmingly dominant and the usual bog-building *Sphagnum* mosses are scarce. Where the blanket peats are slightly drier, heather *Calluna vulgaris*, crowberry *Empetrum nigrum* and bilberry *Vaccinium myrtillus* become more prominent. The uncommon cloudberry *Rubus chamaemorus* is locally abundant in bog vegetation. Bog pools provide diversity and are often characterised by common cottongrass *E. angustifolium*. Substantial areas of the bog surface are eroding, and there are extensive areas of bare peat. In some areas erosion may be a natural process reflecting the great age (9000 years) of the south Pennine peats.

6.2.2.3 H91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

This habitat type comprises a range of woodland types dominated by mixtures of oak (*Quercus robur* and/or *Q. petraea*) and birch (*Betula pendula* and/or *B. pubescens*). It is characteristic of base-poor soils in areas of at least moderately high rainfall in northern and western parts of the UK. The habitat shows considerable variation across its range, in terms of the associated ground flora and the richness of bryophyte communities. There is also a continuous spectrum of variation between oak-dominated

and birch-dominated stands. Often these local variations reflect factors such as rainfall, slope, aspect, soil depth, and past and present woodland management (e.g. coppicing, planting, grazing).

Around the fringes of the upland heath and bog of the south Pennines are blocks of old sessile oak woods, usually on slopes. These tend to be dryer than those further north and west, such that the bryophyte communities are less developed (although this lowered diversity may in some instances have been exaggerated by the effects of 19th century air pollution). Other components of the ground flora such as grasses, dwarf shrubs and ferns are common. Small areas of alder woodland along stream-sides add to the overall richness of the woods.

6.2.2.4 H4010 Northern Atlantic wet heaths with *Erica tetralix*; Wet heathland with cross-leaved heath

Wet heath usually occurs on acidic, nutrient-poor substrates, such as shallow peats or sandy soils with impeded drainage. The vegetation is typically dominated by mixtures of cross-leaved heath *Erica tetralix*, heather *Calluna vulgaris*, grasses, sedges and *Sphagnum* bog-mosses. Wet heaths occur in several types of ecological gradient. In the drier areas of the south and east, wet heaths are local and often restricted to the transition zone between 4030 European dry heaths and constantly wet valley mires. In the uplands they occur most frequently in gradients between dry heath or other dry, acid habitats and 7130 Blanket bogs. At high altitude in the Scottish Highlands wet heaths occur in mosaics with 4060 Alpine and Boreal heaths; in these situations lichens and northern or montane species may be well-represented. Flushed wet heaths are especially frequent in areas of high rainfall, and occur as topogenous fens, usually in channels within heath or grassland vegetation.

Wet heath is an important habitat for a range of vascular plant and bryophyte species of an oceanic or Atlantic distribution in Europe, several of which have an important part of their EU and world distribution in the UK.

6.2.2.5 H7140 Transition mires and quaking bogs

The term 'transition mire' relates to vegetation that in floristic composition and general ecological characteristics is transitional between acid bog and 7230 Alkaline fens, in which the surface conditions range from markedly acidic to slightly base-rich. The vegetation normally has intimate mixtures of species considered to be acidophile and others thought of as calciphile or basophile. In some cases the mire occupies a physically transitional location between bog and fen vegetation, as for example on the marginal lagg of raised bog or associated with certain valley and basin mires. In other cases these intermediate properties may reflect the actual process of succession, as peat accumulates in groundwater-fed fen or open water to produce rainwater-fed bog isolated from groundwater influence. Many of these systems are very unstable underfoot and can therefore also be described as 'quaking bogs'.

6.2.3 Condition, threats, and pressures

There are five SSSI's underpinning the South Pennine Moors SAC;

- Dark Peak SSSI (NGR: SK 110960)- There are 246 live units within the site with 4.33% assessed as favourable, 89.95% unfavourable- recovering, 5.99% unfavourable- no change and 0.10% unfavourable- declining with moor burning identified as a reason for adverse condition.
- Eastern Peak District Moors SSSI (NGR: SK 110960)- There are 136 live units within the site with 30.94% assessed as favourable, 68.75% unfavourable- recovering and 0.31% unfavourable- no change with inappropriate weed control identified as a reason for adverse condition.
- Goyt Valley SSSI (NGR: SK 010720)- There are 31 live units within the site with 0.80% assessed as favourable, 90.20% unfavourable- recovering, 1.06% unfavourable- no change and 7.94% unfavourable- declining with overgrazing identified as a reason for adverse condition.
- Leek Moors SSSI (SK 020650)- There are 255 live units within the site with 15.27% assessed as favourable, 67.81% unfavourable- recovering, 10.84% unfavourable- no change, 5.81%

unfavourable- declining and 0.27% as partially destroyed with overgrazing and air pollution identified as a reason for adverse condition.

- South Pennine Moors SSSI (NGR: SD 920300)- There are 164 live units within the site with 0.64% assessed as favourable, 89.28% unfavourable- recovering, 9.88% unfavourable- no change and 0.19% unfavourable- declining with undergrazing identified as a reason for adverse condition.

The SIP for the South Pennine Moors SAC has identified the following threats and pressures which may affect the condition of the qualifying features on site, and which are relevant to the types of impact pathways from the WRMP options;

- Hydrological changes- H7130 blanket bog, H7140 transition mires and quaking bogs.
- Public access disturbance- H4010 Northern Atlantic wet heaths with *Erica tetralix*; Wet heathland with cross-leaved heath, H4030 European dry heaths, H7130 blanket bog, H7140 transition mires and quaking bogs.
- Air pollution: impact of atmospheric nitrogen deposition- H4010 Northern Atlantic wet heaths with *Erica tetralix*; Wet heathland with cross-leaved heath, H4030 European dry heaths, H7130 blanket bog, H7140 transition mires and quaking bogs, H91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles.
- Wildfire/arson- H4010 Northern Atlantic wet heaths with *Erica tetralix*; Wet heathland with cross-leaved heath, H4030 European dry heaths, H7130 blanket bog, H7140 transition mires and quaking bogs, H91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles.
- Vehicles- H4010 Northern Atlantic wet heaths with *Erica tetralix*; Wet heathland with cross-leaved heath, H4030 European dry heaths, H7130 blanket bog, H7140 transition mires and quaking bogs.
- Invasive species - H4010 Northern Atlantic wet heaths with *Erica tetralix*; Wet heathland with cross-leaved heath, H4030 European dry heaths, H7130 blanket bog, H7140 transition mires and quaking bogs.

6.3 ASSESSMENT OF EFFECTS

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 6-1**.

Only European dry heaths and oak woodland are considered in the construction phase as identified by priority habitat mapping available as being in close proximity to the pipeline route. There are no areas of wetland habitat in close proximity to the pipeline route. These are however considered in operation as the pipeline could permanently impede surface and groundwater flows to the habitats.

The proposed pipeline route will be constructed through the B6050 or A619 which extends between the two components of the SAC at Robin Hood. The pipeline may require crossings of a number of brooks that feed the SAC e.g. Blackleah Brook and Heathy Lea Brook. The works therefore have the potential to result in the following effects:

- Offsite habitat degradation – compaction of soils and hydrologically connected vegetation between the two components of the SAC.
- Water quality – accidental oil spills, sediment laden runoff.
- Contamination – smothering of vegetation from dust and potential nitrogen loading.
- Biological disturbance – introduction of non-native invasive species.

The proposed pipeline route will be constructed through the B6050 or A619 which extends between the two components of the SAC at Robin Hood. The pipeline may require crossings of a number of brooks that feed the SAC e.g. Blackleah Brook and Heathy Lea Brook. The works therefore have the potential to result in the following effects:

- Permanent impedance of surface water and groundwater flows to water dependent habitats.

6.4 UNCERTAINTIES

There is limited understanding of the distribution of habitats within proximity to the construction corridor and therefore the project-level HRA will need to complete NVC surveys to confirm broad type, species composition and diversity and quality to update assessment to confirm offsite area to be temporarily lost during construction, and hydrological pathways to SAC.

Similarly, no air quality baseline survey or assessment has been completed to understand the likelihood of nitrogen deposition from the work, and exceedances of critical levels. Again, this will need to be considered as part of the project-level HRA.

Table 6-1 Information to inform an assessment of adverse effects on South Pennine Moors SAC

Qualifying features	Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
CONSTRUCTION PHASE					
H4030 European dry heaths H910A, Old sessile oak woods with Ilex and Blechnum in the British Isles	Structure and function (including its typical species): Functional connectivity with wider landscape	Maintain or restore as appropriate the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site	<p><u>Offsite habitat degradation</u></p> <p>The proposed pipeline route will extend between the two components of the SAC at Robin Hood. Priority habitat mapping suggests that the majority of habitat between the components is deciduous woodland. However, any areas of marshy land is likely to provide hydrological connectivity and continuity between the components. Construction works could cause temporary degradation of adjacent habitats through compaction of vegetation and soils which could alter water availability by disrupting surface and groundwater flows.</p> <p>Open cut is proposed for the pipeline installation, and where possible the width of the construction corridor (20m) topsoil stripped will be minimised to the trench width. Ground protection matting will be used to minimise compaction of soils which will aid recovery and prevent the loss of vegetation structure. Topsoil will be stripped to keep the layers separate thereby retaining the seed bank and root balls and expediting habitat recovery.</p> <p>An Arboricultural Implications Assessment will be required to ensure root protection zones are not compromised by the pipeline construction.</p> <p><u>Water quality – pollution incidents, runoff</u></p> <p>Given the proximity to the river, and likely requirement for dewatering during the works due to a high water table in the area, there is the potential for indirect effects of pollution such as excess sediment discharge, discharge of contaminated water from dewatering activities, and accidental oil spill. In order to mitigate for such effects, all petrochemicals will be stored within designated areas located a suitable distance from the SAC. All refuelling of vehicles will also be undertaken off site and works will ensure appropriate spill kits are available to ensure accidental spills are intercepted prior to reaching the designated site. Appropriate measures will also be employed to ensure excess sediment is not released into the designated site, this may include (but is not limited to) installation of silt fencing in-between works areas and the watercourse, use of silt busters to capture and filter surface water run-off. No surface water runoff or dewatering water will be discharged directly to the channel of the designated site.</p> <p><u>Contamination - dust and NOx</u></p> <p>Topsoil stripping and excavation works have potential for indirect adverse effects from dust pollution with smothering of the heath habitats predicted in the absence of mitigation. This will only effect habitats within 100m without mitigation, as identified through the commonly applied distance thresholds of dust from large construction sites^{64, 65}.</p> <p>The use of heavy plant and vehicles during the construction phase may alter the air quality in the proximity of the site with increased concentrations of nitrogen oxides (NOx). Such increases may directly interfere with site improvement plans to control, reduce and ameliorate atmospheric nitrogen impacts.</p> <p>Increased nitrogen can lead to increased fertility leading to changes in plant community. The Air Pollution Information System estimates that the current critical loading (i.e. over which effects of N deposition would start to occur) for dry heath is 10-20 kg N ha⁻¹ year⁻¹. Recent guidance published by Natural England notes that designated sites within 200m of roads to be used as part of a plan or project need to be assessed for nitrogen loading⁶⁶.</p> <p>The habitats in the SAC are considered to be sensitive to N deposition, particularly dry heaths. The Air Pollution Information System estimates that the critical loading (i.e. over which effects of N deposition would start to occur) for <i>Quercus</i> dominated woodland is 10-15Kg N/ha/year. An increase in N loading is considered likely given the potential works in the road and requirement to hold traffic during construction work. A detailed air quality assessment will need to be completed once the detailed construction methods and programme are known, to confirm whether there will be any issues from NOx loading. If this assessment concludes adverse effects, traffic will need to be rerouted or traffic management measures implemented to avoid the critical load being exceeded.</p> <p><u>Biological Disturbance – Invasive non-native species</u></p> <p>The works have the potential to spread invasive non-native species given the close proximity of the works to the SAC and watercourse crossings required. Works, particularly in aquatic habitats should follow best</p>	<p><u>Offsite habitat loss and degradation</u></p> <ul style="list-style-type: none"> • Install pipeline within road and avoid installing sections of pipeline in land adjacent to SAC which could be hydrologically linked. • Minimise construction corridor. • Topsoil strip the trench width only rather than whole working corridor. • Ground protection matting to minimise compaction of adjacent wet heath habitat. • Topsoil stripping, keeping soil layers separate to maintain the seed bank and habitat recovery following open cut pipeline installation for open cut sections. • Undertaking the pipeline installation in short sections to minimise run-off. • Locate construction compounds on habitats that are not hydrologically linked to the SAC. • Ensure continued supply of water along ditches if being crossed by pipeline e.g. over pumping. • Arboricultural Implications Assessment of pipeline route and proximity to oak woodland. • Pipeline must avoid root protection zones when extending close to SAC (although assumed to be minimal risk as road already exists within which the pipeline is being constructed). <p><u>Water quality</u></p> <ul style="list-style-type: none"> • Adherence to EA Pollution Prevention Guidelines (now archived) and NRW, SEPA's Guidance on Pollution Prevention including Works and Maintenance in or near Water (2017). <p><u>Contamination – dust and NOx</u></p> <ul style="list-style-type: none"> • Complete an air quality assessment of potential for N loading on sensitive habitats once details of plant and construction programme have been confirmed (e.g. using method outlined in DMRB Air Quality Appendix F). • If air quality assessment identifies an exceedance of the critical load due to stationary traffic being held as pipeline is installed in road, traffic must be diverted or other traffic management measures put in place to ensure critical load, and therefore an adverse effect on the site, is avoided. • Dust suppression measures including dampening and dust screens to be applied to reduce dispersion to minimum distance <p><u>INNS</u></p> <ul style="list-style-type: none"> • Best practice biosecurity measures, as recommended by the GB Non-Native Species Secretariat (http://www.nonnativespecies.org/index.cfm?sectionid=58) would guard against any potential for spreading 	No adverse effects on conservation objectives or site integrity

⁶⁴ Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction. IAQM, London

⁶⁵ Technical Statement TS/AQ1, Association of British Ports (ABP), 2000

⁶⁶ NE Internal Guidance – Approach to Advising Competent Authorities on Road Traffic Emissions and HRAs V1.4 Final - June 2018

Qualifying features	Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
			<p>practice biosecurity measures as standard.</p>	<p>invasive species as a result of construction.</p> <ul style="list-style-type: none"> Where any INNS are identified as a risk of being introduced, spread within, or moved off site, ensure mitigation measures are considered at the early planning stage, and ensure enough time is given to implement them. Consider phasing construction to allow time to deal with the presence and/or risk of spread of INNS. Ensure INNS and locations (mapped) are incorporated within all relevant site method statements, including the site Ecological Protection Plan and Species Protection Plans, where appropriate. <p><i>General</i></p> <ul style="list-style-type: none"> A Construction Management Plan will be drawn up to detail all exclusion and protection measures. All of the above mitigation measures will be monitored and enforced by an on-site Environmental Clerk of Works. 	
<p>H4030 European dry heaths</p> <p>H4010 Northern Atlantic wet heaths with <i>Erica tetralix</i>; Wet heathland with cross-leaved heath</p> <p>H7130 Blanket bogs</p> <p>H7140 Transition mires and quaking bogs</p>	<p>Supporting processes (on which the feature relies) Hydrology</p>	<p>At a site, unit and/or catchment level (as appropriate), restore a hydrological regime to provide the conditions necessary to sustain the H4010 feature within the site</p>	<p>Around 2km from the western start of the pipeline, the distance between both flanking designated areas is at its narrowest (~51m), with the pipeline flanking the northern margin of the southern unit of the SAC, SPA and SSSI. Around 1.5km the pipeline sits towards the base of a valley within which a small watercourse flows (Wadshelf Brook, a tributary of the River Derwent). Thereafter toward 3.5km the pipeline is situated on higher ground above the watercourse.</p> <p>Surface flow vectors indicate that flow from the northern and southern designated areas is generally towards the south and north respectively, draining into Wadshelf Brook. For much of the area along the pipeline route considered, the designated areas lie at slightly higher topographic elevations than the pipeline.</p> <p>The geology underlying the pipeline is complex. Around the area of the pipeline route considered, the geology comprises of interbedded coarse sandstones and mudstones of the Carboniferous aged Namurian Millstone Grit Group trending to the finer sandstones and mudstones of the Carboniferous aged Langsettian Pennine Lower Coal Measures Formation. Siltstones, coals and marine bands are noted throughout the stratigraphy. Faulting is common in these rocks, however there is no faulting noted within the study area of the pipeline route. Data taken from the British Geological Survey (BGS) 1:50000 scale geology map, Sheet 112 (Chesterfield) indicates the dip of strata around the pipeline to be between 3-5 degrees and dipping generally in an easterly direction, although north of the pipeline these dips locally are to the south east and south of the pipeline, they are locally to the north east. Superficial geology is limited to scattered head deposits towards the start of, and around, the pipeline.</p> <p>The hydrogeology of the area around the pipeline consists entirely of the Millstone Grit Group and Pennine Lower Coal Measures Formation aquifers which the BGS indicates as being moderately productive multi-layered aquifers where flow is nearly all via fractures and fissures in the rocks. There are no water wells indicated in the vicinity of the pipeline and no Environment Agency Source Protection Zones are present nearby. The nearest water wells indicated by BGS data are ~5km to the south east near Holymoorside. There are also very few groundwater sources adjacent to the site, therefore approximate water levels cannot be identified. However, understanding the general direction of dip and magnitude of dip of the rocks, it is indicated that groundwater flows are expected to be in an easterly direction. Specifically, the bedrock dips suggest that groundwater flow would be locally towards the pipeline where it is adjacent to the designated areas and, overall in an easterly direction.</p> <p>Due to the close proximity of the pipeline to the designated areas there is a potential that the pipeline route could impact on the hydrology and hydrogeology of these areas. The surface flow directions and elevation differences between the pipeline and the surrounding designated sites suggest that there will be no impact on surface hydrology from the construction and operation of the pipeline. However, it is recommended that good construction practices are adopted when building the pipeline to prevent movement of sediment and contaminants into the adjacent surface watercourse. Although there is no water level data, groundwater flow directions have been assessed by considering the local bedding dips and their orientations and it is clear that groundwater flow is away from the designated areas and towards the pipeline, ultimately in an easterly direction. Furthermore, the complexity of the layered geology in the area further reduces the potential for the pipeline to exert any effect on the designated areas. Combining these findings, it is concluded that there is no overall effect on the groundwater supply to these designated areas from the construction and operation of the pipeline.</p>	<p>Best practice construction methods to avoid preferential flow of water along pipeline.</p>	<p>No adverse effects on conservation objectives or site integrity</p>

7. STAGE 2 APPROPRIATE ASSESSMENT: PEAK DISTRICT MOORS (SOUTH PENNINE MOORS PHASE 1) SPA

7.1 INTRODUCTION

The following preferred plan options have been screened in as potentially impacting the Peak District Moors (South Pennine Moors Phase 1) SPA:

- 123B Raise Dam at Tittesworth Reservoir (25%): **construction only**
- 128 Carsington to Tittesworth main (large): **construction only**
- 128Z Carsington to Tittesworth main (small): **construction only**
- 305A Heathy Lea to North Notts transfer (large): **construction only**

The Peak District Moors (South Pennine Moors Phase 1) SPA is designated for the following features, with all being screened in for assessment:

- A140 Golden plover *Pluvialis apricaria*
- A098 Merlin *Falco columbarius*
- A222 Short-eared owl *Asio flammeus*

Given the limited baseline information about where within the site the species can be found nesting and foraging, all three have been screened in.

7.2 SITE SUMMARY

7.2.1 Site description

The South Pennine Moors SPA Phases 1 and 2 include the major moorland blocks of the South Pennines from Ilkley in the north to Leek and Matlock in the south. They lie within three National Character Areas: the Southern Pennines, The Dark Peak and the South-West Peak.

This is a landscape of large-scale sweeping moorlands, pastures enclosed by drystone walls, and gritstone settlements contained within narrow valleys. The soils within the SPA are generally acidic in nature and nutrient-poor and consist of varying depths of peat overlying a geology of sandstone, gritstone and sedimentary rock. The geomorphology and landscape is one of large expanses of uplands and valleys with associated crags, ledges and escarpments.

The Dark Peak is made of three mountain massifs reaching over 600m in altitude with a substantial area of blanket peat at 400-500m above sea level. Between these lie steep sided valleys with tributaries via the River Etherow to the Mersey and, via the rivers Derwent and Don, to the Humber. Impoundment for reservoir reflect the importance of these areas for the water supply of the major conurbations that lie nearby. The valleys also provide some of the last fragments of semi-natural woodland in the areas.

To the south-east the 'eastern moors' provide a lower and drier ridge of moorland and characteristic gritstone edges with a substantially wooded undercliff, this is an area of added interest for the range of physical remains reflecting a long period of settlement and use. In the south-west the moors above Buxton and Leek provide a mosaic of moorland with bog, heath and rushy pasture mixed together.

7.2.2 Qualifying features screened into Stage 2 Appropriate Assessment: baseline

7.2.2.1 Golden plover (breeding)

At the time of its classification, the SPA supported 435 breeding pairs of golden plover, which represented 1.7% of the British breeding population.

In Britain, the species is distributed widely throughout upland areas, with concentrations in northern and western Scotland and the north and south Pennines, and smaller outlying groups breeding in Wales and south-west England. The English and Welsh populations breed at the southern edge of the species' global range.

Golden plover nest in a shallow scrape on the ground often hidden by moorland vegetation. Golden plover use the blanket bog habitat within the SPA and are more common on the higher and more remote bogs. Most

breeding pairs are found within the Dark Peak but important outlier breeding groups remain in the more northern sections of the south west peak and the eastern moors. Birds will use a variety of vegetation types from high heather cover to high sedge cover providing a suitable structure is maintained. They avoid deep vegetation, areas that are overlooked and areas of high disturbance.

Food consists of invertebrates, mainly beetles and earthworms; marginal or low-intensity agricultural pastures (off-site), adjacent to or nearby moorland nesting habitat, are important feeding grounds in the summer for the adults. Eggs are typically laid between April-mid-May and one brood is raised per year. In some years young birds reliant on parents are still seen in July. Wet bog conditions support the larvae and adults of craneflies which are an important food source for the newly hatched birds.

Survey results suggest a slight increase in breeding pairs from 435 in 1990 to 490 in 2004/2005 (no results available for 2014)⁶⁷. Habitat requirements for golden plover include a mix of short and taller vegetation for feeding and nesting respectively, with open, short vegetation or bare ground used for roosting. It is not known where the key sites for breeding golden plover are and this would need to be discussed with Natural England and relevant land management teams to confirm the conclusions of this assessment, with baseline breeding surveys carried out where necessary. However, it should be noted that mitigation is available to avoid adverse effects.

7.2.2.2 Merlin (breeding)

At the time of its classification, the SPA supported 35 breeding pairs of merlin, which represented 5.4% of the British breeding population.

In the UK, Merlin is confined as a breeding species to heather moorland areas, mainly in the uplands of Northern Ireland, Scotland, Wales and northern England, with small numbers in south-west England.

The majority of merlin in the UK nest in a shallow scrape on the ground and this is the case for the birds of the Peak District Moors SPA. The scrape will be lined with small twigs, pieces of heather, bracken and other material and concealed by mature/over mature heather. Territories are traditional and are used repeatedly from year to year by successive generations of birds.

Merlin are widespread across the site and use an extensive area within the SPA in which to hunt for prey. Eggs are laid between May and early June with hatching timed to coincide with a greater abundance of passerines which make up most of the diet of these birds. The young will often leave the nest at 18-20 days and scatter into the surrounding undergrowth. They fledge at 25-32 days and are independent about a month later. One brood a year is raised. Replacement clutches may be laid after early egg loss.

Survey results suggest a decline in breeding pairs from 28 in 2004/05, to 20 in 2010 and 18 in 2014⁶⁸. Habitat requirements for merlin include medium to tall ground vegetation with clusters of scattered trees for nesting, and shorter grassland swards for feeding. It is not known where the key sites for breeding merlin are and this would need to be discussed with Natural England and relevant land management teams to confirm the conclusions of this assessment, with baseline breeding surveys carried out where necessary. However, it should be noted that mitigation is available to avoid adverse effects.

7.2.2.3 Short-eared owl (breeding)

The breeding population of short-eared owls is both difficult to accurately assess and prone to significant year to year fluctuations reflecting variations in the numbers of field voles which are their main prey. At the time of classification it was estimated that there were 22 pairs of short-eared owls in the SPA (the species is only classified for the phase 1 part of the SPA). Short-eared owls are ground nesting birds that use long heather and tall rushes to provide cover for the nests.

Survey results suggest a slight increase in breeding pairs from 19 in 1990 to 24 in 2004/2005 (no results available for 2014)⁶⁹. Habitat requirements for short-eared owl include short to medium ground vegetation, scrub or trees for nesting, and open ground for feeding. It is not known where the key sites for the species are and this would need to be discussed with Natural England and relevant land management teams to confirm

⁶⁷ [Breeding Birds Survey Project | Moors for the Future](#)

⁶⁸ [Breeding Birds Survey Project | Moors for the Future](#)

⁶⁹ [Breeding Birds Survey Project | Moors for the Future](#)

the conclusions of this assessment, with baseline breeding surveys carried out where necessary. However, it should be noted that mitigation is available to avoid adverse effects.

7.2.3 Condition, threats, and pressures

There are four SSSI's underpinning Peak District Moors (South Pennine Moors Phase 1) SPA;

- Dark Peak SSSI (SK 116 967) – there are 246 live units of upland dwarf shrub heath, bog and acid grassland in the site: 4.33% favourable, 89.58% unfavourable-recovering, 5.99% unfavourable- no change and 0.10% unfavourable- declining. Fire has been cited as a reason for unfavourable condition.
- Eastern Peak District Moors SSSI (SK 265 792) – there are 136 live units of upland acid grassland, bog, neutral grassland, dwarf shrub heath, broadleaved woodland and lowland fen, marsh and swamp for this site: 30.94% favourable, 68.75% unfavourable- recovering and 0.31% unfavourable- no change. Inappropriate weed control is cited as a reason for unfavourable condition.
- Goyt Valley SSSI (SK 011 738) – there are 31 live units of upland bog, fens, marsh and swamp, acid grassland, dwarf shrub heath and broadleaved woodland for this site: 0.80% favourable, 90.20% unfavourable- recovering, 1.06% unfavourable- no change and 7.94% unfavourable- declining. Overgrazing is cited as a reason for unfavourable condition.
- Leek Moors SSSI (SK 027 655) – there are 255 live units of upland bogs, dwarf shrub heath, fen, marsh and swamp and acid grassland for this site: 15.27% favourable, 67.81% unfavourable-recovering, 10.84% unfavourable- no change, 5.81% unfavourable- declining and 0.27% partially destroyed.

The SIP for the Peak District Moors (South Pennine Moors Phase 1) SPA has identified the following threats and pressures which may affect the condition of the qualifying features on site⁷⁰, and which are relevant to the types of impact pathways from the WRMP options;

- Hydrological changes - A103 Peregrine, A140 Golden Plover, A222 Short-eared Owl.
- Low breeding success/ poor recruitment - A098 Merlin, A103 Peregrine, A222 Short-eared Owl
- Air pollution: impact of atmospheric nitrogen deposition - A098 Merlin, A140 Golden Plover, A222 Short-eared Owl.
- Vehicles - A098 Merlin, A140 Golden Plover, A222 Short-eared Owl.
- Changes in species distributions - A098 Merlin, A222 Short-eared Owl.
- Planning permission: general - A103 Peregrine, A098 Merlin, A140 Golden Plover, A222 Short-eared Owl.

7.3 ASSESSMENT OF EFFECTS

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 7-1**.

7.3.1 Option 123B

The scheme involves increasing the storage the storage capacity of Tittesworth reservoir by 25%. This will be achieved by raising the existing embankment by 2.3m. Given the proximity to the SPA, the potential for offsite functionally linked habitat which could be used for foraging being lost under the increased reservoir footprint could not be ruled out at screening.

7.3.2 Option 128 and 128Z

The proposed pipeline extends within 2.9km of the SPA, and the potential for habitat degradation to offsite functionally linked habitat, and disturbance should the qualifying features be using these areas, cannot be ruled out on the information currently available. For example, the SACO states for European golden plover that supporting habitats (within and outside the SPA) could be used for foraging and therefore the target is

⁷⁰ Natural England (2014) Site Improvement Plan South Pennine Moors.

“Maintain existing, and elsewhere restore the amount of prey-rich grassland feeding habitat within 4 km of moorland nesting areas”.

7.3.3 Option 305A

The proposed pipeline route will be constructed through the B6050 or A619 which extends between the two components of the SPA at Robin Hood. The pipeline may require crossings of a number of brooks that feed the SPA e.g. Blackleah Brook and Heathy Lea Brook. The works therefore have the potential to result in the following effects:

- Noise and visual disturbance during construction.
- Contamination – smothering of vegetation from dust and nitrogen loading resulting in a change to food availability.

7.4 UNCERTAINTIES

There is limited understanding of the distribution of the qualifying features in habitats (either within the site boundary or offsite functionally linked) adjacent to the likely construction corridors (based on high level routing at this plan level). Breeding bird survey to confirm whether nest sites occur along pipeline corridor and therefore whether exclusion measures are required. Similarly, baseline noise surveys and assessment should be undertaken to understand ambient noise environment and whether construction noise will be over and above this, to refine the acoustic mitigation measures (if required). Both will need to be completed as part of a project-level HRA.

Table 7-1 Information to inform an assessment of adverse effects on the Peak District Moors (South Pennine Moors Phase 1) SPA

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
CONSTRUCTION PHASE					
<p>A098 <i>Falco columbarius</i>; Merlin (Breeding)</p> <p>A140 <i>Pluvialis apricaria</i>; European golden plover (Breeding)</p> <p>A222 <i>Asio flammeus</i>; Short-eared owl (Breeding)</p>	Supporting habitat (both within and outside the SPA): function/supporting process - Food availability within supporting habitat	<p>Merlin: Maintain the overall availability of small birds and day flying moths in the breeding season.</p> <p>Golden plover: Maintain the availability of key prey items (e.g. earthworm, leatherjackets, beetles, spiders) at prey sizes preferred by Golden Plover. Maintain existing, and elsewhere restore the amount of prey-rich grassland feeding habitat within 4 km of moorland nesting areas.</p> <p>Short-eared owl: Maintain the overall availability of prey species preferred by breeding Short-eared owl, particularly small mammals and small/medium sized birds.</p>	<p><u>Loss of offsite functionally linked habitat (foraging)</u></p> <p>The Peak District Moors (South Pennine Moors Phase 1) SPA is designated for the following qualifying features:</p> <ul style="list-style-type: none"> A140 Golden plover, <i>Pluvialis apricaria</i> (breeding) A098 Merlin, <i>Falco columbarius</i> (breeding) A222 Short-eared owl, <i>Asio flammeus</i> (breeding) <p>Golden plover in particular, is considered to be a mobile species which could forage on habitats outside the boundaries of the SPA. The SACO includes the following attributes and targets for this species:</p> <ul style="list-style-type: none"> Supporting habitat (both within and outside the SPA): function/supporting process - Food availability within supporting habitat: Maintain the availability of key prey items (e.g. earthworm, leatherjackets, beetles, spiders) at prey sizes preferred by Golden Plover. Maintain existing, and elsewhere restore the amount of prey-rich grassland feeding habitat within 4km of moorland nesting areas. <p>Leek Moors SSSI, which is closest to Tittesworth, lists golden plover as an interest feature, but neither of the other two species. The Peak District Moors Breeding Bird Survey 2018⁷¹ recorded the majority of golden plover in the northern Goyt Valley SSSI which is c.10km from Tittesworth.</p> <p>Merlin also has an attribute relating to food availability within offsite supporting habitat, with the following areas specifically cited; Stalybridge Moor, Thurlstone Moor and Canyards Hills. None of these locations are in proximity to Tittesworth. The Peak District Moors Breeding Bird Survey did record merlin in the Leek District SSSI.</p> <p>Short-eared owl is considered unlikely to frequently forage outside the SPA, with the following habitat requirements; “<i>Extensive, low nutrient and naturally vegetated open ground supporting abundant vole populations will provide prey source for breeding short-eared owl</i>”, and no specific areas or distances identified in the SACO for offsite habitat. No short-eared owl were recorded in Leek Moors SSSI during the Peak District Moors Breeding Bird Survey.</p> <p>The habitat bordering Tittesworth Reservoir is predominantly deciduous woodland, and therefore unlikely to support significant foraging areas for the above species.</p>	None required.	No adverse effects on conservation objectives or site integrity
	Supporting habitat (both within and outside the SPA): disturbance - Minimising disturbance caused by human activity	<p>Restrict and reduce the frequency, duration and/or intensity of disturbance affecting nesting, roosting, foraging and/or, feeding birds so that the breeding [Merlin/European golden plover/Short-eared owl] population feature is not significantly disturbed.</p>	<p><u>Noise and visual disturbance</u></p> <p>During construction of both Option 128 and 305, workforce personnel will be carrying out activities directly adjacent to the SPA and within potential offsite functional habitat.</p> <p>Literature review suggests that merlin can be habituated to road noise, but a variety of exclusions zones have been implemented around nesting sites for visual disturbance, including as little as 91m and up to 400m cited in literature⁷². There is no evidence available regarding dispersion distances/flight responses to noise.</p> <p>The Waterbird Mitigation Disturbance Toolkit considers the sensitivity of golden plover to visual and noise disturbance. It has been concluded that in an estuarine environment, they are moderately sensitive to noise and visual stimuli. A 200m exclusion zone has been considered for visual stimuli from workforces, and a noise threshold of 70dB at the receptor⁷³.</p> <p>There is limited literature available regarding the responses of short-eared owl to noise and visual stimuli. An exclusion zone of between 300 and 600m has been cited in one study gathering expert opinion on flight responses from human presence⁷⁴. There is no evidence available regarding dispersion distances/flight responses to noise.</p>	<p><u>Noise and visual disturbance</u></p> <ul style="list-style-type: none"> Avoid breeding bird period (March-August inclusive) unless it can be demonstrated that there are no breeding sites within proximity of the construction corridors, or there is sufficient evidence to demonstrate that noise and visual disturbance will not occur. <p><u>Contamination – dust and NOx</u></p> <ul style="list-style-type: none"> Complete an air quality assessment of potential for N loading on sensitive habitats once details of plant and construction programme have been confirmed (e.g. using method outlined in DMRB Air Quality 	No adverse effects on conservation objectives or site integrity

⁷¹ Moors for the Future Partnership and Natural England (March 2021) Peak District Moors Breeding Bird Survey 2018, Revised 2021.

⁷² Ruddock M and Whitfield D. P. (2007) A Review of Disturbance Distances in Selected Bird Species. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.

⁷³ N Cutts K Hemingway & J Spencer (March 2013) Waterbird Disturbance Mitigation Toolkit Informing Estuarine Planning & Construction Projects. Produced by the Institute of Estuarine & Coastal Studies (IECS) University of Hull, Version 3.2.

⁷⁴ Ruddock M and Whitfield D. P. (2007) A Review of Disturbance Distances in Selected Bird Species. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
			<p>Natural England's internal guidance also suggest that Stage 2 Appropriate Assessments are required where there is a change in baseline noise levels by 3dB.</p> <p>To ensure no adverse effects, construction should be completed outside the breeding bird period (March-August inclusive) as a worst-case. Survey work at the project-level may confirm that there are no breeding sites in proximity to pipeline routes, or functionally linked habitat.</p> <p><u>Contamination – dust and NOx loading</u></p> <p>Dust could be generated during the construction works where concrete breakout is required in the road. HGV and holding traffic by restricting flow to one lane during construction, could increase nitrogen loading on adjacent vegetation. Dust smothering and localised increases in nitrogen loading could change the availability of prey.</p> <p>Guidance provided by the Institute of Air Quality Management⁷⁵ specific to the assessment of dust from construction and demolition identifies that deposition could be an issue up to 50m from the boundary of the site and 50m from haulage routes used by construction vehicles for up to 500m from a large construction site, 200m from a medium construction site and 50m from a small construction site. Evidence from the Dibden Bay Public Inquiry suggests that vegetation soiling from large construction sites, operating for more than a year, could occur up to 100m, and 25m with mitigation⁷⁶.</p> <p>Given the small size of the construction activity, it is assumed that vegetation soiling could occur over 50m without mitigation. Therefore, the area that could be affected by dust deposition for Option 305 is estimated to be 1ha within the SPA, and 12.6ha of offsite functional habitat. Given the overall area of the SPA (45,270.52ha) and temporary nature of the works, significant adverse effects to the breeding population are considered unlikely.</p> <p>The potential for impacts from the Option 128 pipeline are less well defined as the use of offsite functionally linked habitat is unclear. However, works on the pipelines at Leek are most likely to give rise to adverse effects, and as such, mitigation measures for dust and air quality emissions should be implemented.</p>	<p>Appendix F).</p> <ul style="list-style-type: none"> If air quality assessment identifies an exceedance of the critical load due to stationary traffic being held as pipeline is installed in road, traffic must be diverted or other traffic management measures put in place to ensure critical load, and therefore an adverse effect on the site, is avoided. Dust suppression measures including dampening and dust screens to be applied to reduce dispersion to minimum distance. <p><i>General</i></p> <ul style="list-style-type: none"> A Construction Management Plan will be drawn up to detail all exclusion and protection measures. All of the above mitigation measures will be monitored and enforced by an on-site Environmental Clerk of Works. 	

⁷⁵ Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction. IAQM, London

⁷⁶ Technical Statement TS/AQ1, Association of British Ports (ABP), 2000.

8. STAGE 2 APPROPRIATE ASSESSMENT: SEVERN ESTUARY/MÔR HAFREN SAC AND SEVERN ESTUARY RAMSAR

8.1 INTRODUCTION

The following preferred plan options have been screened in as potentially impacting the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar:

- 33 Shelton WTW Expansion partially supported by UU release from Vyrnwy (25MI/d): **construction and operation**
- 66 Strensham WTW Expansion partially supported by UU release from Vyrnwy (25MI/d): **construction and operation**
- 143 W.Midlands Raw Water Storage: **construction and operation**
- 429 Mythe WTW DO Recovery: **operation**

The Severn Estuary/Môr Hafren SAC is designated for the following 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
- H1170 Reefs
- H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritima*)
- S1095 Sea lamprey, *Petromyzon marinus*
- S1099 River lamprey, *Lampetra fluviatilis*
- S1103 Twaite shad, *Alosa fallax*

A number of options, particularly 33 and 66, could be supported by releases by United Utilities from Lake Vyrnwy. In the WRMP, Severn Trent included an assessment of option 303C for a 25MI/d release. This has subsequently been removed on the understanding that UU have the water available to allow the transfer and have completed their own environmental assessments as part of the Strategic Resource Option for RAPID. The modelling and assessments carried out during the RAPID Gate 2 process for the STT SRO found that releases of 25MI/d were compliant with HRA (and WFD) assessments, which is why this value has been carried forward in the WRMP plans. However, feedback from the Environment Agency on Severn Trent's WRMP24, requested that the 25MI/d transfer from UU, to be used at either Shelton or Strensham WTW, needs to be shown as a standalone transfer from UU in the plan. Severn Trent has therefore incorporated the necessary assessments of the 25MI/d release into the options, for Options 33 and 66. This Stage 2 Appropriate Assessment has assessed Options 33 and 66 with reference to include the Vyrnwy release and based on both schemes being in operation utilising the full benefit

It is anticipated that United Utilities will release water into the River Severn 15% of the time to support downstream abstraction at times when river flows are low. At all other times it is assumed that abstraction can continue without support from Vyrnwy release. Severn Trent will use existing assets to abstract the water and will be within licence. However, due to the delay in delivery of the UU trade, the full benefit in operation will not be realised until 2033. Further operational detail will be developed as the scheme progresses alongside the required environmental assessment.

Severn Trent are committed to extending the work beyond WRMP24 submission on the Severn Estuary SAC and Ramsar. This being because Severn Trent are scoping the work required for the drought plan options on the Severn, the STT SRO is progressing modelling work during Gate 3 of the RAPID process and there is the ongoing review of the River Severn Regulation by Environment Agency, Natural England and Natural Resources Wales. There needs to be a consistent approach across these workstreams to ensure outputs are appropriate to progress options under different planning regimes. There are multiple projects currently underway, which when complete, will require further development and refinement of the in-combination assessment presented in WRMP24 HRA. It is for these projects to assess the individual impact and the in-combination effects to the Severn Estuary SAC at the time of their submission. The current indicative timelines for this work are outlined below:

- **Pre application for the 25MI/d Vyrnwy to River Severn Transfer and River Severn abstraction:** Severn Trent submitted the pre-application in January 2024. The Environment Agency provided their response in August 2024 and NRW responded in December 2024. Full licence applications by end of 2025.
- **Shropshire Groundwater Scheme (SGS) review:** technical report expected to be complete in December 2025. Stress testing, engagement on options/impacts and any decisions on licences would extend beyond this.
- **Severn Trent's Drought Plan:** Draft submission of the Drought Plan is expected to be completed in October 2025.
- **River Severn Drought Order (RSDO):** expected to be completed in 2027.
- **River Severn Regulation Review (RSRR):** the indicative programme is expected to be completed in 2028 and covers updating the evidence base, models and understanding. These will need to continue to be maintained and improved, it is anticipated the review will continue in some form on a cyclical basis to link into the WRMP cycle post WRMP29.
- **Severn Thames Transfer (STT Strategic Resource Option (SRO):** Severn Trent, United Utilities, Thames Water's STT SRO is on hold.
 - The soonest Thames could start construction of STT is in July 2034, for use in 2039. However, this would require a change in their WRMP for this scheme to come back online. If activated as a scheme, the 9 year period to start of construction would allow time for full understanding of the HRA effects of this project.
 - United Utilities 25MI/d release from Vyrnwy Reservoir is due for completion in 2033 (part of Severn Trent's WRMP and a proof of trading concept project the STT SRO)
 - The STT schemes all work on the put and take concept, minus losses, therefore Severn Trent don't see flow changes of fresh water entering the Severn Estuary from the River Severn. This has been modelled using a PYWR hydrologic/water resources model.

This section provides the outcomes of the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar Stage 2 Appropriate Assessment where the effects of the WRMP24 options operating 'in-combination' have been explored. **Section 17** presents the between company strategic in-combination effects. This is based on the information available at the time to support our revised draft WRMP24. For other water companies WRMPs, this is either their published draft plans (dWRMPs (Bristol Water, Wessex Water)) or where they have been made available, their revised draft plans (rdWRMPs (Dŵr Cymru Welsh Water, South Staffordshire and United Utilities)). In addition, Severn Trent continue to engage with the Environment Agency, Natural England and Natural Resources Wales to define the scope of supporting environmental evidence and appropriate assessment needed to support the abstraction licence applications for the AMP8 Shelton and Strensham schemes.

The above list is not exhaustive and there may be additional projects over the next 5 years (before the next WRMP HRA produced in WRMP29).

As the proposed WRMP supply schemes are progressed to project delivery phase, any future licence applications will consider any potential HRA impacts (individual and in-combination) through the normal process as part of Severn Trent's due diligence. Severn Trent will engage with EA, NRW and NE at these suitable points.

Severn Trent will not implement any of the proposed options which have the potential to impact the Severn Estuary SAC prior to appropriate assessments being completed and agreed with regulators and where where relevant, they will provide a progress update through its annual review of its WRMP.

8.2 SITE SUMMARY

8.2.1 Site description⁷⁷

The Severn Estuary has been designated an SAC on the basis that it supports occurrences of habitat types and species listed in Annexes I and II respectively of the Habitats Directive that are considered important in a European context and meeting the criteria in Annex III of the Directive.

The designation includes an overarching “estuaries” feature within which subtidal sandbanks, intertidal mudflats and sandflats, Atlantic salt meadows and reefs (of *Sabellaria alveolata*) and three species of migratory fish are defined as both features in their own right and as sub-features of the estuary feature.

In addition hard substrate habitats including eel grass beds, the estuary-wide assemblage of fish species and the assemblage of waterfowl species (for which the Ramsar Site and SPA are specifically designated) are identified as notable estuarine assemblages which are an intrinsic part of the estuary ecosystem – these are therefore covered by the “estuaries” feature.

8.2.2 Qualifying features screened into Stage 2 Appropriate Assessment: baseline

8.2.2.1 Sandbanks which are slightly covered by sea water all the time

Sandbanks which are slightly covered by sea water all the time (subtidal sandbanks) consist of sandy sediments that are permanently covered by shallow sea water, typically at depths of less than 20 m below chart datum (but sometimes including channels or other areas greater than 20 m deep). The habitat comprises distinct banks (i.e. elongated, rounded or irregular ‘mound’ shapes) which may arise from horizontal or sloping plains of sandy sediment. Where the areas of horizontal or sloping sandy habitat are closely associated with the banks, they are included within the Annex I type.

Sandbanks which are slightly covered by sea water all the time occur widely on the Atlantic coasts of north-west Europe, and occur widely around the UK coast. They are widespread in inshore waters (within 12 nautical miles of the coast) and also occur offshore in the southern North Sea and in the Irish Sea (between 12 and 200 nautical miles).

The UK SAC series includes large sublittoral sandbanks showing good habitat structure and function. The selected sites represent the range of variation within the four main sub-types (gravelly and clean sands, muddy sands, eelgrass beds, and maerl beds), which are often associated with different physiographic features (e.g. estuaries, open coast, bays, sea lochs). The differing character of this habitat around the UK coast has also been taken into account.

The Severn Estuary subtidal sandbanks can be considered to contribute to the gravelly and clean sand sandbank resource. The Severn Estuary contributes approximately 3% of the UK Natura 2000 resource for subtidal sandbanks, by area.

8.2.2.2 Estuaries

Estuaries are habitat complexes which comprise an interdependent mosaic of subtidal and intertidal habitats, which are closely associated with surrounding terrestrial habitats. Many of these habitats, such as mudflats and sandflats not covered by sea water at low tide, saltmarshes, sandbanks which are slightly covered by sea water all the time and reefs, are identified as Annex I habitat types in their own right.

Estuaries are defined as the downstream part of a river valley, subject to the tide and extending from the limit of brackish water. There is a gradient of salinity from freshwater in the river to increasingly marine conditions towards the open sea.

Estuaries are widespread throughout the Atlantic coasts of Europe. Approximately one-quarter of the area of estuaries in north-western Europe occurs in the UK. The UK has over 90 estuaries¹⁸.

Sites represents the geographical range of estuaries in the UK, and to encompass examples of the four geomorphological sub-types (coastal plain, bar-built, complex, and ria estuaries) and the associated range of communities. Selection has generally favoured larger estuaries, as they display a wider variety of habitats, but

⁷⁷ Natural England & The Countryside Council for Wales (2009) *The Severn Estuary/ Môr Hafren European Marine Site*.

smaller estuaries have also been selected where they have specific features of interest, such as undisturbed transitions from marine to terrestrial habitats, or are representative of a particular geomorphological sub-type.

The Severn Estuary is the largest example of a coastal plain estuary in the UK, and one of the largest estuaries in Europe. It contributes approximately 30% of the UK Natura 2000 resource for estuaries, by area.

8.2.2.3 *Mudflats and sandflats not covered by seawater at low tide*

Intertidal mudflats and sandflats are submerged at high tide and exposed at low tide. They form a major component of Estuaries and Large shallow inlets and bays in the UK but also occur extensively along the open coast and in lagoonal inlets. The physical structure of the intertidal flats ranges from mobile, coarse-sand beaches on wave-exposed coasts to stable, fine-sediment mudflats in estuaries and other marine inlets. This habitat type can be divided into three broad categories (clean sands, muddy sands and muds), although in practice there is a continuous gradation between them. Within this range the plant and animal communities present vary according to the type of sediment, its stability and the salinity of the water.

Mudflats and sandflats not covered by sea water at low tide are a widespread habitat type on coasts of Atlantic Europe, particularly around the North Sea, and occur widely throughout the UK.

The intertidal part of the Severn Estuary supports extensive mudflats and sandflats. These cover an area of approximately 20,300 ha - the fourth largest area in a UK estuary and representing approximately 7 % of the total UK resource of this habitat type (approximately 10% of the UK Natura 2000 resource for Intertidal mudflats and sandflats, by area.²⁴). The intertidal mudflats and sandflats of the Severn Estuary are representative of estuarine mudflats and sandflats influenced by strong tidal streams and extreme silt loading.

8.2.2.4 *Reefs*

Reefs are rocky marine habitats or biological concretions that rise from the seabed. They are generally subtidal but may extend as an unbroken transition into the intertidal zone, where they are exposed to the air at low tide. Intertidal areas are only included within this Annex I type where they are connected to subtidal reefs. Reefs are very variable in form and in the communities that they support. Two main types of reef can be recognised: those where animal and plant communities develop on rock or stable boulders and cobbles, and those where structure is created by the animals themselves (biogenic reefs).

Rocky reefs are extremely variable, both in structure and in the communities they support. A wide range of topographical reef forms meet the EU definition of this habitat type. These range from vertical rock walls to horizontal ledges, sloping or flat bed rock, broken rock, boulder fields, and aggregations of cobbles. In contrast to the variety of rocky reefs, there is somewhat less variation in biogenic reefs, but the associated communities can vary according to local conditions of water movement, salinity, depth and turbidity. The main species which form biogenic reefs in the UK are blue mussels *Mytilus edulis*, horse mussels *Modiolus*, ross worms *Sabellaria* spp., the serpulid worm *Serpula vermicularis*, and cold-water corals such as *Lophelia pertusa*.

Reefs occur widely around the UK coast, and are found in both inshore and offshore waters. There is a far greater range and extent of rocky reefs than biogenic concretions. Only a few invertebrate species are able to develop biogenic reefs, and these have a restricted distribution and extent in the UK. The Severn Estuary has areas of biogenic reefs, formed by the tube-dwelling polychaete worm *Sabellaria alveolata*. *Sabellaria alveolata* reefs in the UK are predominantly an intertidal habitat but the Severn Estuary is one of the few places where *Sabellaria alveolata* reefs occur extensively in the subtidal, as well as the intertidal.

8.2.2.5 *Atlantic salt meadows (Glauco-Puccinellietalia maritimae)*

Atlantic salt meadows develop when halophytic vegetation colonises soft intertidal sediments of mud and sand in areas protected from strong wave action. This vegetation forms the middle and upper reaches of saltmarshes, where tidal inundation still occurs but with decreasing frequency and duration. A wide range of community types is represented and the saltmarshes can cover large areas, especially where there has been little or no enclosure on the landward side. The vegetation varies with climate and the frequency and duration of tidal inundation. Grazing by domestic livestock is particularly significant in determining the structure and species composition of the habitat type and in determining its relative value for plants, for invertebrates and for wintering or breeding waterfowl.

This Annex I type is predominantly found on Atlantic coasts in western Europe. Atlantic salt meadows occur on North Sea, English Channel and Atlantic shores. There are more than 29,000 ha of the habitat type in the UK, mostly in the large, sheltered estuaries of south-east, south-west and north-west England and in south Wales. Smaller areas of saltmarsh are found in Scotland.

The Severn Estuary are for the most part the largest examples of this habitat type, with good structure and function, and which support a well-developed zonation of plant communities within the saltmarsh. There are transitions to other high-quality habitat assemblages at many of the sites that have been selected. Sites with complete sequences of vegetation and transitions to other habitats, such as sand dunes, represent the range of variation of the habitat type, and this has been an important consideration in site selection. The Severn Estuary holds the largest aggregation of saltmarsh in the south and south-west of the UK. It covers approximately 1,400 ha, representing about 4% of the total area of saltmarsh in the UK.

8.2.2.6 *Sea lamprey and river lamprey*

The river and sea lamprey are a primitive type of fish having a distinctive suckered mouth but no jaws. Although numbers of lamprey have declined over the last 100 years, the UK is still one of their strongholds. River lamprey are distributed from the western Mediterranean to southern Norway, and sea lamprey can be found from northern Norway to western Mediterranean and eastern North America. In Britain, the ammocoetes of lamprey occur in silt beds in many rivers from northern Scotland southwards. Although for sea lamprey they are now absent from many northern rivers. Occasionally, they are found in suitable silts in large lakes. They are absent from a number of rivers because of pollution or obstacles that the adults cannot surmount during the spawning migration, such as natural waterfalls or artificial dams. Other threats include pollution and channelisation⁷⁸.

Sea and river lampreys spend their adult life in the sea or estuaries but spawn and spend the juvenile phase in rivers. They use the Severn Estuary as a migratory passage to and from their spawning and nursery grounds in the rivers.

The sea and river lamprey population of the Severn depends on habitat in the adjacent River Usk SAC, River Wye SAC and River Severn. The habitats in these rivers, including spawning and nursery areas, are essential for the fulfilment of the species' lifecycle⁵⁴.

8.2.2.7 *Twaite shad*

Twaite shad are the only two members of the herring family found in fresh water in the UK. A major part of the spawning population of shad consists of fish that have spawned and passed up and down through the estuary more than once. The shad enter estuaries in spring and move up into the rivers to spawn. The Severn estuary serves as a nursery area for juvenile shad where they feed on plankton.

Twaite shad are present along the western coastline of Europe. From southern Norway to the eastern Mediterranean Sea for twaite shad. Species numbers have declined throughout Europe. The twaite shad is known to have more stable populations in the River Severn, River Wye, River Usk and the River Tywi.

The twaite shad population of the Severn depends on habitat in the adjacent River Usk SAC, River Wye SAC and River Severn. The habitats in these rivers, including spawning and nursery areas, are essential for the fulfilment of the species' lifecycle.

8.2.3 Condition, threats, and pressures

There are three SSSIs underpinning Severn Estuary/Môr Hafren SAC;

- Bridge Water Bay SSSI (ST 268 491) – there are 30 live of lowland neutral grassland and littoral sediment units for this site: 88.42% favourable, 11.28% unfavourable- recovering, 0.29% unfavourable- no change. Inappropriate water levels have been cited as a reason for unfavourable condition.
- Severn Estuary SSSI (ST 529 870) – there are 82 live units of littoral sediment, littoral rock and neutral grassland for this site: 92.71% favourable, 0.08% unfavourable- recovering, 5.54% unfavourable- no change, 1.67% unfavourable- declining. Undergrazing, overgrazing and disturbance are cited as reasons for unfavourable condition.
- Upper Severn Estuary SSSI (SO 716 063) – there are 11 live units of lowland neutral grassland, littoral sediment and improved grassland for this site: 85.85% favourable, 3.31% unfavourable- recovering, 10.84% unfavourable- declining.

⁷⁸ Maitland P. S (2003) *Ecology of the River, Brook and Sea Lamprey*. Conserving Natura 2000 Rivers. Ecology Series 5. English Nature, Peterborough.

The SIP threats and pressures for Severn Estuary/Môr Hafren SAC, relevant to the types of impact pathways from the WRMP options are;

- Public access/ disturbance - H1130 Estuaries, H1170 Reefs, H1330 Atlantic salt meadows.
- Physical modification - S1095 Sea lamprey, S1099 River lamprey, S1103 Twaite shad.
- Impacts of development - H1130 Estuaries, H1140 Intertidal mudflats and sandflats, H1170 Reefs, H1330 Atlantic salt meadows, S1095 Sea lamprey, S1099 River lamprey, S1103 Twaite shad.
- Coastal squeeze - H1130 Estuaries, H1140 Intertidal mudflats and sandflats, H1170 Reefs, H1330 Atlantic salt meadows.
- Change in land management - H1130 Estuaries, H1330 Atlantic salt meadows.
- Changes in species distributions - H1170 Reefs, S1095 Sea lamprey, S1099 River lamprey, S1103 Twaite shad.
- Water pollution - H1110 Subtidal sandbanks, H1130 Estuaries, H1140 Intertidal mudflats and sandflats, H1170 Reefs, H1330 Atlantic salt meadows, S1095 Sea lamprey, S1099 River lamprey, S1103 Twaite shad.
- Air pollution: impact of atmospheric nitrogen deposition - H1130 Estuaries, H1330 Atlantic salt meadows, S1095 Sea lamprey, S1099 River lamprey, S1103 Twaite shad.
- Fisheries: recreational marine and estuarine - H1140 Intertidal mudflats and sandflats, H1170 Reefs, H1330 Atlantic salt meadows, S1095 Sea lamprey, S1099 River lamprey, S1103 Twaite shad.
- Invasive species - H1130 Estuaries, H1140 Intertidal mudflats and sandflats, H1170 Reefs, H1330 Atlantic salt meadows.

8.2.4 Information available from the Severn Thames Transfer Strategic Resource Option⁷⁹

The baseline monitoring programme for the Severn Thames Transfer SRO, consisting of a review of Environment Agency and Natural Resources Wales data as well as targeted surveys for STT, has confirmed that the fish community within the River Severn and associated tributaries consisting of several species that are considered sensitive to changes in water quality, flow and habitat. This includes Atlantic salmon *Salmo salar* (Annex II species), sea/brown trout *Salmo trutta*, allis *Alosa* and twait shad *Alosa fallax* (both Annex II species), river lamprey *Lampetra fluviatilis*, sea lamprey *Petromyzon marinus* and brook lamprey *Lampetra planeri* (all Annex II species); bullhead *Cottus gobio* (Annex II species), and European eel *Anguilla anguilla*. However, the targeted survey work has focussed on locations relevant to the SRO, and therefore are dominated by locations on the River Vyrnwy and at Deerhurst.

8.2.4.1 Summary of findings for River Vyrnwy reach between Vyrnwy Reservoir and River Severn: relevant to Options 33 and 66

The STT Gate 2 Fisheries Assessment report split this reach into two; one from Vyrnwy Reservoir to Llanymynech and the second from Llanymynech to the confluence with the River Severn.

Vyrnwy Reservoir to Llanymynech

It is well known that the waterfalls at Dolanog creates a natural barrier that presents the upstream limit for migratory species such as Atlantic salmon, sea lamprey, river lamprey and European eel. Downstream of the waterfall, the river widens, and extensive riffle and rapids provides excellent spawning and juvenile habitats for salmonids. Downstream of the confluence with the River Banwy up to the Llanymynech area, the river changes again and it becomes much wider with less overhanging trees. Riffle/rapid habitat becomes less dominant with much deeper pools present, interspersed by long run/glide habitats. Habitat mapping also suggests that suitable shad spawning habitat is present throughout the River Vyrnwy.

Walkovers completed in 2021 of the River Vyrnwy, downstream of Dolanog Falls, in January 2021 found frequent areas of appropriate juvenile salmonid habitat, with suitable depth, velocity and substrate, most notably for parr. Connectivity between areas of juvenile habitat within the watercourse is considered good, with areas of run and glide interspersed with regularity across the full length of the survey reach. The conditions within the reach also provide suitable connectivity for upstream and downstream migrating fish.

⁷⁹ Taken from the STT Gate 2 Fisheries Assessment report (Accessed at [STT-G2-S3-114-Fisheries-Assessment.pdf \(severntrent.com\)](#)) and STT Gate 2 Fisheries Evidence (Accessed at [STT-G2-S3-106-Fisheries-Evidence.pdf \(severntrent.com\)](#))

Walkovers completed in 2022 also identified lamprey spawning habitat in the River Vyrnwy with ammocoete habitat mapping also showing optimal and sub-optimal ammocoete habitat in the River Vyrnwy. Shad spawning habitat has also been identified within the reaches of the River Vyrnwy but there are no records of shad being found within the Vyrnwy catchment.

Llanymynech to confluence with River Severn

The available data indicate that the fish community within the reach (River Vyrnwy Llanymynech to the River Severn confluence) consists largely of European eel, bullhead, lamprey species, stone loach, Atlantic salmon, brown trout, minnow and three spined stickleback. An individual grayling was also observed in 2009. The lower river within this reach remains characterised by a mixture of low and moderate energy flow types, with runs and riffles predominating and occasional glides and pools. Sediment bars are abundant throughout the reach, with particularly extensive point bars and most are unvegetated. In several areas, the bars create a wide diversity of flow habitats, while there are a number of complex side channels around several of these point bars related to channel migration and there are a number of cut-off meanders along the reach

Walkover surveys completed in 2022 also identified lamprey spawning habitat in the River Vyrnwy with ammocoete habitat mapping also showing optimal and sub-optimal ammocoete habitat in the River Vyrnwy. Sea lamprey eDNA has also been confirmed in the lower reaches of the River Vyrnwy⁸⁰. Shad spawning habitat has also been identified in the reaches of the River Vyrnwy.

8.2.4.2 Summary of findings for River Severn reach between the River Vyrnwy confluence and Bewdley: relevant to Options 33 and 143

The river is characterised by a mixture of deep glides and runs, with occasional riffle sections. Sediment bars are rare throughout the reach, although there are multiple islands scattered throughout the reach. The reach is of a very low gradient, and is fairly sinuous. River channel widths vary from ~40-45m throughout the majority of the reach.

The STT Fisheries Evidence Report indicates that the fish community of this reach of the River Severn is diverse and representative of the dominant habitats. Several species dominate the fish community in most years including: Three spined stickleback, barbel, bleak (*Alburnus alburnus*), bullhead, chub, dace, gudgeon (*Gobio gobio*), minnow, roach, ruffe (*Gymnocephalus cernua*) and stone loach. Perch (*Perca fluviatilis*) and pike (*Esox Lucius*) are also observed frequently at some sites. Less frequent is the occurrence of species such as lamprey and Atlantic salmon in the community. European eel has also been recorded throughout the reach with individuals varying from 17-700 mm. The highest abundances have been recorded at the Shrewsbury fish pass in 2014.

There are few areas of essential habitat on the lower and middle reaches of the River Severn for salmonid fish. These reaches also serve as a migration route for adult fish (upstream) and smolts (downstream). Areas of key spawning and nursery habitat are known to occur on the upper River Severn and several larger tributaries, including the River Tanat, River Vyrnwy and the River Rhiw. The "Unlocking the Severn"⁸¹ (UtS) project reintroduced free passage to 158 miles of river, previously blocked off in the 1840s to migratory species such as shad and ensures access to areas of essential habitat going forward. However, it should be noted that no historical records of shad have been recorded within this section of the waterbody. The reach additionally provides some limited nursery habitat for salmonids, although the reach is considered of significant importance for juvenile coarse fish and lamprey ammocoete habitat.

8.2.4.3 The River Severn from Bewdley to the confluence with the River Avon: relevant to Option 66

A total of thirty species of fish have been recorded across 39 sites on the River Severn, including the tributaries associated with this reach. Species captured during surveys are predominantly coarse fish with a medium – high tolerance to environmental pressures such as; chub, roach, gudgeon, dace and minnow present at more than half of sites. Bullhead are also present at more than half of sites and represent the most prevalent low tolerance species within the dataset. Migratory species European eel are also recorded at the majority of sites and Atlantic salmon are also recorded relatively frequently, present at 14 sites, whereas sea/ brown trout are recorded at five sites.

⁸⁰ Jason Jones, NRW Fisheries Technical Specialist, Pers Comm.

⁸¹ Unlocking the Severn. A partnership between Canal & Rivers Trust; Severn Rivers Trust; Environment Agency and Natural England. Available at: <https://www.unlockingthesevern.co.uk> Accessed on: 19/08/2022.

There are few areas of essential habitat on the lower and middle reaches of the River Severn for salmonids. Instead, these areas serve as a migration route for adult fish (upstream) and smolts (downstream). Areas of key spawning and nursery habitat are known to occur on the upper River Severn and several larger tributaries, including the River Tanat, River Vyrnwy and the River Rhiw.

This reach also provides migratory passage for Atlantic salmon to the River Clun Special Area of Conservation (SAC), with the reach again benefiting from the reconnectedness efforts of the UtS82 project (e.g., positive eDNA detection of migrating shad between 2017-2019)⁸³. The site is designated for freshwater pearl mussel (*Margaritifera margaritifera*). The freshwater pearl mussel life cycle involves an adult stage, living as a filter feeder, a juvenile stage living interstitially in sediment, and a larval (or glochidial) stage living attached to the gills of trout or salmon. All life stages are important, as is the viability of the host species of fish, such as the Atlantic salmon that migrate to the site via the River Severn. The Conservation Objectives for the River Clun SAC indicate that favourable condition status for this site is dependent upon maintaining the free movement of the host fish population for freshwater pearl mussel, both into, and through the SAC river catchment.

8.3 ASSESSMENT OF EFFECTS

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 8-1**.

8.3.1 Construction

All three options will require new river intakes, Options 33 and 143 in the locality of Shrewsbury and Option 66 in the locality of Upton-on-Severn. The potential works to construct new intakes therefore have the potential to result in the following effects:

- Loss of offsite functionally linked habitat – potential that new intakes could remove suitable habitats for designated fish species.
- Disturbance – underwater noise and vibration causing disruption to migration patterns.
- Water quality – accidental oil spills, sediment laden runoff.
- Biological disturbance – introduction of non-native invasive species.

There is also an in-combination issue with removal of habitat in three locations along the River Severn, subject to suitability for migratory fish.

8.3.2 Operation

8.3.2.1 Option 33

Option 33 would lead to the expansion of Shelton WTW by 18MI/d, plus use of the 25MI/d release from Vyrnwy Reservoir. It is not certain by how much the abstraction from the River Severn to supply Shelton WTW will increase by, however, the increase will be within existing license conditions, although potentially above recent actual. Increased abstraction on the River Severn could impact migratory fish passage and reduce the freshwater flows into the estuary, with impacts to the sub-features, and also result in habitat deterioration to the reach downstream of the abstraction.

8.3.2.2 Option 66

Option 66 would lead to the expansion of Strensham WTW by 30MI/d, plus use of the 25MI/d release from Vyrnwy Reservoir. Increased abstraction on the River Severn could impact migratory fish passage and reduce the freshwater flows into the estuary, with impacts to the sub-features, and also result in habitat deterioration to the reach downstream of the abstraction.

8.3.2.3 Option 143

Option 143 will increase abstraction on the River Severn by c.100MI/d during periods of high flow only. Increased abstraction on the River Severn could impact migratory fish passage and reduce the freshwater

⁸² Unlocking the Severn. A partnership between Canal & Rivers Trust; Severn Rivers Trust; Environment Agency and Natural England. Available at: <https://www.unlockingthesevern.co.uk> Accessed on: 19/08/2022.

⁸³ Antognazza, C.M., Britton, J.R., De Santis, V., Kolia, K., Turunen, O.A., Davies, P., Allen, L., Hardouin, E.A., Crundwell, C., & Andreou, D. Environmental DNA reveals the temporal and spatial extent of spawning migrations of European shad in a highly fragmented river basin. *Aquat. Conserv.* 31(8), pp. 2029-2040 (2021).

flows into the estuary, with impacts to the sub-features, and also result in habitat deterioration to the reach downstream of the abstraction.

8.3.2.4 Option 429

Option 429 would lead to allow for an additional 21Ml/d to be abstracted at the Mythe abstraction on the River Severn. This could impact migratory fish passage and reduce the freshwater flows into the estuary, with impacts to the sub-features, and also result in habitat deterioration to the reach downstream of the abstraction.

To summarise, the relevant impact pathways from the above options are considered to be:

- Increased velocities (25Ml/d Vyrnwy Reservoir release), and the resulting impact on the upstream and/or downstream migration of Atlantic salmon, sea / brown trout, shad (considering the Unlocking the Severn Scheme) and European eel.
- Reduced velocities in downstream reach and the resulting impact on the upstream and/or downstream migration of Atlantic salmon, sea / brown trout, shad (considering the Unlocking the Severn Scheme) and European eel.
- Loss/decrease in habitat quantity and quality due to changes in hydraulics resulting in increased competition for space.
- Loss of juvenile and adult habitats within margins due to decreased wetted width and velocities, including habitats for lamprey ammocoetes.
- Risk of displacement of juvenile fish due to increased flows (25Ml/d Vyrnwy Reservoir release).
- Changes in water quality could have a direct impact on fish populations (e.g. mortality as a result of localised dissolved oxygen sags).
- Changes in the availability of food (biofilm, macrophytes, macroinvertebrates) due to changes in flows and changes in water quality.
- Reduction in freshwater input into the estuary.

8.4 UNCERTAINTIES

Hydrological modelling has yet to be completed for the options to understand the length of impacted reach downstream of the intakes, and potential changes to velocity, wetted width and water quality. The assessments completed within this HRA have used information available from the Severn Thames Transfer SRO work on likely species within the reaches and hydrology assessment undertaken. The latter is a high level hydrological assessment using readily available flow and level data (hydrology data explorer and NRFA) to characterise how the flow regime of the impacted rivers might change as a result of the operation of the options.

There is limited understanding of the distribution of the qualifying features within the wider River Severn catchment, passability of existing weirs, and therefore extent of offsite functionally linked habitat. Baseline surveys of the affected reaches (habitat and barriers) should be undertaken to support the project-level HRAs and determine the extent of habitat to be lost, and which species of the migratory fish population this would impact.

Given the complexity of the operating regime on the River Severn, once available to Severn Trent, the hydrological model from the STT SRO should be used to test the impacts of the changes/new abstractions both alone and in-combination to verify the conclusions within this report and support a project-level HRA.

Table 8-1 Information to inform an assessment of adverse effects on the Severn Estuary SAC and Ramsar

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
CONSTRUCTION PHASE					
H1130 Estuaries (encompassing all sub-features)	Water quality –physico-chemical parameters (Including temperature, salinity, oxygen, nutrients, pH and turbidity etc)	<p>Physico-chemical parameters should not pose a risk to the ecology of the habitats and species of the SAC, SPA or Ramsar Site.</p> <p>Levels should comply with targets established under the EA Review of Consents and the Water Framework Directive.</p>	<p><i>Options 33, 66 and 143</i></p> <p>Construction of a intakes within the River Severn will likely require a cofferdam and piling works. The extent of land-take within the River Severn is uncertain, as is the use of the habitat by the migratory fish species. The potential for underwater noise and vibration to disturb and disrupt movement along the watercourse could also be an issue, altering migratory patterns and recruitment. Construction of the intakes will need to be timed to avoid the most sensitive periods for migration. Water quality issues whilst working in the watercourses including site-derived pollutants and release of fine sediments will need to be managed.</p> <p>In addition to the impacts of the construction works, the inclusion of new intakes on the River Severn could lead to fish mortality and a reduction in the overall population size through entrainment and impingement. The screening of the intakes will need to be adequately designed to address these issues and avoid loss of recruitment of the migratory fish species.</p>	<p><u>Loss of functionally linked habitat</u></p> <ul style="list-style-type: none"> Design intakes to minimise loss of functionally linked habitat, the presence of which will need to be identified through site specific surveys. <p><u>Disturbance</u></p> <ul style="list-style-type: none"> Restrict work between 1st November to 31st May to avoid impacts to migratory fish. Carry out a fish rescue when using a cofferdam/portadam. Complete a pre-works fish habitat survey and assessment, and lamprey assessment. <p><u>Water quality</u></p> <ul style="list-style-type: none"> Adherence to EA Pollution Prevention Guidelines (now archived) and NRW, SEPA's Guidance on Pollution Prevention including Works and Maintenance in or near Water (2017). <p><u>Impingement and entrainment</u></p> <ul style="list-style-type: none"> Intake to be screened and designed in accordance with best practice⁸⁴. <p><u>General</u></p> <ul style="list-style-type: none"> A Construction Management Plan will be drawn up to detail all exclusion and protection measures. All of the above mitigation measures will be monitored and enforced by an on-site Environmental Clerk of Works. 	No adverse effects on conservation objectives or site integrity
OPERATION PHASE					
River lamprey Sea lamprey	Migratory access	<ul style="list-style-type: none"> Water quality is sufficient to support migratory passage. Levels (for temperature, salinity, turbidity, pH, and dissolved oxygen) should comply with targets established under the EA Review of Consents and the Water Framework Directive. Water flows: Flows from the rivers Wye, Usk and Severn into the estuary must be sufficient to allow migration. Physical barriers: No artificial barriers significantly impairing adults from reaching existing and historical spawning grounds or juveniles from moving downstream. 	<p><i>Option 33 (abstraction)</i></p> <p>This option would lead to an increase in the capacity of Shelton WTW by 18MI/d to maximise the license capacity of the intakes on the River Severn. The scheme would be operational year round however, under low flow conditions (15% of the time), 10.5MI/d would be supported with release from Vyrnwy Reservoir.</p> <p>There are no NRFA flow gauges in proximity to the Shelton Intake. As such, a combination of the flows from the Severn at Montford (54005) and Perry at Yeaton (54020) NRFA flow gauges have been used to get an understanding of the baseline flows for the abstraction point. This likely underrepresents the flows with several ungauged tributaries entering the River Severn between Montford flow gauge and the Shelton Intake. Based on this, the Q95 flow at the abstraction point is 386.2MI/d and the Q70 is 646MI/d. A reduction in these flows by 18 MI/d would lead to a 4.6% reduction and 2.8% reduction in Q95 and Q75 flows, respectively, downstream of the Shelton Intake. This flow reduction is expected to be insufficient to cause any pathways to impact the aquatic ecology in the River Severn.</p> <p>The STT survey work suggests the reach between the River Vyrnwy confluence and Bewdley provides limited habitat for salmonids, but lamprey habitat is present, although the species are less frequently recorded. Although hydrological modelling will be required to determine the impacted reach, and project level-specific surveys undertaken, the potential for AEoI is considered unlikely.</p>	None required.	No adverse effects on conservation objectives or site integrity
Ramsar criterion 4: Run of migratory fish species	The feature will be considered to be in favourable condition when, subject to natural		<p><i>Option 66 (abstraction)</i></p>	None required.	No adverse effects on conservation objectives or

⁸⁴ Environment Agency (2005) Screening for Intake and Outfalls: a best practice guide Science Report SC030231. Accessed at [Microsoft Word - W6_103 TR amended 1.doc \(publishing.service.gov.uk\)](#).

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
<p>Sea Lamprey <i>Petromyzon marinus</i></p> <p>River lamprey <i>Lampetra fluviatilis</i></p> <p>Twaite shad <i>Alosa fallax</i></p> <p>Allis shad <i>Alosa</i></p> <p>Atlantic salmon <i>Salmo salar</i></p> <p>Sea trout <i>S. trutta</i></p> <p>European eel <i>Anguilla anguilla</i>.</p> <p>Ramsar criterion 8: fish of the whole estuarine and river system</p> <p>110 species recorded</p>	<p>processes, each of the following conditions are met:</p>	<p>– i. the migratory passage of both adults and juveniles of the assemblage of migratory fish species through the Severn Estuary between the Bristol Channel and any of their spawning rivers is not obstructed or impeded by physical barriers, changes in flows, or poor water quality;</p> <p>– ii the size of the populations of the assemblage species in the Severn Estuary and the rivers which drain into it, is at least maintained and is at a level that is sustainable in the long term;</p> <p>– iii. the abundance of prey species forming the principal food resources for the assemblage species within the estuary, is maintained.</p> <p>iv. Toxic contaminants in the water column and sediment are below levels which would pose a risk to the ecological objectives described above</p>	<p>This scheme is to expand Strensham Water Treatment Works (WTW) by 30MI/d and is to include the construction of a new intake at Upton-upon-Severn. This hydrological assessment has assumed that this would lead to additional abstraction from the River Severn at the new intake by 30MI/d.</p> <p>The Severn at Saxons Lode NRFA flow gauge (54032) can be used to give a good estimation of the baseline flows for the point of abstraction. Based on this, the Q95 at the abstraction point 1342.7MI/d and the Q70 is 2661.1MI/d. A reduction in these flows by 30MI/d would lead to a 2% and a 1% reduction in Q95 and Q70 flows, respectively. This flow reduction is expected to be insufficient to cause any pathways to impact the aquatic ecology in the River Severn.</p> <p>The STT survey work suggests the reach between Bewdley and the confluence with the River Avon has few areas of essential habitat on the lower and middle reaches of the River Severn for salmonids. Although hydrological modelling will be required to determine the impacted reach, and project level-specific surveys undertaken, the potential for AEol is considered unlikely.</p> <p>The low flows at the intake would be protected by the hands-off flow condition at Deerhurst, therefore, the flow change at Q95 would not be realised in reality.</p> <p><i>Options 33 and 66 – 25MI/d Vyrnwy Reservoir release</i></p> <p>The additional flow augmentation into the River Vyrnwy to support abstraction on the River Severn has been explored as part of the Severn to Thames Transfer SRO (Strategic Resource Option) in terms of the impacts on the aquatic habitats within the River Vyrnwy (see further details below). The investigation outlined that there is only significant changes in the aquatic habitat within the River Vyrnwy when releases from the reservoir are greater than 75MI/d (in addition to the 45MI/d compensation flow). As a result, the release value considered as part of these options would not significantly alter the aquatic habitats in the River Vyrnwy. It is worth noting that releases are currently made from Vyrnwy Reservoir for flood drawdown, river regulation and fisheries management purposes. When licensing this option, consideration will be needed to ensure that the releases to support this option are managed together with these additional releases from the reservoir. This is a known risk of the scheme and licensing work is underway with the relevant regulators and stakeholders to ensure that this risk is not realised.</p> <p>Results of work undertaken for the STT SRO indicated that there are limited changes in water quality from the release and that any changes are generally limited to the ~3km reach of the River Vyrnwy immediately downstream of the reservoir. As such, water quality impacts on migration are considered negligible.</p> <p>The release from Vyrnwy Reservoir will be 25MI/d, and is only a small percentage of the natural flow variation in the River Severn. Overall, impacts on the fish community as a result of hydrological and hydraulic changes are not expected. Furthermore, the release of 25MI/d into the River Vyrnwy is not considered to impact on barrier passability or hydrological migration cues or impact on the structure and function of the habitats that support the fish community of the Severn Estuary European Marine Site.</p> <p>As part of the STT work, the risk to salmonid habitat has been subject to detailed investigations to establish how releases from the Vyrnwy Reservoir and Severn Regulation Release could operate together. Analysis of habitat and velocity/depth changes during these investigations indicated an inflection point of 174MI/d as the upper limit of the tolerances in velocity for the salmonid community. At these flows, habitats become less suitable and continuous releases at this rate would also impact on fine sediment accumulation in riffles, further impacting on habitat quality. The STT solution was, therefore, amended to include a maximum release of 25MI/d from the Vyrnwy Reservoir. Therefore with managed releases (compensation flow, Severn Regulation Release and STT release) flows are expected to remain below the 175MI/d threshold that was identified and modelled data shows only limited reductions in suitable habitat and therefore no significant effects on supporting habits⁸⁵.</p> <p>This modelling is equally applicable to the use of the 25MI/d for alternative purposes i.e. for reabstraction by Severn Trent as STT is no longer part of</p>	<p>None identified.</p> <p>With regards the options requiring abstraction from the River Severn, with the release of 25MI/d from Lake Vyrnwy (options 33 and 66), a pre-application for the licence arrangements was submitted by Severn Trent and partners at the end of January 2024 to progress the project-level assessment, including HRA, with the regulators (Environment Agency, Natural England and Natural Resources Wales).</p>	<p>site integrity.</p> <p>No adverse effects on conservation objectives or site integrity.</p>

⁸⁵ Strategic Regional Water Resource Solutions: Annex B4.2: Informal Habitats Regulation Assessment (HRA) Standard Gate Two Submission for River Severn to River Thames Transfer (STT) (November 2022). Accessed at [STTG2S3121Informal-Habitats-Regulation-Assessment-HRA.pdf](https://www.thameswater.co.uk/sttg2s3121informal-habitats-regulation-assessment-hra.pdf) (thameswater.co.uk)

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
			<p>Thames Water's preferred programme.</p> <p><i>Option 143</i> This scheme is to convert an existing quarry into a reservoir and build a new WTW. Water will be abstracted from the River Severn near Shrewsbury to provide water to both the new WTW and reservoir. In total flows will be abstracted from the River Severn for 215 days of the year, accounting for the Severn Corridor Abstraction Licensing Strategy. The abstraction will be as follows:</p> <ul style="list-style-type: none"> • 50 days – 132.5MI/d abstraction (during this time, 100MI/d will be diverted towards reservoir to fill the storage. Reservoir size is 4,900MI and it will be recharged within 50 days) • 165 days – 32.5MI/d abstraction and transfer directly to new WTW. • 150 days – There will be no abstraction from River Severn and the WTW will be supplied from the reservoir. <p>This will lead to a reduction in flow in the River Severn at times that the abstraction is in operation. The operation of this option would be constrained by the HOF condition on the River Severn at Bewdley (54001) of 2271 MI/d (~60%ile). Below this, it is expected that abstraction from the new intake would be ceased.</p> <p>There are no NRFA flow gauges in proximity to the new intake. As such, a combination of the flows from the Severn at Montford (54005) and Perry at Yeaton (54020) NRFA flow gauges have been used to get an understanding of the baseline flows for the abstraction point. This likely underrepresents the flows with several ungauged tributaries entering the River Severn between Montford flow gauge and the Shelton Intake. Based on this series the Q60 flow at the abstraction point would be 1453 MI/d. If the full 132.5 MI/d were to be abstracted from the River Severn under these flow conditions it would account to a 9% reduction in these moderate flows. This reduction would be within the normal envelope of flow change within the River Severn and would not lead to a significant hydrological change to introduce any pathways to impacting the aquatic ecology.</p>	None required.	No adverse effects on conservation objectives or site integrity.
			<p><i>Option 429</i> This scheme would allow for an additional 21MI/d to be abstracted at the Mythe abstraction on the River Severn.</p> <p>The Severn at Saxons Lode NRFA flow gauge (54032) can be used to give a good estimation of the baseline flows for the point of abstraction. Based on this, the Q95 at the abstraction point 1342.7MI/d and the Q70 is 2661.1MI/d. A reduction in these flows by 21MI/d would lead to a 2% and a 1% reduction in Q95 and Q70 flows, respectively. This flow reduction is expected to be insufficient to cause any pathways to impact the aquatic ecology in the River Severn.</p> <p>The River Severn flows at the Haw Bridge NRFA gauging station (54057), the final NRFA flow gauge upstream of the tidal limit of the River Severn, have been used to give an indication of the reduction of pass forward flow to the Severn Estuary as a result of Option 429. The Q95 flows at Haw Bridge are 1805.8MI/d and Q70 flows are 3594.2MI/d with a 21MI/d reduction leading to a 1% reduction in Q95 and >1% reduction in Q70 flows. These reductions would have negligible impacts on the Severn Estuary.</p> <p>Further, the low flows at the intake would be protected by the hands-off flow condition at Deerhurst, therefore, the flow change at Q95 would not be realised in reality.</p>	None required.	No adverse effects on conservation objectives or site integrity.
Twaite shad	Migratory access	– Water quality is sufficient to support migratory passage. Levels (for temperature, salinity, turbidity, pH, and dissolved oxygen) should comply with targets established under the EA Review of Consents and the Water Framework Directive. – Water flows: Flows from the rivers Wye, Usk and	<p><i>Option 33</i> As above for sea and river lamprey.</p>	None required.	No adverse effects on conservation objectives or site integrity
			<p><i>Option 66</i> As above for sea and river lamprey.</p>	None required.	No adverse effects on conservation objectives or site integrity.
			<p><i>Option 429</i> As above for sea and river lamprey.</p>	None required.	No adverse effects on conservation objectives or site integrity.
			<p><i>Option 143</i></p>	None required.	No adverse effects on

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
		<p>Severn into the estuary must be sufficient to allow migration.</p> <p>– Physical barriers: No artificial barriers significantly impairing adults from reaching existing and historical spawning grounds or juveniles from moving downstream.</p>	<p>As above for sea and river lamprey.</p>		<p>conservation objectives or site integrity.</p>
H1130 Estuaries (encompassing all sub-features)	Tidal regime and flows (saline water and freshwater contributions)	<p>– Riverine flows (Rivers Wye, Usk and Severn) and estuarine flows must be sufficient to ensure Water Framework Directive target of Good Ecological Status (GES) is met.</p>	<p><i>Option 33</i></p> <p>This option would lead to an increase in the capacity of Shelton WTW by 18MI/d to maximise the license capacity of the intakes on the River Severn. The scheme would be operational year round however, under low flow conditions (15% of the time), 10.5MI/d would be supported with release from Vyrnwy Reservoir.</p> <p>The River Severn flows at the Haw Bridge NRFA gauging station (54057), the final NRFA flow gauge upstream of the tidal limit of the River Severn, have been used to give an indication of the reduction of pass forward flow to the Severn Estuary as a result of Option 33. The Q95 flows at Haw Bridge are 1805.8MI/d and Q70 flows are 3594.2MI/d. A reduction of these flows by up to 18MI/d would lead to a 1% reduction in Q95 flows and a 0.5% reduction in Q70 flows. These reductions would have negligible impacts on the Severn Estuary.</p> <p>The additional flow augmentation by 25MI/d into the River Vyrnwy to support abstraction on the River Severn has been explored as part of the Severn to Thames Transfer SRO (Strategic Resource Option) in terms of the impacts on the aquatic habitats within the River Vyrnwy. The investigation outlined that there is only significant changes in the aquatic habitat within the River Vyrnwy when releases from the reservoir are greater than 75MI/d (in addition to the 45MI/d compensation flow). As a result, the release value considered as part of this option would not significantly alter the aquatic habitats in the River Vyrnwy. It is worth noting that releases are currently made from Vyrnwy Reservoir for flood drawdown, river regulation and fisheries management purposes. When licensing this option, consideration will be needed to ensure that the releases to support this option are managed together with these additional releases from the reservoir. This is a known risk of the scheme and licensing work is underway with the relevant regulators and stakeholders to ensure that this risk is not realised.</p> <p>See above for further details under 'sea and river lamprey'</p>	None required.	<p>No adverse effects on conservation objectives or site integrity.</p>
			<p><i>Option 66</i></p> <p>This scheme is to expand Strensham Water Treatment Works (WTW) by 30MI/d and is to include the construction of a new intake at Upton-upon-Severn. This hydrological assessment has assumed that this would lead to additional abstraction from the River Severn at the new intake by 30MI/d.</p> <p>The River Severn flows at the Haw Bridge NRFA gauging station (54057), the final NRFA flow gauge upstream of the tidal limit of the River Severn, have been used to give an indication of the reduction of pass forward flow to the Severn Estuary as a result of Option 66. The Q95 flows at Haw Bridge are 1805.8MI/d and Q70 flows are 3594.2MI/d. A reduction of these flows by up to 30MI/d would lead to a 2% reduction in Q95 flows and a 1% reduction in Q70 flows. These reductions would have negligible impacts on the Severn Estuary.</p> <p>The low flows at the intake would be protected by the hands-off flow condition at Deerhurst, therefore, the flow change at Q95 would not be realised in reality.</p> <p>The additional flow augmentation by 25MI/d into the River Vyrnwy to support abstraction on the River Severn has been explored as part of the Severn to Thames Transfer SRO (Strategic Resource Option) in terms of the impacts on the aquatic habitats within the River Vyrnwy. The investigation outlined that there is only significant changes in the aquatic habitat within the River Vyrnwy when releases from the reservoir are greater than 75MI/d (in addition to the 45MI/d compensation flow). As a result, the release value considered as part of this option would not significantly alter the aquatic habitats in the River Vyrnwy. It is worth noting that releases are currently made from Vyrnwy Reservoir for flood drawdown, river regulation and fisheries management purposes. When licensing this option, consideration will be needed to ensure that the releases to support this option are managed together with these additional releases from the</p>	None required.	<p>No adverse effects on conservation objectives or site integrity.</p>

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
			<p>reservoir. This is a known risk of the scheme and licensing work is underway with the relevant regulators and stakeholders to ensure that this risk is not realised.</p> <p>See above for further details under 'sea and river lamprey'.</p>		
			<p>Option 143</p> <p>This scheme is to convert an existing quarry into a reservoir and build a new WTW. Water will be abstracted from the River Severn near Shrewsbury to provide water to both the new WTW and reservoir. In total flows will be abstracted from the River Severn for 215 days of the year, accounting for the Severn Corridor Abstraction Licensing Strategy⁸⁶. The abstraction will be as follows:</p> <ul style="list-style-type: none"> • 50 days – 132.5MI/d abstraction (during this time, 100MI/d will be diverted towards reservoir to fill the storage. Reservoir size is 4,900MI and it will be recharged within 50 days) • 165 days – 32.5MI/d abstraction and transfer directly to new WTW. • 150 days – There will be no abstraction from River Severn and the WTW will be supplied from the reservoir. <p>This will lead to a reduction in flow in the River Severn at times that the abstraction is in operation. The operation of this option would be constrained by the HOF condition on the River Severn at Bewdley (54001) of 2271 MI/d (~60%ile). Below this, it is expected that abstraction from the new intake would be ceased.</p> <p>There are no NRFA flow gauges in proximity to the new intake. As such, a combination of the flows from the Severn at Montford (54005) and Perry at Yeaton (54020) NRFA flow gauges have been used to get an understanding of the baseline flows for the abstraction point. This likely underrepresents the flows with several ungauged tributaries entering the River Severn between Montford flow gauge and the Shelton Intake. Based on this series the Q60 flow at the abstraction point would be 1453 MI/d. If the full 132.5 MI/d were to be abstracted from the River Severn under these flow conditions it would account to a 9% reduction in these moderate flows. This reduction would be within the normal envelope of flow change within the River Severn and would not lead to a significant hydrological change to introduce any pathways to impacting the aquatic ecology.</p>	None required.	No adverse effects on conservation objectives or site integrity.
			<p>Option 429</p> <p>This scheme would allow for an additional 21MI/d to be abstracted at the Mythe abstraction on the River Severn.</p> <p>The River Severn flows at the Haw Bridge NRFA gauging station (54057), the final NRFA flow gauge upstream of the tidal limit of the River Severn, have been used to give an indication of the reduction of pass forward flow to the Severn Estuary as a result of Option 429. The Q95 flows at Haw Bridge are 1805.8MI/d and Q70 flows are 3594.2MI/d with a 21MI/d reduction leading to a 1% reduction in Q95 and >1% reduction in Q70 flows. These reductions would have negligible impacts on the Severn Estuary.</p> <p>Further, the low flows at the intake would be protected by the hands-off flow condition at Deerpark, therefore, the flow change at Q95 would not be realised in reality.</p>	None required.	No adverse effects on conservation objectives or site integrity.
H1130 Estuaries (encompassing all sub-features)	Tidal regime and flows (saline water and freshwater contributions)	Riverine flows (Rivers Wye, Usk and Severn) and estuarine flows must be sufficient to ensure Water Framework Directive target of Good Ecological Status (GES) is met.	<p>In-combination: Options 33, 66, 143, 429 and 434</p> <p>There are five options within the preferred plan that have the potential to impact the river flows in the River Severn and pass forward flow to the Severn Estuary, with first year of use listed:</p> <ul style="list-style-type: none"> • 33 – 2030-31 • 66 – 2030-31 • 143 – 2040-41 • 429 – 2055-56 • 434 – 2049-50 	<p>The operational rules of the Severn Regulation require a review and update to ensure support flows and regulation releases do not coincide. This could include, for example, the temporary use of alternative sources for regulation during times of support releases from the Vyrnwy Reservoir.</p>	No adverse effects on conservation objectives or site integrity within Severn Trent WRMP anticipated.
River lamprey, sea lamprey, twaite shad	Migratory access	– Water quality is sufficient to support migratory passage. Levels (for temperature, salinity, turbidity, pH, and dissolved oxygen) should comply with		<p>The Maintained Flow and HoF needs to be reviewed to determine to what extent the compensation flow from the Vyrnwy reservoir is considered “abstractable” to further reduce the volume of releases from the Vyrnwy Reservoir.</p>	<p>Further assessment required for in-combination effects with other company WRMPs and regulation releases.</p> <p>Severn Trent is committed to modelling the in-combination effect against the naturalised flow regime beyond the</p>

⁸⁶ Severn-Corridor-abstraction-licensing-strategy.pdf (publishing.service.gov.uk)

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
		<p>targets established under the EA Review of Consents and the Water Framework Directive.</p> <ul style="list-style-type: none"> - Water flows: Flows from the rivers Wye, Usk and Severn into the estuary must be sufficient to allow migration. - Physical barriers: No artificial barriers significantly impairing adults from reaching existing and historical spawning grounds or juveniles from moving downstream. 	<p>The operation of these options cumulatively is currently not clear, particularly Option 33 and Option 66 which will each be supported by releases of up to 25MI/d from Vyrnwy Reservoir when the flow in the River Severn is below a hand-off flow condition. At the time of writing this, the licensing and operation of these options was being discussed and, as such, assumptions have been made for this assessment that may not reflect how the options are operated in reality.</p> <p>The most upstream impact in the River Severn catchment as a result of the options in the preferred plan would be the increase in flows in the River Vyrnwy and River Severn as a result of the additional release from Vyrnwy Reservoir to support the abstraction for Option 33 and Option 66 under low flow conditions. The additional flow augmentation into the River Vyrnwy to support abstraction on the River Severn has been explored as part of the Severn to Thames Transfer SRO (Strategic Resource Option) in terms of the impacts on the aquatic habitats within the River Vyrnwy. The investigation outlined that there are only significant changes in the aquatic habitat within the River Vyrnwy when releases from the reservoir are greater than 75MI/d (in addition to the 45MI/d compensation flow). As a result, the release value considered as part of this option would not significantly alter the aquatic habitats in the River Vyrnwy. It is worth noting that releases are currently made from Vyrnwy Reservoir for flood drawdown, river regulation and fisheries management purposes. When licensing this option, consideration will be needed to ensure that the releases to support this option are managed together with these additional releases from the reservoir. This is a known risk of the scheme and licensing work is underway with the relevant regulators and stakeholders to ensure that this risk is not realised.</p> <p>The next downstream impact would be a result of the additional abstraction at the Shelton intake as a result of Option 33. When water is available, this option would see an additional 18MI/d abstracted from the River Severn. There are no NRFA flow gauges in proximity to the Shelton Intake. As such, a combination of the flows from the Severn at Montford (54005) and Perry at Yeaton (54020) flow gauges have been used to get an understanding of the baseline flows for the abstraction point. This likely underrepresents the flows with several ungauged tributaries entering the River Severn between Montford flow gauge and the Shelton Intake. Based on this, the Q95 flow at the abstraction point is 386.2MI/d and the Q70 is 646MI/d. A reduction in these flows by 18 MI/d would lead to a 4.6% reduction and 2.8% reduction in Q95 and Q70 flows, respectively, downstream of the Shelton Intake. This flow reduction is expected to be insufficient to cause any pathways to impact the aquatic ecology in the River Severn. These impacts under low flow conditions would not be realised in reality as the abstraction would be supported by the releases from Vyrnwy Reservoir.</p> <p>The next downstream impact would be as a result of Option 143. This scheme is to convert an existing quarry into a reservoir and build a new WTW. Water will be abstracted from the River Severn near Shrewsbury to provide water to both the new WTW and reservoir. In total water will be abstracted from the River Severn for 215 days of the year, accounting for the Severn Corridor Abstraction Licensing Strategy⁸⁷. The abstraction will be as follows:</p> <ul style="list-style-type: none"> • 50 days – 132.5MI/d abstraction (during this time, 100MI/d will be diverted towards reservoir to fill the storage. Reservoir size is 4,900MI and it will be recharged within 50 days) • 165 days – 32.5MI/d abstraction and transfer directly to new WTW. • 150 days – There will be no abstraction from River Severn and the WTW will be supplied from the reservoir. <p>This will lead to a reduction in flow in the River Severn at times that the abstraction is in operation. The operation of this option would be constrained by the HOF condition on the River Severn at Bewdley (54001) of 2271 MI/d (Q60). Below this, it is expected that abstraction from the new intake would be ceased and therefore the impacts would be no greater than those expected for Option 33 alone.</p> <p>Again, a combination of the flows from the Severn at Montford (54005) and Perry at Yeaton (54020) NRFA flow gauges have been used to get an understanding of the baseline flows for the abstraction point. This likely underrepresents the flows with several ungauged tributaries entering the River Severn between</p>		<p>WRMP24 submission. This extended timescale is required because Severn Trent are scoping the work required for the drought plan options on the Severn, the STT SRO is progressing modelling work during Gate 3 of the RAPID process and there is the ongoing review of the River Severn Regulation by Environment Agency, Natural England, and Natural Resources Wales.</p>

⁸⁷ Severn-Corridor-abstraction-licensing-strategy.pdf (publishing.service.gov.uk)

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
			<p>Montford flow gauge and the Shelton Intake. Based on this series, the Q60 flow at the abstraction point would be 1453MI/d. If the full 132.5MI/d at Haugmond Hill Quarry and 18MI/d at Shelton were to be abstracted from the River Severn under these flow conditions it would account to a 10% reduction in these moderate flows. This reduction would be within the normal envelope of flow change within the River Severn and is unlikely to lead to a significant hydrological change to introduce any pathways to impacting the aquatic ecology.</p> <p>Downstream of the Trimpley abstraction from the River Severn, there would then be an additional abstraction of 8MI/d with Option 434 allowing Trimpley WTW to operate at a greater rate. For this assessment it has been assumed that, simplistically, this would reduce river flows by 8MI/d downstream of the abstraction point.</p> <p>The Severn at Bewdley (54001) NRFA flow gauge can be used as an indication for flows in the River Severn at Trimpley. Here there is a Q95 of 941.7MI/d and, considering the additional abstraction of 26MI/d (18MI/d associated with Option 33 and 8MI/d associated with Option 434, noting Option 143 would be constrained by the HOF at this flow), there is the potential for a 3% reduction in low flows. This flow reduction is expected to be insufficient to cause any pathways to impact the aquatic ecology in the River Severn. These impacts under low flow conditions would likely be smaller in magnitude in reality as the abstraction under low flows associated with Option 33 would be supported by the releases from Vyrnwy Reservoir. Above the HOF constraint at Bewdley (2271MI/d) associated with Option 143, there would be a total reduction in flow of 148.5MI/d. When flow is above the HOF at the Bewdley gauge (2271MI/d), there would be a reduction in flows of roughly 7%. Again, this reduction would be within the normal envelope of flow change within the River Severn and is unlikely to lead to a significant hydrological change to introduce any pathways to impacting the aquatic ecology.</p> <p>Downstream, below the Strensham intake, Option 66 would allow an additional abstraction of 30MI/d to be abstracted from the River Severn, noting that this abstraction will likely be supported by releases from Vyrnwy Reservoir under low flow conditions.</p> <p>The Severn at Saxons Lode (54032) flow gauge is downstream of the Strensham intake at Upton however, there are no large tributaries between the abstraction point and the gauge so can be used to represent the flows at the abstraction point. The Q95 flow at the Saxons Lode gauge is measured as 1330.56MI/d. Noting that Option 143 will not be operational at these low flows, there is a potential total additional abstraction of 56MI/d, a reduction in flow of 4%. This flow reduction is expected to be insufficient to cause any pathways to impact the aquatic ecology in the River Severn. These impacts under low flow conditions would likely be smaller in magnitude in reality as the abstraction under low flows associated with Option 33 and Option 66 would be supported by the releases from Vyrnwy Reservoir. At roughly Q60, where Option 143 would no longer be constrained by the HOF condition, there could be a maximum reduction in flows of up to 178.5MI/d. The Q60 flow at the Saxons Lode gauge is measured as 3501.27MI/d and a 178.5MI/d abstraction would result in a 5% reduction in flow at this flow condition. A 5% reduction in moderate flows is not expected to lead to a significant hydrological change to introduce any pathways to impacting the aquatic ecology.</p> <p>The most downstream option that impacts the River Severn is Option 429 which would increase the sustainable operating capacity of Mythe WTW by approximately 21MI/d. As with Option 434, for this assessment it has been assumed that, simplistically, this would reduce river flows by 21MI/d downstream of the abstraction point.</p> <p>The Severn at Saxons Lode (54032) flow gauge can be used to represent the flows at the Mythe abstraction point, noting the gauge is upstream of the abstraction point and there are a number of ungaged tributaries between the gauge and the abstraction point so the flow is likely under represented. The Q95 flow at the Saxons Lode gauge is measured as 1330.56MI/d. Noting that Option 143 will not be operational at these low flows, there is a potential total additional abstraction of 77MI/d, a reduction in flow of 6%. This flow reduction is expected to be insufficient to cause any pathways to impact the aquatic ecology in the River Severn and these impacts under low flow conditions would likely be smaller in magnitude in reality as the abstraction under low flows associated with Option 33 and Option 66 would be supported by the releases from Vyrnwy</p>		

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
			<p>Reservoir. At roughly Q60, where Option 143 would no longer be constrained by the HOF condition, there could be a maximum reduction in flows of up to 199.5MI/d. The Q60 flow at the Saxons Lode gauge is measured as 3501.27MI/d and a 199.5MI/d abstraction would result in a 6% reduction in flow at this flow condition. A 6% reduction in moderate flows is not expected to lead to a significant hydrological change to introduce any pathways to impacting the aquatic ecology.</p> <p>The River Severn flows at the Haw Bridge gauging station (54057), the final flow gauge upstream of the tidal limit of the River Severn, have been used to give an indication of the reduction of pass forward flow to the Severn Estuary as a result of the options in the Severn Trent rdWRMP preferred plan. The Q95 flows at Haw Bridge are 1805.8MI/d and could be reduced by up to 77MI/d as a result of the additional abstractions on the River Severn. This additional abstraction would be a 4% reduction in pass forward flow to the estuary, again noting that this magnitude would be lower in reality with Option 33 and Option 66 being supported by Vyrnwy Reservoir releases under low flow conditions. Above Q60 (4605.12MI/d), where Option 143 would operate at the full abstraction rate, the potential additional abstraction of up to 199.5MI/d would result in a 4% reduction in pass forward flow to the estuary. These reductions would likely have negligible impacts on the processes and habitats in Severn Estuary.</p>		

9. STAGE 2 APPROPRIATE ASSESSMENT: RIVER CLUN SAC

9.1 INTRODUCTION

The following preferred plan options have been screened in as potentially impacting the River Severn, and therefore potential migration of Atlantic salmon on which the River Clun qualifying feature; freshwater pearl mussel, relies for its life cycle stages:

- 33 Shelton WTW Expansion: **construction and operation**
- 66 Strensham WTW Expansion: **construction and operation**
- 143 W.Midlands Raw Water Storage: **construction and operation**
- 429 Mythe WTW DO Recovery: **operation**
- 559 Bishops Castle transfer: **construction only**

River Clun SAC is designated for the following qualifying features;

- Annex II species that are a primary reason for selection of this site
 - S1029 Freshwater pearl mussel *Margaritifera margaritifera*

9.2 SITE SUMMARY

9.2.1 Site description

The River Clun is a tributary of the River Teme, which is the second largest tributary of the River Severn, draining a hilly, predominantly rural catchment of Silurian and Devonian rocks. The site includes only the lower reaches of the river and extends upstream from the confluence with the Teme to Broadward Bridge near Marlow. This section of the river holds a population of the freshwater pearl mussel *Margaritifera margaritifera*, one of the few lowland populations left in the UK. The freshwater pearl mussel larvae attach to the gills of salmon and trout before eventually detaching and settling in the riverbed gravels where they grow to adulthood.

9.2.2 Qualifying features screened into Stage 2 Appropriate Assessment: baseline

9.2.2.1 S1029 Freshwater pearl mussel *Margaritifera margaritifera*

The freshwater pearl mussel grows to 140 mm in length, and burrows into sandy substrates, often between boulders and pebbles, in fast-flowing rivers and streams. It requires cool, well-oxygenated soft water free of pollution or turbidity. The mussel spends its larval, or glochidial, stage attached to the gills of salmonid fishes. The larvae attach themselves during mid to late summer and drop off the following spring to settle in the riverbed gravel where they grow to adulthood.

Population declines have been caused by factors such as pearl-fishing, pollution, acidification, organic enrichment, siltation, river engineering, and declining salmonid stocks. *M. margaritifera* is now a rare species whose conservation is giving rise to concern, and its increasing rarity in mainland Europe gives extra significance to UK populations. Many UK rivers now contain only scattered individuals, with no juvenile mussels recorded; such populations may become extinct due to lack of recruitment. Despite serious declines in both range and total population, Scotland is the remaining European stronghold for *M. margaritifera*, supporting functional populations in over 50 rivers, mainly in the Highlands.

9.2.3 Condition, threats, and pressures

There is one SSSI underpinning the River Clun SAC;

- River Teme SSSI (NGR: SO 121848–SO 850525) - There are six live units within the site assessed as 96.61% unfavourable- no change and 3.39% unfavourable- declining with inappropriate weirs and dams, invasive freshwater species, water pollution identified as reasons for adverse conditions within the units.

The SIPs for the River Clun SAC has identified the following threats and pressures which may affect the condition of the qualifying features on site;

- Siltation

- Water pollution
- Low breeding success/poor recruitment
- Disease
- Physical modification
- Invasive species
- Change in land management

9.3 ASSESSMENT OF EFFECTS

9.3.1 Construction

The precise scope of the construction (including location, timing, materials, extent, duration, etc.) cannot be defined at this point, although it is likely that in-channel works will be scheduled for the summer to facilitate water management.

The River Clun SAC may be affected by Atlantic salmon being exposed to construction-related effects through;

- site-derived pollutants (principally oils and other contaminants) entering the River Severn or tributaries hence affecting the Atlantic salmon movement to and from the River Clun thereby reducing the supporting role it has in maintaining freshwater pearl mussel populations.
- underwater noise and vibration disturbance of Atlantic salmon during construction of new intakes, pipeline crossings and infrastructure in proximity to the River Severn and tributaries.

As such, mitigation measures may be required for the options listed above to avoid an adverse effect. For example these could include:

- Utilise trenchless construction technologies for pipeline crossings where possible to avoid disturbance to in-river habitats.
- Restrict work between 1st November to 31st May to avoid impacts to migratory fish.
- Adherence to EA Pollution Prevention Guidelines (now archived) and NRW, SEPA's Guidance on Pollution Prevention including Works and Maintenance in or near Water (2017).
- A Construction Management Plan will be drawn up to detail all exclusion and protection measures.
- All of the above mitigation measures will be monitored and enforced by an on-site Environmental Clerk of Works.

9.3.2 Operation

The River Clun SAC may be affected by Atlantic salmon migration being impeded or altered through changes in flow in its spawning tributaries, or passage through the functionally linked River Severn.

The following SACO are relevant:

- Passage of host fish - Maintain the free movement of host fish populations into and through the SAC.
- Supporting offsite riverine habitat – Maintain the extent and quality of any riverine habitats present beyond the SAC boundary upon which freshwater pearl mussel population of the SAC depend.

The relevant information for Atlantic salmon movement can be found in **Section 8** and is therefore also relevant for the River Clun SAC.

10. STAGE 2 APPROPRIATE ASSESSMENT: CANNOCK CHASE SAC

10.1 INTRODUCTION

Option 44 has the potential to cause LSEs to the Cannock Chase SAC due to impact pathways to the qualifying habitats during construction only.

Cannock Chase SAC is designated for the following features:

- H4030 European dry heaths
- H4010 Northern Atlantic wet heaths with *Erica tetralix*

Both have been screened in for assessment as publicly available habitat mapping is not sufficient to distinguish between the habitat types.

10.2 SITE SUMMARY

10.2.1 Site description

The area of lowland heathland at Cannock Chase is the most extensive in the Midlands. The character of the vegetation is intermediate between the upland or northern heaths of England and Wales and those of southern counties. Dry heathland communities are of the heather – western gorse (*Calluna vulgaris* – *Ulex gallii*) and heather – wavy hair-grass (*Calluna vulgaris* – *Deschampsia flexuosa*) types. Within the heathland, species of northern latitudes occur, such as cowberry *Vaccinium vitis-idaea* and crowberry *Empetrum nigrum*. Cannock Chase has the main British population of the hybrid bilberry *Vaccinium intermedium*, a plant of restricted occurrence. The scarcity of water over much of the Chase effectively confines wetland flora and fauna to the stream valley systems and a scatter of natural and artificial pools and damp depressions. The Oldacre and Sherbrook valleys have small-scale mosaics of spring-fed mire and wet heath vegetation, a result of complex water chemistry. Where acidic conditions prevail the mires are mostly formed of bog mosses *Sphagnum* spp. with cranberry *Vaccinium oxycoccus*, cottongrasses *Eriophorum* spp. and cross-leaved heath *Erica tetralix*.

10.2.2 Qualifying features screened into Stage 2 Appropriate Assessment: baseline

10.2.2.1 H4030 European Dry Heaths

The area of lowland heathland at Cannock Chase is the most extensive in the Midlands, although there have been losses due to fragmentation and scrub/woodland encroachment. The character of the vegetation is intermediate between the upland or northern heaths of England and Wales and those of southern counties. Dry heathland communities belong to NVC types H8 *Calluna vulgaris* – *Ulex gallii* and H9 *Calluna vulgaris* – *Deschampsia flexuosa* heaths. Within the heathland, species of northern latitudes occur, such as cowberry *Vaccinium vitis-idaea* and crowberry *Empetrum nigrum*. Cannock Chase has the main British population of the hybrid bilberry *Vaccinium intermedium*, a plant of restricted occurrence. There are important populations of butterflies and beetles, as well as European nightjar *Caprimulgus europaeus* and five species of bats. The habitat is present throughout the Cannock Chase SSSI, recorded at 30 of the 32 Units present within the site.

10.2.2.2 H4010 Northern Atlantic wet heaths with *Erica tetralix*

Wet heath usually occurs on acidic, nutrient-poor substrates, such as shallow peats or sandy soils with impeded drainage. The vegetation is typically dominated by mixtures of cross-leaved heath *Erica tetralix*, heather *Calluna vulgaris*, grasses, sedges and *Sphagnum* bog-mosses. Wet heaths occur in several types of ecological gradient. In the drier areas of the south and east, wet heaths are local and often restricted to the transition zone between 4030 European dry heaths and constantly wet valley mires. In the uplands they occur most frequently in gradients between dry heath or other dry, acid habitats and 7130 Blanket bogs. At high altitude in the Scottish Highlands wet heaths occur in mosaics with 4060 Alpine and Boreal heaths; in these situations lichens and northern or montane species may be well-represented. Flushed wet heaths are especially frequent in areas of high rainfall, and occur as topogenous fens, usually in channels within heath or grassland vegetation.

Wet heath is an important habitat for a range of vascular plant and bryophyte species of an oceanic or Atlantic distribution in Europe, several of which have an important part of their EU and world distribution in the UK. The habitat has been monitored within two Units within the Cannock Chase SSSI, Unit 25 (Oldacre Valley)- 11.70ha assessed as unfavourable no change and Unit 26 (Sherbrook Valley)- 23.64ha assessed as unfavourable no change.

10.2.3 Condition, threats, and pressures

The Cannock Chase SAC is legally underpinned by one Site of Special Scientific Interest (SSSI); Cannock Chase SSSI (NGR: SJ 990180)- There are 30 live units within the site which are assessed as 1.07% favourable, 90.23% unfavourable- recovering, 2.76% unfavourable- no change and 5.94% unfavourable-declining with forestry and woodland management and water abstraction identified as reasons for adverse conditions within the units.

The following are pressures / threats with the outlined measures required to improve the condition of the feature which are listed within the Cannock Chase SAC Site Improvement Plan⁸⁸ which are relevant to the types of impact pathways from the WRMP options are;

- Air pollution- impact of atmospheric nitrogen pollution- Control, reduce and ameliorate atmospheric nitrogen impacts on the whole of Cannock Chase SAC.
- Invasive species- Continue to monitor and control Invasive Non-Native Species (INNS).

10.3 ASSESSMENT OF EFFECTS

10.3.1 Construction

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 10-1**.

The pipeline is routed just outside the boundary of Cannock Chase SAC and parallel with the existing access road. The works during construction therefore have the potential to result in the following effects:

- Offsite habitat degradation – compaction of soils and hydrologically connected vegetation.
- Contamination – smothering of vegetation from dust and potential nitrogen loading.
- Biological disturbance – introduction of non-native invasive species.
- Permanent impedance of surface water and groundwater flows to water dependent habitats.

⁸⁸ Natural England. (2014). *Site Improvement Plan Cannock Chase SAC*. Improvement Programme for England's Natura 2000 Sites. Planning for the Future.

Table 10-1 Information to inform an assessment of adverse effects on the Cannock Chase SAC

Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
CONSTRUCTION PHASE				
<p>Structure and function (including its typical species): Functional connectivity with wider landscape</p>	<p>Maintain or restore as appropriate the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site</p>	<p><u>Offsite habitat degradation</u></p> <p>The proposed pipeline route will extend alongside the northern boundary of the SAC between the two components of the SAC at Robin Hood. Priority habitat mapping does not accurately distinguish between wet and dry heathland habitats. Construction works could cause temporary degradation of adjacent habitats through compaction of vegetation and soils which could alter water availability by disrupting surface and groundwater flows.</p> <p>Open cut is proposed for the pipeline installation, and where possible the width of the construction corridor (20m) topsoil stripped will be minimised to the trench width. Ground protection matting will be used to minimise compaction of soils which will aid recovery and prevent the loss of vegetation structure. Topsoil will be stripped to keep the layers separate thereby retaining the seed bank and root balls and expediting habitat recovery.</p> <p><u>Contamination - dust and NOx</u></p> <p>Topsoil stripping and excavation works have potential for indirect adverse effects from dust pollution with smothering of the heath habitats predicted in the absence of mitigation. This will only effect habitats within 100m without mitigation, as identified through the commonly applied distance thresholds of dust from large construction sites^{89, 90}.</p> <p>The use of heavy plant and vehicles during the construction phase may alter the air quality in the proximity of the site with increased concentrations of nitrogen oxides (NOx). Such increases may directly interfere with site improvement plans to control, reduce and ameliorate atmospheric nitrogen impacts.</p> <p>Increased nitrogen can lead to increased fertility leading to changes in plant community. The Air Pollution Information System estimates that the current critical loading (i.e. over which effects of N deposition would start to occur) for dry heath is 10-20 kg N ha⁻¹ year⁻¹. Recent guidance published by Natural England notes that designated sites within 200m of roads to be used as part of a plan or project need to be assessed for nitrogen loading⁹¹. An increase in N loading is considered likely given the potential works in the road and requirement to hold traffic during construction work.</p> <p>It is currently unclear as to whether the construction will exceed the air quality thresholds for impacts (change of 1000 AADT (annual average daily traffic) or 200 HGV movements daily threshold above which significant air quality impacts can be experienced⁹²) as there may be a requirement to hold traffic whilst works are carried out in the road. Therefore, an increase in N loading is considered likely and an air quality assessment will need to be completed once the detailed construction methods and programme are known, to confirm whether there will be any issues from NOx loading. If this assessment concludes adverse effects, traffic will need to be rerouted or traffic management measures implemented to avoid the critical load being exceeded.</p> <p>An air quality assessment will need to be completed once the detailed construction methods and programme are known, to confirm whether there will be any issues from NOx loading. If this assessment concludes adverse effects, traffic will need to be rerouted or traffic management measures implemented to avoid the critical load being exceeded.</p> <p><u>Biological Disturbance – Invasive non-native species</u></p> <p>The works have the potential to spread invasive non-native species given the close proximity of the works to the SAC. Works should follow best practice biosecurity measures as standard.</p>	<p><u>Offsite habitat loss and degradation</u></p> <ul style="list-style-type: none"> • Install pipeline within existing access road where possible and avoid installing sections of pipeline in land adjacent to SAC which could be hydrologically linked. • Minimise construction corridor. • Topsoil strip the trench width only rather than whole working corridor. • Ground protection matting to minimise compaction of adjacent wet heath habitat. • Topsoil stripping, keeping soil layers separate to maintain the seed bank and habitat recovery following open cut pipeline installation for open cut sections. • Undertaking the pipeline installation in short sections to minimise run-off. • Locate construction compounds on habitats that are not hydrologically linked to the SAC. • Ensure continued supply of water along ditches if being crossed by pipeline e.g. over pumping. <p><u>Contamination – dust and NOx</u></p> <ul style="list-style-type: none"> • Complete an air quality assessment of potential for N loading on sensitive habitats once details of plant and construction programme have been confirmed (e.g. using method outlined in DMRB Air Quality Appendix F). • If air quality assessment identifies an exceedance of the critical load due to stationary traffic being held as pipeline is installed in road, traffic must be diverted or other traffic management measures put in place to ensure critical load, and therefore an adverse effect on the site, is avoided. • Dust suppression measures including dampening and dust screens to be applied to reduce dispersion to minimum distance <p><u>Non-native invasive species</u></p> <ul style="list-style-type: none"> • Best practice biosecurity measures, as recommended by the GB Non-Native Species Secretariat (http://www.nonnativespecies.org/index.cfm?sectionid=58) would guard against any potential for spreading invasive species as a result of construction. <p><u>General</u></p> <ul style="list-style-type: none"> • A Construction Management Plan will be drawn up to detail all exclusion and protection measures. • All of the above mitigation measures will be monitored and enforced by an on-site Environmental Clerk of Works. 	<p>No adverse effects on conservation objectives or site integrity</p>

⁸⁹ Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction. IAQM, London

⁹⁰ Technical Statement TS/AQ1, Association of British Ports (ABP), 2000

⁹¹ NE Internal Guidance – Approach to Advising Competent Authorities on Road Traffic Emissions and HRAs V1.4 Final - June 2018

⁹² Highways England. Design Manual for Roads and Bridges Volume 11 Section 3, Part 1 - Air Quality

Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
Supporting processes (on which the feature relies) Hydrology	At a site, unit and/or catchment level (as appropriate), restore a hydrological regime to provide the conditions necessary to sustain the H4010 feature within the site	Due to the close proximity of the pipeline to the designated areas there is a potential that the pipeline route could impact on the hydrology and hydrogeology of these areas, if constructed outside the existing access road, which is already likely to have disrupted localised flow pathways to some extent. Good construction practices should be adopted when building the pipeline to prevent movement of sediment and contaminants into the adjacent surface watercourse. It is recommended that further investigation of localised surface and groundwater flow pathways be investigated to ensure localised drying in immediate adjacent supporting habitat is avoided.	Best practice construction methods to avoid preferential flow of water along pipeline.	No adverse effects on conservation objectives or site integrity

11. STAGE 2 APPROPRIATE ASSESSMENT: PASTUREFIELDS SALT MARSH SAC

11.1 INTRODUCTION

Option 44 has potential to cause LSEs during construction to the Pasturefields Salt Marsh SAC due to impact pathways to offsite functionally linked habitat.

Pasturefield Salt Marsh SAC is designated for one qualifying habitat; H1340 Inland salt meadows.

11.2 SITE SUMMARY

11.2.1 Site description

Pasturefields Salt Marsh SAC is a remnant of the former saltmarshes of the Trent Valley, once exploited for brine extraction. This saltmarsh still has two old brine wells, fed by naturally saline (salt-rich) water seeping up from deep underground. The site lies within the Needwood and South Derbyshire Claylands National Character Area (NCA), a predominately rolling plateau that slopes from the southern edge of the Peak District to the valley of the River Trent in the south-west. Despite its small size, it contains an unusual variety of halophytic (salt tolerant) plants which are usually found in more saline coastal habitats. These include common saltmarsh-grass *Puccinellia maritima*, lesser sea-spurrey *Spergularia marina*, saltmarsh rush *Juncus gerardii* and sea arrowgrass *Triglochin maritimum*.

11.2.2 Qualifying features screened into Stage 2 Appropriate Assessment: baseline

11.2.2.1 H1340 Inland salt meadows

Inland salt meadows refer to non-coastal sites supporting saltmarsh vegetation. In the UK this vegetation corresponds to NVC types SM16 *Festuca rubra* salt-marsh community and SM23 *Spergularia marina* – *Puccinellia distans* salt-marsh community. The Annex I type comprises anthropogenic stands found, for example, in former salt-working sites, as well as natural or near-natural forms. Inland salt meadows are a rare habitat type, having declined dramatically in the past 50 years in all areas where it occurs. The destruction of much of the natural habitat can be traced back to early salt-production activities. Pasturefields Salt Marsh in the West Midlands is the only known remaining example in the UK of a natural salt spring with inland saltmarsh vegetation. The vegetation consists of red fescue *Festuca rubra*, with common saltmarsh-grass *Puccinellia maritima*, lesser sea-spurrey *Spergularia marina*, saltmarsh rush *Juncus gerardii* and sea arrowgrass *Triglochin maritimum* in the most saline situations.

11.2.3 Condition, threats, and pressures

Pasturefields Salt Marsh SAC is legally underpinned by one Site of Special Scientific Interest (SSSI); River Mease SSSI. There is 1 live unit within the site last assessed in 2015 as unfavourable- no change with freshwater drainage identified as reasons for adverse conditions within the units.

There are no pressures / threats with the required to improve the condition of the feature which are listed within the Pasturefields Saltmarsh SAC Site Improvement Plan specifically associated with Inland salt meadows.

The SACO for the site, produced by Natural England to identify attributes and targets to achieve Favourable Conservation Status; those associated with the impacts identified for functionally linked habitat for Option 44 are below:

- Structure and function (including its typical species)- Functional connectivity with wider landscape- Maintain or restore the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site.

11.3 ASSESSMENT OF EFFECTS

11.3.1 Construction

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 11-1**.

Although the pipeline for Option 44 does not come into proximity of the Pasturefields Salt Marsh SAC, it does extend in closer proximity to potentially functional linked areas of saltmarsh at: Ingestre (SJ980247) and Lion Lodge (SJ989239), approximately 600m and 420m respectively.

The SACO refers to these areas as follows: *“According to the inventory produced by Chatters (2017), there are six other inland saltmarshes within five miles of Pasturefields (Astonfields at SJ926248; Ingestre at SJ980247; Kingston Pool at SJ944235; Lion Lodge at SJ989239; Shirleywich at SJ984 259; and Tixall at SJ976 227. They are all small sites. They all lie on Mercia Mudstone, so their eco-hydrological characteristics are likely to be similar to those supporting Pasturefields. Whether the conservation of the inland saltmarsh at Pasturefields depends on maintenance or restoration of these sites is not known, but it is plausible that species typically associated with Pasturefields might survive better in a landscape of numerous scattered saltmarshes than a landscape with one isolated example. Beyond Staffordshire in the surrounding counties, Chatters lists twelve more sites in Cheshire, three in Warwickshire and four in Worcestershire”.*

The works during construction therefore have the potential to result in the following effects:

- Permanent impedance of surface water and groundwater flows to water dependent habitats.

Table 11-1 Information to inform an assessment of adverse effects on the Pasturefields Salt Marsh SAC

Attribute	Target	Potential Effects	Mitigation	Effect on site integrity?
CONSTRUCTION PHASE				
<p>Structure and function (including its typical species): Functional connectivity with wider landscape</p>	<p>Maintain or restore as appropriate the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site</p>	<p>Due to the close proximity of the pipeline to the potential offsite functionally linked habitat areas there is a potential that the pipeline route could impact on the local hydrology and hydrogeology, and cause drying and changes to localised flow pathways. Good construction practices should be adopted when building the pipeline to prevent movement and compaction of sediment, and creation of preferential pathways which could divert water away from the habitats. It is recommended that further investigation of localised surface and groundwater flow pathways be investigated to ensure localised drying in immediate adjacent supporting habitat is avoided.</p>	<p><u>Offsite habitat loss and degradation</u></p> <ul style="list-style-type: none"> • Minimise construction corridor. • Topsoil strip the trench width only rather than whole working corridor. • Ground protection matting to minimise compaction of adjacent wet heath habitat. • Topsoil stripping, keeping soil layers separate to maintain the seed bank and habitat recovery following open cut pipeline installation for open cut sections. • Undertaking the pipeline installation in short sections to minimise run-off. • Locate construction compounds on habitats that are not hydrologically linked to the SAC. • Ensure continued supply of water along ditches if being crossed by pipeline e.g. over pumping. • Best practice construction methods to avoid preferential flow of water along pipeline. <p><u>General</u></p> <ul style="list-style-type: none"> • A Construction Management Plan will be drawn up to detail all exclusion and protection measures. • All of the above mitigation measures will be monitored and enforced by an on-site Environmental Clerk of Works. 	<p>No adverse effects on conservation objectives or site integrity</p>

12. STAGE 2 APPROPRIATE ASSESSMENT: RIVER MEASE SAC

12.1 INTRODUCTION

The following preferred plan options have been screened in as potentially impacting the River Mease SAC:

- Option 44 New R Sow abstraction and WTW near Stafford: **construction and operation**
- Option 64 Rehabilitation Milton groundwater source: **operation only**
- Option 556 ASL Capacity Increase - Hallgates to Oldbury: **construction only**

Theoretical pathways for effects exist through:

- potential construction-related impacts on off-site supporting habitat that will rely on project-level mitigation (and so cannot be 'screened out');
- reduced freshwater input to the wider river catchment, therefore causing potential deterioration of off-site supporting habitat, reduction in accessibility and reduction in prey.

The River Mease SAC is designated for the following features, however on the basis of the above pathways, only those qualifying features in bold have been taken through to the appropriate assessment:

- H3260 Water courses of plain to montane levels with the *Ranunculus fluitans* and *Callitriche-Batrachion* vegetation
- **S1149 Spined loach *Cobitis taenia***
- **S1163 Bullhead *Cottus gobio***
- **S1092 White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes***
- **S1355 Otter *Lutra***

12.2 SITE SUMMARY

12.2.1 Site description

Rising in the Coal Measures of north-west Leicestershire, the River Mease flows approximately 25 kilometres westwards across a largely rural and agricultural landscape to its confluence with the River Trent at Croxall. As a relatively un-modified lowland river, the River Mease contains a diverse range of physical in-channel features, including riffles, pools, slacks, vegetated channel margins and bankside tree cover, which provide the conditions necessary to sustain populations of spined loach *Cobitis taenia*, bullhead *Cottus gobio*, white-clawed crayfish *Austropotamobius pallipes* and otter *Lutra*. The head of the site includes the lower reaches of the Gilwiskaw Brook which flows along a steep gradient. Due to the fast-flowing nature of the river, aquatic vegetation is sparse and marginal vegetation restricted to stands of floating sweet-grass *Glyceria fluitans* but these sections provide valuable habitat for bullhead, which favours clean coarse gravels for spawning. Populations of bullhead also occur in the lower reaches of the Mease where river substrates are finer but woody debris lying within the river channel becomes more important in providing suitable breeding habitat. Below Snarestone the descent becomes more gradual and the river enters a broad lowland floodplain. These middle reaches of the River Mease provide excellent habitat for spined loach *Cobitis taenia*. This largely sedentary fish is closely associated with the open sandy substrates of the riverbed which act as important feeding and spawning grounds. Refuges from predators and strong river flows are very important and are provided by aquatic and marginal vegetation within the river channel. Stands of marginal vegetation are typically dominated by common club-rush *Schoenoplectus lacustris*, floating sweet-grass, reed canary-grass *Phalaris arundinacea*, branched bur-reed *Sparganium erectum*, greater pond sedge *Carex riparia* and bulrush *Typha latifolia*. Submerged aquatic vegetation becomes more varied on the lower reaches of the river with river water-crowfoot *Ranunculus fluitans*, common water-crowfoot *R. aquatilis*, blunt-leaved pondweed *Potamogeton obtusifolius*, fennel pondweed *P. pectinatus*, arrowhead *Sagittaria sagittifolia* and yellow waterlily *Nuphar lutea* becoming increasingly frequent. Bankside tree cover is very variable but an important feature of the river channel as submerged root systems of larger trees provide important in-channel cover for fish and provide woody debris to the watercourse in the form of fallen branches.

12.2.2 Qualifying features screened into Stage 2 Appropriate Assessment: baseline

12.2.2.1 *Spined loach*

Habitat preferences of spined loach include sandy substrate with patchy, dense macrophytes. This species has a specialised feeding mechanism which requires fine substrate. This species is vulnerable to predation due to its small size. Dense patches of macrophytes within areas of open sandy substrate provide refuge against predation⁹³.

Habitat suitable for spined loach is present within the middle, broad and lowland reaches of River Mease SAC. Here the substrate is sandy and provides important feeding spawning grounds. The associated aquatic vegetation, including tree roots, at the margins also provides important refuges for spined loach from predators.

NBN Atlas

Out of a total of 104 records within 10km of the relevant screened options and River Mease SAC, 29 records for spined loach are for the period 2010 to 2019. These records are associated with Rivers Trent, Mease, Blithe, Penk and an un-named tributary of the River Mease.

12.2.2.2 *Bullhead*

The bullhead is the only freshwater cottid species found in the UK, and is adapted to benthic habitats. This species predominantly occurs in stony streams and rivers where the flow is moderate, water is cool, and oxygen-rich. The bullhead spawn from February to June, and are territorial and tied to their nest. Shade and cover are important for this species which actively hides from light. The bulk of their diet is benthic invertebrates, particularly crustaceans. Their habitat requirements are variable depending on the life stage. Coarse substrates are essential for breeding, with shallow stony riffles used by young fish. Sheltered areas with woody debris and leaf litter are preferred by adult fish. The upper pH tolerance levels of 9.0 and lower limit of oxygen concentration of 40% is associated with bullhead. Water depth is not critical to this species, but high temperatures and/or low dissolved oxygen are likely to be fatal in shallow waters⁹⁴.

The head of the River Mease SAC is fast-flowing and provides valuable bullhead habitat, with clean and coarse gravels. There is additional bullhead habitat in the lower reaches where the substrate is finer but there is woody debris, providing suitable breeding habitat.

NBN Atlas

Out of a total of 801 records within 10km of the relevant screened options and River Mease SAC, 118 records for bullhead are for the period 2010 to 2019. These records are associated with Rivers Trent, Mease, Penk, Blithe, Dove and Tame, as well as a tributary of the River Trent towards Milwich.

12.2.2.3 *White-clawed crayfish*

The white-clawed crayfish (WCC; *Austropotamobius pallipes*) is the only native species of freshwater crayfish in Britain, and is the largest freshwater crustacean⁹⁵. WCC populations in the UK are fragmented and have rapidly declined since the 1970s. Specific areas with WCC cited as the primary reason for SAC site selection occurring mainly in the north and west of England⁹⁶. Populations are known within South Wales, Suffolk, East Midlands, Dorset, Somerset, Gloucestershire, Exmoor and the North York Moors⁹⁷.

WCC can live for more than 10 years⁹⁸. Breeding occurs in the autumn and early winter when the water temperature drops below 10°C for an extended period. The breeding time may vary with latitude and altitude. Females over winter with a clutch of eggs. Hatched eggs release from the female and become independent in June (south of England) and August (north of England). Migration into deeper water may occur in the winter. WCC have been known to burrow into riverbanks, particularly in the winter months⁹⁸. WCC occur in areas with hard, mineral-rich waters on calcareous and rapidly weathering rocks. It is found in both still and running water and is typically associated with watercourses of 0.75 m to 1.25 m, but has also been found in shallow

⁹³ English Nature. (1998) *The habitat and management requirements of spined loach* *Cobitis taenia*. No. 244 – English Nature Research Reports.

⁹⁴ Tomlinson, M. L., & Perrow, M. R. (2003). *Ecology of the Bullhead*. Conserving Natura 2000 Rivers Ecology Series No. 4 English Nature, Peterborough.

⁹⁵ Peay, S. (2002). *Guidance on Habitat for White-clawed Crayfish and its Restoration*. English Nature and the Environment Agency.

⁹⁶ JNCC. (2022). *1092 White-clawed (or Atlantic stream) crayfish* *Austropotamobius pallipes* [White-clawed \(or Atlantic stream\) crayfish \(Austropotamobius pallipes\) - Special Areas of Conservation \(jncc.gov.uk\)](#) Accessed in August 2022.

⁹⁷ Buglife. (2015). *Crayfish Identification, Distribution and Legislation*. Environment Agency.

⁹⁸ Holdich, D. (2003). *Ecology of the White-clawed Crayfish*. Conserving Natura 2000 Rivers. Ecology Series No. 1. English Nature.

streams (as low as 5 cm), and in deeper slow-flowing rivers (2.5 m). Water chemistry figures suitable for white-clawed crayfish include calcium at 5 mg/l, and pH between 6.5-9.0⁹⁸.

Barriers to crayfish movement can include major weirs, dams or waterfalls; a length of highly modified channel lacking suitable refuges; fast-flowing flume or culvert; dried-up section of a channel; or poor water quality within a reach. It is worth noting that barriers for white-clawed crayfish may not necessarily be barriers for signal crayfish *Pacifastacus leniusculus* as this species can walk over land and are less vulnerable to desiccation⁹⁵.

The River Mease SSSI/SAC Restoration Plan Technical Report (2012) noted that WCC appeared to be absent from the majority of the watercourse, with the exception of a population close to the Trent confluence. A dominant population of non-native American signal crayfish were also recorded in this location⁹⁹.

NBN Atlas

Out of a total of 599 records within 10km of the relevant screened options and River Mease SAC, six records for WCC are for the period 2010 to 2019. These records are associated with Rising Brook south of Rugeley Town, and Shropshire Brook near Upper Longdon.

12.2.2.4 Otter

Otters are very territorial, highly mobile and are known to use 20km or more of river habitat¹⁰⁰ as male have been known to have a home range encompassing up to 50km of river¹⁰¹. They are usually active at dusk and during the night, although they are known to be active during the daytime. Otters mainly eat fish, although crustaceans, frogs, voles and aquatic birds may also be a food resource¹⁰². In addition to rivers, otters are encountered on small streams, ditches, ponds, lakes, canals and marshes and can also be found in coastal areas and estuaries. An otter's resting site is known as a holt, which may be in a tree root system, a hole in a bank or under a pile of rocks. Drains and caves have also been recorded as otter holts. They also rest above ground in vegetation, creating flattened areas known as couches¹⁰². Resting sites are described as any site that an otter uses to stop when not engaged in foraging or commuting.

Breeding can occur at any time of year with one to four pups being born; the pups remain dependent on their mother for one year¹⁰². Females use a breeding site within their home range that is undisturbed, away from flooding and close to a good food supply¹⁰³. A distinction is made between the breeding site and the natal den. Identifying the location of natal den appears to be extremely difficult and may be some distance from major rivers¹⁰².

Otter populations declined rapidly in the 1960s due to the pollution of watercourses by pesticides. A ban on certain pesticides has resulted in an increase in otter numbers and they are now widely distributed across England, but still rare and uncommon in some areas of the UK¹⁰².

There is no specific detail on the locations of the River Mease SAC associated with otter.

NBN Atlas

Out of a total of 821 records within 10km of the relevant screened options and River Mease SAC, 149 records for otter are for the period 2010 to 2019. These records are associated with Rivers Trent, Mease, Sow, Blithe and Dove.

12.2.3 Condition, threats, and pressures

The River Mease SAC is legally underpinned by one Site of Special Scientific Interest (SSSI); River Mease SSSI. This SSSI is designated due to the presence of spined loach and bullhead. There are four SSSI units associated with the site; all of which are classified as 'river and streams' and have been assessed to be in 'unfavourable – no change' condition. Unit 1 covers the River Trent to Harlston Bridge (5.85 Ha), Unit 2 Harlston Bridge to Netherseal (9.50 Ha), Unit 3 Netherseal to Snareston (5.44 Ha) and Unit 4 Snareston to Packington (2.24 Ha). All units have information on failing targets due to: 1) point source and diffused pollution;

⁹⁹ Jacobs (March 2012) *River Mease SSSI/SAC Restoration Plan Technical Report*. For Natural England and the Environment Agency.

¹⁰⁰ The Mammal Society. Species factsheet: the otter (*Lutra lutra*). https://www.mammal.org.uk/wp-content/uploads/2016/08/otter_complete.pdf - accessed November 2021.

¹⁰¹ Chanin P., 2003. *Ecology of the European Otter*. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough.

¹⁰² Chanin P., 2003. *Ecology of the European Otter*. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough.

¹⁰³ Liles G., 2003. *Otter Breeding Sites. Conservation and Management*. Conserving Natura 2000 Rivers Conservation Techniques Series No. 5. English Nature, Peterborough.

2) physical modifications including over dredging, weirs or other impoundments, non-native species lack of river bank vegetation, lack of macrophyte species density and composition; and 3) over abstraction¹⁰⁴.

The following are pressures / threats with the outlined measures required to improve the condition of the feature which are listed within the River Mease SAC Site Improvement Plan¹⁰⁵:

- Water pollution – reduce levels of nutrients by controlling point and diffuse pollution sources.
- Inappropriate weirs, dams and other structures – implement the river restoration plan.
- Invasive species – manage and reduce the impact of invasive species.
- Siltation – work with land managers to reduce siltation levels.
- Water abstraction – improve the understanding of the ecological implications of the current water inputs and abstractions.

12.3 ASSESSMENT OF EFFECTS

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 12-1**.

¹⁰⁴ Natural England's Designated Sites View – River Mease SSSI. [Designated Sites View \(naturalengland.org.uk\)](https://www.naturalengland.org.uk/Designated-Sites-View). Accessed on 25 August 2022.

¹⁰⁵ Natural England. (2014). *Site Improvement Plan River Mease*. Improvement Programme for England's Natura 2000 Sites. Planning for the Future.

Table 12-1 Information to inform an assessment of adverse effects on River Mease SAC: spined loach, bullhead, white-clawed crayfish and otter

Qualifying Feature	Attribute	Target	Potential Effect	Mitigation	Effect on site integrity?
CONSTRUCTION PHASE					
Spined loach and bullhead	Supporting habitat: structure/function: Integrity of off-site habitats	Restore any supporting riverine habitats present beyond the site boundary upon which the [qualifying feature] of the site depends.	<p><i>Option 44</i></p> <p>The precise scope of the construction requirements for each option (including location, timing, materials, extent, duration, etc.) cannot be precisely defined at this point.</p> <p>There is potential off-site supporting habitat loss due to the new river abstraction, which is located on the River Sow, in addition to 3 crossings along the watercourse. The River Sow is a tributary of the River Trent, and the River Mease SAC discharges into the River Trent further downstream at Croxhall (approximately 21km from the River Sow)</p> <p>There are records of spined loach and bullhead within the River Sow. The likelihood of these populations being connected to those of the River Mease SAC are considered to be low. The APEM survey cited in the SACO states "...APEM found that young of the year were generally concentrated in the higher reaches of the Mease, suggesting that the Gilwiskaw Brook may be important habitat for spawning and juvenile fish, but overall young of the year were poorly distributed across the SAC".</p> <p>Literature for both species suggests that the bottom-dwelling habit, 'nesting'/burrowing and territorial behaviours, and poor swimming ability limits the distances over which the species will range^{106,107}, and therefore confines the population extent.</p> <p>The qualifying features may also be expose to site-derived pollutants (principally oils and other contaminants) and sediment entering the tributaries of/and River Trent, hence affecting potential off-site supporting habitats. An increase in fine sediments has potential to negatively affect the habitat suitability for spined loach and bullhead. The aquatic communities within the River Mease are highly sensitive to sedimentation and are typically associated with habitats dominated by fast flows and coarse sediments. Additional fine sediments could settle on macrophyte beds and coarse substrates downstream of the River Sow changing habitat suitability or smothering the plants, which could result in a reduction in the availability of suitable refuge areas for spined loach and bullhead.</p> <p>It is not possible to quantify the likely effects without details of the construction (including intended approaches and time of year). However, there are numerous established measures that can be employed to reliably avoid impact pathways being realised.</p>	<ul style="list-style-type: none"> Avoidance of suitable habitat to support spined loach or bullhead within the footprint of the works. Pipeline sections crossing the River Sow to utilise trenchless technology. Develop a precautionary working methodology (PWM) with regards to spined loach and bullhead which minimises the footprint of the proposed works within habitats which are suitable for the species. A suitably qualified and experienced Environment Clerk of Work (EnvCoW) would be appointed by the Contractor to oversee the implementation of mitigation and monitoring of the water environment. Adhere to relevant Environment Agency Pollution Prevention Guidance Notes for works in proximity to water. 	No adverse effects on site integrity from any option
	Supporting habitat: structure/function: Vegetation composition: invasive non-native species	Ensure any non-native species categorised as 'high-impact' in the UK are either rare or absent but if present are causing minimal damage to the [qualifying feature]	<p><i>Option 556</i></p> <p>Construction of the pipeline will require the crossing of Ashby-de-la-Zouch Canal upstream of the confluence with the River Mease (approximately 1.3km) and upstream of the River Mease SAC (approximately 5.4km).</p> <p>Limited records for both species exist within the pipeline crossing route and confluence with the River Mease and the Ashby-de-la-Zouch Canal. Environment Agency data at three monitoring stations within the River Mease provide records (2014-2017) of bullhead within the water course. No records of spined loach were present.</p> <p>Literature for both species suggests that the bottom-dwelling habit, 'nesting'/burrowing and territorial behaviours, and poor swimming ability limits the distances over which the species will range, and therefore confines the population extent.</p> <p>The qualifying features be exposed to site-derived pollutants (principally oils and other contaminants) and sediment entering the River Mease (through the construction across the pipeline over Ashby-de-la-Zouch Canal), hence affecting potential off-site supporting habitats. An increase in fine sediments has potential to negatively affect the habitat suitability for spined loach and bullhead. The aquatic communities within the River Mease are highly sensitive to sedimentation and are typically associated with habitats dominated by fast flows and coarse sediments. Additional fine sediments could settle on macrophyte beds and coarse substrates downstream of the crossing changing habitat suitability or smothering the plants, which could result in a reduction in the availability of suitable refuge areas for spined loach and bullhead.</p>		
			<p><i>Option 44 and Option 556</i></p> <p>Construction activities have the potential to cause or facilitate the spread of invasive non-native species. Invasive plant species can colonise new areas of land from seeds contained in the parent plant or the soil, or from fragments of living root or stem. Such reproductive materials can be inadvertently transferred to enabling works areas from outside of the scheme boundary if they adhere to vehicles, machinery, tools or clothing. they can also be inadvertently transferred in waste. Although there are no works proposed within the SAC boundary,</p>	<ul style="list-style-type: none"> Where any INNS are identified as a risk of being introduced, spread within, or moved off site, ensure mitigation measures are considered at the early planning stage, and ensure enough time is given to implement them. 	No adverse effect on site integrity

¹⁰⁶ Culling M.A and Côté I.M. (2006) *Genetics and ecology of spined loach in England: implications for conservation management* Science Report: SC000026/SR. Report for the Environment Agency,

¹⁰⁷ Tomlinson ML & Perrow MR (2003). *Ecology of the Bullhead*. Conserving Natura 2000 Rivers Ecology Series No. 4. English Nature, Peterborough.

Qualifying Feature	Attribute	Target	Potential Effect	Mitigation	Effect on site integrity?
			<p>seeds and plant fragments could be transported through the wider River Trent catchment and potential off-site supporting habitats.</p> <p>Once present, invasive species can spread rapidly and out-compete the native vegetation that characterises the notable non-designated habitat. Habitat loss and fragmentation can also encourage the colonisation of invasive species by providing a pathway of suitable environmental conditions for invasive species to move closer to areas currently free from these species, this could affect the conservation status of the qualifying habitat.</p> <p>Standard best practice mitigation measures are considered to be available to prevent the introduction of aquatic or riparian invasive species to the SAC or supporting habitats. Taking into account the proposed mitigation no adverse effects on site integrity are anticipated due to invasive species.</p>	<ul style="list-style-type: none"> Consider phasing construction to allow time to deal with the presence and/or risk of spread of INNS. Ensure INNS and locations (mapped) are incorporated within all relevant site method statements, including the site Ecological Protection Plan and Species Protection Plans, where appropriate. 	
White-clawed crayfish	Supporting habitat: structure/function: Supporting off-site habitat	Restore the quality of any supporting habitat present beyond the site boundary upon which the white-clawed crayfish population of the site depend	<p><i>Option 44</i></p> <p>There is potential off-site supporting habitat loss due to the installation of the pipeline which crosses the River Sow (the closest river crossing being approximately 21 km upstream of the River Mease SAC boundary). There are records of white-clawed crayfish within the River Trent and the River Sow. There are two barriers (two weirs within the River Trent) to fish movement between the River Mease SAC and the River Sow. It is unknown whether supporting habitats for white-clawed crayfish are present within the footprint of the proposed pipeline crossing, it is assumed that large watercourses will be tunnelled and smaller watercourses may be open cut.</p> <p>As above regarding site-derived pollution and sediments.</p> <p><i>Option 556</i></p> <p>There is potential off-site supporting habitat loss due to the installation of the pipeline due to the construction of the pipeline will require the crossing of Ashby-de-la-Zouch Canal upstream of the confluence with the River Mease (approximately 1.3km) and upstream of the River Mease SAC (approximately 5.4km).</p> <p>Limited historical species records are present within the study area. It is unknown whether supporting habitats for white-clawed crayfish are present within the footprint of the proposed pipeline crossing, it is assumed that large watercourses will be tunnelled and smaller watercourses may be open cut.</p> <p>As above regarding site-derived pollution and sediments.</p>	<ul style="list-style-type: none"> Avoidance of suitable habitat to support white-clawed crayfish within the footprint of the works. Develop a PWM with regards to white-clawed crayfish which minimises the footprint of the proposed works within habitats which are suitable for the species. A suitably qualified and experienced EnvCoW would be appointed by the Contractor to oversee the implementation of mitigation and monitoring of the water environment. 	No adverse effects on site integrity from any option
	Population (of the feature): Population health	<p>Restore the absence of non-native crayfish species from within the SAC and the catchment surrounding the site</p> <p>Restore the absence of individuals within the site infected with crayfish plague or porcelain disease</p> <p>Ensure human activities within or around the SAC do not pose a significant risk of plague transfer to the crayfish population</p>	<p><i>Option 44 and Option 556</i></p> <p>Construction activities and operational monitoring activities have potential to cause or facilitate the spread of invasive non-native species, including non-native crayfish. There are recent (past decade) records of signal crayfish <i>Pacifastacus leniusculus</i> on River Trent, upstream on the River Mease¹⁰⁸. Although there are no works proposed within the SAC boundary, it is possible that non-native crayfish species, crayfish plague or porcelain disease are brought into the working area and transferred to the SAC downstream or other off-site supporting habitats downstream.</p> <p>Once present, invasive species can spread rapidly and out-compete the native vegetation that characterises the notable non-designated habitat. Habitat loss and fragmentation can also encourage the colonisation of invasive species by providing a pathway of suitable environmental conditions for invasive species to move closer to areas currently free from these species, this could affect the conservation status of the qualifying habitat.</p> <p>Taking into account the proposed mitigation no adverse effects on site integrity are anticipated due to invasive species.</p>	<ul style="list-style-type: none"> Where any INNS are identified as a risk of being introduced, spread within, or moved off site, ensure mitigation measures are considered at the early planning stage, and ensure enough time is given to implement them. Consider phasing construction to allow time to deal with the presence and/or risk of spread of INNS. Ensure INNS and locations (mapped) are incorporated within all relevant site method statements, including the site Ecological Protection Plan and Species Protection Plans, where appropriate. 	No adverse effects on site integrity from any option
Otter	Supporting processes (on which the feature and/or its supporting habitat relies): Connectivity within and to the site	Ensure there are no significant artificial barriers to the safe passage and movement of otters into, within and away from the SAC	<p><i>Option 44</i></p> <p>There is potential off-site supporting habitat loss due to the upgrades to the reservoir embankment which will encroach on the existing extent of the River Sow (approximately 21 km upstream of the River Mease SAC boundary). There are records of otter within the River Sow. It is unknown whether otters are present within suitable supporting habitats within the footprint of the proposed reservoir impacts to the River Sow. It is assumed that large watercourses will be tunnelled and smaller watercourses may be open cut.</p> <p><i>Option 556</i></p> <p>There is potential off-site supporting habitat loss due to the installation of the pipeline due to the construction of the pipeline will require the crossing of Ashby-de-la-Zouch Canal upstream of the confluence with the River Mease (approximately 1.3km) and upstream of the River Mease SAC (approximately 5.4km).</p> <p>Limited historical species records are present within the study area. It is unknown whether supporting habitats for otters are present within the footprint of the proposed pipeline crossing, it is assumed that large watercourses will be tunnelled and smaller watercourses may be open cut.</p>	<ul style="list-style-type: none"> Avoidance of suitable habitat to support otter within the footprint of the works Develop a PWM with regards to otter which minimises the footprint of the proposed works within habitats which are suitable for the species A suitably qualified and experienced EnvCoW would be appointed by the Contractor to oversee the implementation of mitigation and monitoring of the water environment 	No adverse effects on site integrity from any option.

¹⁰⁸ NBN Atlas. <https://nbnatlas.org/> Accessed September 2022.

Qualifying Feature	Attribute	Target	Potential Effect	Mitigation	Effect on site integrity?
OPERATION PHASE					
Spined loach, bullhead, white-clawed crayfish and otter	Supporting habitat: structure/function: Integrity of off-site habitats	Restore any supporting riverine habitats present beyond the site boundary upon which the [qualifying feature] of the site depends.	<p><i>Option 44</i></p> <p>Option 44 would involve a new abstraction of 25MI/d from the River Sow southeast of Stafford (exact location unknown). There is little hydrological information available for the abstraction point so the baseline flow in which the assessment has been conducted against is a combination of the 28052 - Sow at Great Bridgeford and 28053 – Penk at Penkridge flow gauges. A combination of the flow from these gauges allows a Q95 of 78.4MI/d and Q75 of 135.9MI/d to be estimated, noting that this is likely to underestimate the actual flow at the abstraction point with several ungauged tributaries not accounted for.</p> <p>Based on the baseline flows, Option 44 could lead to a reduction in Q95 flows of 31.9% and Q70 flows of 18.4%. This is a significant hydrological change that would have pathways to impact the aquatic environment.</p> <p>The flow immediately downstream of the River Trent and River Sow increases to 207.1MI/d and 317.4MI/d under Q95 and Q75 conditions respectively (noting that this is based on the 28083 - Trent at Darlaston flow gauge which likely underrepresents the contribution of the River Trent at this point). The percentage reduction at this point is reduced to 12.1% under Q95 condition and 7.9% under Q75 conditions. At the next downstream flow gauge on the River Trent, 28012 - Trent at Yoxall, the percentage reduction in flow is minor with a 6% reduction in Q95 flows and 4% reduction in Q70 flows.</p> <p>It is worth noting, that at this stage the option is in the early phase of development and would require a new abstraction licence. It is assumed that suitable conditions would be set in the license that would restrict abstraction under a range of flows that are important to the aquatic ecology, including the qualifying features. With this assumed, there would be no adverse impacts on the aquatic ecology associated with this option.</p>	<ul style="list-style-type: none"> Suitable conditions within license to ensure sufficient flows maintained to support life stages of qualifying features. 	No adverse effects on conservation objectives and site integrity
			<p><i>Option 64</i></p> <p>A potential pathway exists where abstraction from the borehole could result in surface water impacts to the River Trent. However, any potential adverse impact on the Trent is unlikely to be significant due to difference in flows between the licenced abstraction (<5MI/d) and the river flows (4477 MI/d average flow at Shardlow NRFA Station Mean Flow Data for 28007 - Trent at Shardlow).</p> <p>The River Mease SAC, which is to the south of Option 64, is located beyond a catchment boundary for both surface water (Mease Rivers Operational Catchment) and groundwater (Tame Anker Mease - Permo-Triassic Sandstone Burton Operational Catchment and British Geological Survey (BGS)), as reflected in the contours.</p> <p>Therefore no impact to the River Mease SAC is anticipated. Impacts to offsite functionally linked habitat within the River Trent are also not anticipated as any changes to flow will not be discernible.</p>	<ul style="list-style-type: none"> None required. 	No adverse effects on conservation objectives and site integrity

13. STAGE 2 APPROPRIATE ASSESSMENT: RUTLAND WATER SPA AND RAMSAR

13.1 INTRODUCTION

Option 190 has the potential to cause LSEs to the Rutland Water SPA and Ramsar due to impact pathways to the qualifying habitats during construction only.

Rutland Water SPA and Ramsar is designated for the following qualifying features:

- Gadwall *Anas strepera* (non-breeding)
- Northern Shoveler *Anas clypeata* (non-breeding)
- Qualifying assemblage of species between July and April (gadwall, shoveler, coot *Fulica atra*, goldeneye *Bucephala clangula*, goosander *Mergus merganser*, great-crested grebe *Podiceps cristatus*, mute swan *Cygnus olor*, teal *Anas crecca*, tufted duck *Aythya fuligula*, wigeon *Anas penelope*).

Theoretical pathways for effects exist through:

- potential construction-related impacts on off-site supporting habitat (Eye Brook Reservoir) that will rely on project-level mitigation (and so cannot be 'screened out').

13.2 SITE SUMMARY

13.2.1 Site description

Rutland Water SPA is a large public water supply reservoir created in 1975 and located within the county of Rutland in the central lowlands of England. The reservoir is by area the largest water body in England and by capacity, the second largest. Since 1975, it has developed into a major wetland of international importance for waterbirds which are attracted to the large expanses of open water, lagoons, islands, mudflats, reedswamp, marsh, old meadows, pastures, scrub and mature woodland.

Consented changes to the water abstraction regime at Rutland Water have resulted in the provision of new wetland habitats for water birds. Most of this provision is within the existing boundary of the SPA but a proportion of the provision (lagoons 4, 5 and 7) is also provided outside of the SPA boundary (i.e. Habitats Regulations compensation). All these areas are being positively managed for water birds and will provide alternative habitats to off-set the negative impacts on the non-breeding water bird assemblage when the new water abstraction regime is implemented.

13.2.2 Qualifying features screened into Stage 2 Appropriate Assessment: baseline

13.2.2.1 Gadwall

Gadwall are present within the SPA throughout the year and the site supports both breeding and nonbreeding populations. However, it is during the passage and winter periods when migrant gadwall visit the site in internationally important numbers. Migrants start to arrive in June and build up in July and August with peak numbers recorded during September to November. During December to February, the numbers of migrants decline but significant numbers still remain within the SPA. The lowest numbers of gadwall are generally recorded during March, April and May.

When the SPA was designated in 1991, there was a baseline population of 1,320 individuals based on the 5-yr mean peak count recorded between 1985/86 and 1989/90. This equated to at least 11% of the NW European flyway population and 22% of the British population. Within this period, a minimum peak count of 1,031 birds was recorded in 1986/87 which sets the monitoring target for determining favourable condition of the SSSI under Common Standards Monitoring (CSM) protocols (Natural England 2016 - Definitions of Favourable Condition for Rutland Water SSSI). This monitoring target allows for natural fluctuations around the baseline. However, favourable conservation status of the SPA requires the baseline population to be maintained which is based on the mean peak count over a 5-year period.

13.2.2.2 *Northern shoveler*

Northern shoveler are present within the SPA throughout the year and the site supports both breeding and non-breeding populations. However, it is during the passage and winter periods when migrants northern shoveler visit the site in internationally important numbers. The numbers of migrants begin to build up in August and achieve peak numbers during September to November. From December, numbers can decline quite markedly through to March depending on conditions, but may pick up a little in April due to some spring passage. The lowest numbers are recorded mainly during May to July.

When the SPA was designated in 1991, there was a baseline population of 450 individuals based on the 5-yr mean peak count recorded between 1985/86 and 1989/90. This equated to at least 1% of the NW European flyway population and 5% of the British population. Within this period, a minimum annual peak count of 285 birds was recorded in 1987/88 which sets the monitoring target for determining favourable condition of the SSSI under Common Standards Monitoring (CSM) protocols (Natural England 2016. Definitions of Favourable Condition for Rutland Water SSSI). This monitoring target allows for natural fluctuations around the baseline. However, favourable conservation status of the SPA requires the baseline population to be maintained which is based on the mean peak count over a 5-year period.

13.2.2.3 *Waterbird assemblage*

From the period July to April each year, the SPA regularly supports a waterbird assemblage where peak counts of more than 20,000 waterbirds are achieved. The waterbird assemblage is present within the SPA throughout the year and includes both breeding and non-breeding waterbird populations. However, the SPA is most important during the passage and winter periods when migrants visit the site in internationally important numbers. Numbers of migrants start to build up mainly in July and each waterbird species can achieve peak numbers at any time between September and January

13.2.2.4 *Eye Brook Reservoir SSSI*

Given the proximity of Eye Brook Reservoir to Rutland Water SPA, it is considered that the reservoir could be used as offsite functionally linked habitat. The SSSI citation for the reservoir states “...*In autumn and winter the site attracts large numbers of ducks most notably Wigeon, Mallard, Teal and Pochard, while in spring and autumn flocks of a wide variety of wading birds on passage use the area for feeding.*”

13.2.3 Condition, threats, and pressures

The Rutland Water SPA and Ramsar is legally underpinned by one Site of Special Scientific Interest (SSSI); Rutland Water SSSI. There are three units associated with the site; all of which are classified as ‘river and streams’ and have been assessed to be in ‘favourable’ condition¹⁰⁹.

The following are pressures / threats with the outlined measures required to improve the condition of the feature which are listed within the Rutland Water SPA Site Improvement Plan¹¹⁰:

- Water abstraction - A005(NB) Great Crested Grebe, A036(NB) Mute swan, A050(NB) Wigeon, A051(NB) Gadwall, A052(NB) Eurasian teal, A056(NB) Shoveler, A061(NB) Tufted Duck, A067(NB) Goldeneye, A070(NB) Goosander, A125(NB) Common coot, Waterbird assemblage – explore whether the compensation areas can be incorporated within the designation.
- Inappropriate water levels - A005(NB) Great Crested Grebe, A036(NB) Mute swan, A050(NB) Wigeon, A051(NB) Gadwall, A052(NB) Eurasian teal, A056(NB) Shoveler, A061(NB) Tufted Duck, A067(NB) Goldeneye, A070(NB) Goosander, A125(NB) Common coot, Waterbird assemblage - Establish and maintain suitable compensatory habitats for waterfowl in the new lagoons during extreme drawdown events.

Eye Brook Reservoir SSSI is considered to be in 100% ‘favourable’ condition. The last assessment of the standing open water and canal habitat was undertaken in 2021 and recorded as “*All notified species meet 5 year count numbers needed for target condition. Teal current 5 year count 768 with a baseline of 247, pochard*”

¹⁰⁹ Natural England's Designated Site View – Rutland Water SSSI. [SSSI detail \(naturalengland.org.uk\)](https://www.naturalengland.org.uk) Accessed on 7 September 2022.

¹¹⁰ Natural England. (2014). *Site Improvement Plan River Mease*. Improvement Programme for England's Natura 2000 Sites. Planning for the Future.

current 5 year count 110 with a baseline of 96 and wigeon current 5 year count 692 with a baseline of 465 and Mallard current 5 year count is 390 with a baseline of 164.”¹¹¹

13.3 ASSESSMENT OF EFFECTS

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 13-1**.

¹¹¹ Natural England Designated Site View – Eye Brook Reservoir SSSI: Condition of SSSI Units for Site Eye Brook Reservoir SSSI. [Designated Sites View \(naturalengland.org.uk\)](https://naturalengland.org.uk). Accessed on 28 September 2022.

Table 13-1 Information to inform an assessment of adverse effects on Rutland Water SPA and Ramsar

Qualifying Feature	Attribute	Target	Potential Effect	Mitigation	Effect on site integrity?
CONSTRUCTION PHASE					
Non-breeding birds	Supporting habitat: Extent and distribution	Maintain the extent and distribution of suitable habitats for the features during passage and winter periods	<p><u>Noise and visual disturbance</u></p> <p>The reservoir is within 3km of Rutland Water SPA and Ramsar, and available Wetland Bird Survey data identifies use of the reservoir by the qualifying bird features, including gadwall (204 in the 19/20 survey period) and Northern shoveler (36 in the 19/20 survey period).</p> <p>The SACO identifies that the bird species could be present on site from July to April. Construction of the new intake structure at the reservoir, pumping station, WTW and pipeline connection could give rise to noise and visual disturbance effects causing displacement of the qualifying features during the wintering period. Natural England's internal guidance suggests that Stage 2 Appropriate Assessments are required where there is a change in baseline noise levels by 3dB. There is uncertainty as to the level of use, and therefore importance of the reservoir as offsite functionally linked habitat, and a noise assessment has not been completed to identify which areas could be impacted by a 3dB increase over baseline noise during construction.</p> <p>However, mitigation measures are considered to be available to avoid adverse effects.</p> <p><u>Contamination – dust and NOx loading</u></p> <p>Dust could be generated during the construction works where concrete breakout is required, and HGV and Non-Road Mobile Machinery could give rise to increases in NOx. Dust smothering and localised increases in nitrogen loading could change the condition and availability of macrophytes and prey within the reservoir.</p> <p>Guidance provided by the Institute of Air Quality Management¹¹² specific to the assessment of dust from construction and demolition identifies that deposition could be an issue up to 50m from the boundary of the site and 50m from haulage routes used by construction vehicles for up to 500m from a large construction site, 200m from a medium construction site and 50m from a small construction site. Evidence from the Dibden Bay Public Inquiry suggests that vegetation soiling from large construction sites, operating for more than a year, could occur up to 100m, and 25m with mitigation¹¹³.</p> <p>The potential for impacts from the option are not well defined as the location of the WTW hasn't been confirmed. However, mitigation measures are considered to be available to avoid adverse effects.</p> <p><u>Biological disturbance – invasive non-native species</u></p> <p>Construction activities have the potential to cause or facilitate the spread of invasive non-native species. Invasive plant species can colonise new areas of land from seeds contained in the parent plant or the soil, or from fragments of living root or stem. Such reproductive materials can be inadvertently transferred to enabling works areas from outside of the scheme boundary if they adhere to vehicles, machinery, tools or clothing. they can also be inadvertently transferred in waste.</p> <p>Once present, invasive species can spread rapidly and out-compete the native vegetation that characterises the notable non-designated habitat. Habitat loss and fragmentation can also encourage the colonisation of invasive species by providing a pathway of suitable environmental conditions for invasive species to move closer to areas currently free from these species, this could affect the conservation status of the qualifying habitat.</p> <p>Standard best practice mitigation measures are considered to be available to prevent the introduction of aquatic or riparian invasive species to the reservoir.</p>	<p><u>Noise and visual disturbance</u></p> <ul style="list-style-type: none"> • Avoid non-breeding period unless it can be demonstrated that there is sufficient evidence to demonstrate that noise and visual disturbance will not occur. • Noise assessment and consideration of attenuation measures to reduce noise across the waterbody may be sufficient to allow some works to be undertaken in the non-breeding season. • The severe weather warning restrictions imposed for wildfowl shooting should be adhered to. <p><u>Contamination – dust and NOx</u></p> <ul style="list-style-type: none"> • Complete an air quality assessment of potential for N loading on sensitive habitats once details of plant and construction programme have been confirmed (e.g. using method outlined in DMRB Air Quality Appendix F). • If air quality assessment identifies an exceedance of the critical load due to stationary traffic being held as pipeline is installed in road, traffic must be diverted or other traffic management measures put in place to ensure critical load, and therefore an adverse effect on the site, is avoided. • Dust suppression measures including dampening and dust screens to be applied to reduce dispersion to minimum distance. <p><u>INNS</u></p> <ul style="list-style-type: none"> • Best practice biosecurity measures, as recommended by the GB Non-Native Species Secretariat (http://www.nonnativespecies.org/index.cfm?sectionid=58) would guard against any potential for spreading invasive species as a result of construction. • Where any INNS are identified as a risk of being introduced, spread within, or moved off site, ensure mitigation measures are considered at the early planning stage, and ensure enough time is given to implement them. • Consider phasing construction to allow time to deal with the presence and/or risk of spread of INNS. • Ensure INNS and locations (mapped) are incorporated within all relevant site method statements, including the site Ecological Protection Plan and Species Protection Plans, where appropriate. <p><u>General</u></p> <ul style="list-style-type: none"> • A Construction Management Plan will be drawn up to detail all exclusion and protection measures. • All of the above mitigation measures will be monitored and enforced by an on-site Environmental Clerk of Works. 	No adverse effects on conservation objectives or site integrity

¹¹² Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction. IAQM, London

¹¹³ Technical Statement TS/AQ1, Association of British Ports (ABP), 2000.

14. STAGE 2 APPROPRIATE ASSESSMENT: BREDON HILL SAC AND DIXTON WOOD SAC

14.1 INTRODUCTION

Option 66 has been screened in as potentially impacting offsite functionally linked habitat used by the Violet click beetle *Limoniscus violaceus* for which both Bredon Hill SAC and Dixton Wood SAC are designated.

Theoretical pathways for effects exist through:

- potential construction-related impacts on off-site supporting habitat that will rely on project-level mitigation (and so cannot be 'screened out').

14.2 SITE SUMMARY

14.2.1 Site description

Bredon Hill has one of the best assemblages of invertebrates associated with ancient trees (known collectively as saproxylic invertebrates) in Britain. The saproxylic invertebrates are associated with ancient native trees, in particular ash *Fraxinus excelsior*. Pedunculate oak *Quercus robur*, beech *Fagus sylvatica* and field maple *Acer campestre* are also important¹¹⁴.

14.2.2 Qualifying features screened into Stage 2 Appropriate Assessment: baseline

14.2.2.1 Violet click beetle

The violet click beetle has been found at two separate sites on Bredon Hill. It is extremely rare in Britain, and there are only three known sites in the UK which supports the species; Windsor Forest, Bredon Hill and Dixton Wood. It is probable that a large population of ancient trees is necessary for a site to support this species. Violet click beetles are thought to breed repeatedly in the same tree until it rots away and the adults fly off to find new breeding sites.

The violet click beetle is also fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and Schedule 2 of the Conservation of Habitats and Species Regulations 2017, making it a 'European Protected Species'. A Licence therefore be required for any activities likely to harm or disturb violet click beetle¹¹⁵.

There is uncertainty as to how far Violet click beetle can disperse, with this being subject of an action within the Site Improvement Plan. Evidence documented in the SACO suggests that the beetle is a poor disperser, however there is insufficient information to determine whether there are linkages between the Bredon Hill SAC and Dixton Wood SAC populations, and use of suitable habitat between the two sites.

14.2.3 Condition, threats and pressures

The Bredon Hill SAC is legally underpinned by one Site of Special Scientific Interest (SSSI); Bredon Hill SSSI. There are 17 units associated with the site; all of which are classified as 'river and streams'. The SSSI condition assessment determines that 88.85% of the site is in favourable condition and 11.15% in unfavourable recovering condition.

The following are pressures / threats with the outlined measures required to improve the condition of the feature which are listed within the Bredon Hill SAC Site Improvement Plan and of relevance to the impact pathways identified for the WRMP24:

- Forestry and woodland management – Formulate and implement a wood mould continuity strategy for the Violet click beetle population.

¹¹⁴ English Nature (2005) EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora Citation for Special Area of Conservation (SAC) Bredon Hill.

¹¹⁵ Natural England (2018) European Site Conservation Objectives: Supplementary advice on conserving and restoring site features Bredon Hill Special Area of Conservation (SAC) Site code: UK0012587.

- Feature location/ extent/ condition unknown - survey of Violet click beetle, to identify site distribution¹¹⁶.

14.3 ASSESSMENT OF EFFECTS

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 14-1**.

¹¹⁶ Natural England (2015) Improvement Programme for England's Natura 2000 Sites (IPENS) Planning for the Future. Site Improvement Plan Bredon Hill.

Table 14-1 Information to inform an assessment of adverse effects on Bredon Hill SAC and Dixon Wood SAC

Attribute	Target	Potential Effect	Mitigation	Effect on site integrity?
Supporting habitat: Extent and distribution – distribution of supporting habitat	Restore distribution and continuity of the feature and its supporting habitat; W8 Ash woodland, with suitably decaying veteran trees and nectar providing plants, across the site.	<p><u>Loss of offsite functionally linked habitat</u></p> <p>The proposed pipeline route and WTW are located c.2km to the west of Bredon Hill SAC, and 10.1km from Dixon Hill SAC. Priority habitat mapping shows that the existing Strensham WTW is surrounded by deciduous woodland, although the species composition is unknown. There are few parcels of woodland between the site and Bredon Hill SAC, with arable fields dominating, suggesting dispersal of the violet click beetle west would be limited (given habitat preferences).</p> <p>The footprint for the WTW expansion has not been confirmed, although the pipeline could potentially result in loss of deciduous woodland. As such, habitat and/or invertebrate surveys should be undertaken to determine presence of violet click beetle in the woodland, and detailed design completed to minimise loss of woodland, use of trenchless techniques for the pipeline connections.</p> <p>Mitigation measures are considered to be available to avoid adverse effects, even though there is uncertainty as to the presence of the qualifying feature.</p>	<p><u>Potential loss of offsite functionally linked habitat</u></p> <ul style="list-style-type: none"> • Design WTW expansion and pipeline route to minimise loss of deciduous woodland, particularly mature stands of ash. • Utilise trenchless technologies for pipeline installation to the WTW to avoid loss of deciduous woodland. <p><u>General</u></p> <ul style="list-style-type: none"> • A Construction Management Plan will be drawn up to detail all exclusion and protection measures. 	No adverse effects on conservation objectives or site integrity

15. STAGE 2 APPROPRIATE ASSESSMENT: FENS POOLS SAC

15.1 INTRODUCTION

Option 79B has been screened in as potentially impacting Fen Pools SAC during construction only.

Fen Pools SAC is designated for the following qualifying features:

- Great crested newt (*Triturus cristatus*)

Theoretical pathways for effects exist through:

- potential construction-related impacts on off-site supporting habitat that will rely on project-level mitigation (and so cannot be 'screened out').

15.2 SITE SUMMARY

15.2.1 Site description

Fens Pools is a 20-hectare SAC and a 38-hectare SSSI situated in the suburban borough of Dudley in Staffordshire. The site comprises of three canal feeder reservoirs and a series of smaller pools. They overlie marls and coal measures of the Carboniferous period. The site shows evidence of past industrial activities and includes a wide range of habitats from open water, swamp, fen and inundation communities to unimproved neutral and acidic grassland and scrub. Great crested newts *Triturus cristatus* occur as part of a nationally significant amphibian assemblage. Fens Pools is the best amphibian site known in the West Midlands.

15.2.2 Qualifying features screened into Stage 2 Appropriate Assessment: baseline

15.2.2.1 *Great crested newt*

The great crested newt *Triturus cristatus* is the largest native British newt, reaching up to around 17 cm length. Breeding sites are mainly medium-sized ponds, though ditches and other waterbody types may also be used less frequently. Ponds with ample aquatic vegetation (which is used for egg-laying) seem to be favoured. Great crested newts do not require very high water quality but are normally found in ponds with a circum-neutral pH. Broad habitat type varies greatly, the most frequent being pastoral and arable farmland, woodland, scrub, and grassland. There are also populations in coastal dunes and shingle structures. Great crested newts can be found in rural, urban and post-industrial settings, with populations less able to thrive where there are high degrees of fragmentation. The connectivity of the landscape is important, since great crested newts often occur in metapopulations that encompass a cluster of several or many ponds. This helps ensure the survival of populations even if sub-populations are affected by, for example, pond desiccation or fish introductions.

15.2.3 Condition, threats, and pressures

The Fen Pools SAC is legally underpinned by one Site of Special Scientific Interest (SSSI); Fen Pools SSSI. This SSSI is designated due to the presence of great crested newts. There are six SSSI units associated with the site; all of which are classified as 'standing open water and canals' and have been assessed to be in 'favourable' condition.

The following are pressures / threats with the outlined measures required to improve the condition of the feature which are listed within the Fens Pools SAC Site Improvement Plan¹¹⁷:

- Water pollution – Off road vehicles/burnt out vehicles pose a pollution threat to the GCN when the abandonment affects the breeding pools for the GCN.
- Habitat fragmentation- Fens Pools is partially isolated as a result of its location with in a large urban area. The connectivity / genetic interchange with other great crested newt populations is believed to be low or non-existent.

¹¹⁷ Natural England. (2014). *Site Improvement Plan Fens Pools*. Improvement Programme for England's Natura 2000 Sites. Planning for the Future.

15.3 ASSESSMENT OF EFFECTS

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 15-1**.

Table 15-1 Information to inform an assessment of adverse effects on Fen Pools SAC

Qualifying Feature	Attribute	Target	Potential Effect	Mitigation	Effect on site integrity?
CONSTRUCTION PHASE					
Great crested newt	Supporting habitat: Extent and distribution	Maintain and expand the distribution and continuity of the Great Crested Newt's supporting habitat,	<p>The precise scope of the construction requirements for each option (including location, timing, materials, extent, duration, etc.) cannot be precisely defined at this point.</p> <p>There is potential off-site supporting habitat loss due to the new river abstraction, which is located on the River Sow, in addition to 3 crossings along the watercourse. The River Sow is a tributary of the River Trent, and the River Mease SAC discharges into the River Trent further downstream at Croxhall (approximately 21km from the River Sow)</p> <p>There are records of spined loach and bullhead within the River Sow. The likelihood of these populations being connected to those of the River Mease SAC are considered to be low. The APEM survey cited in the SACO states "...APEM found that young of the year were generally concentrated in the higher reaches of the Mease, suggesting that the Gilwiskaw Brook may be important habitat for spawning and juvenile fish, but overall young of the year were poorly distributed across the SAC".</p> <p>Literature for both species suggests that the bottom-dwelling habit, 'nesting'/burrowing and territorial behaviours, and poor swimming ability limits the distances over which the species will range , , and therefore confines the population extent.</p> <p>The qualifying features may also be expose to site-derived pollutants (principally oils and other contaminants) and sediment entering the tributaries of/and River Trent, hence affecting potential off-site supporting habitats. An increase in fine sediments has potential to negatively affect the habitat suitability for spined loach and bullhead. The aquatic communities within the River Mease are highly sensitive to sedimentation and are typically associated with habitats dominated by fast flows and coarse sediments. Additional fine sediments could settle on macrophyte beds and coarse substrates downstream of the River Sow changing habitat suitability or smothering the plants, which could result in a reduction in the availability of suitable refuge areas for spined loach and bullhead.</p> <p>It is not possible to quantify the likely effects without details of the construction (including intended approaches and time of year). However, there are numerous established measures that can be employed to reliably avoid impact pathways being realised.</p>	<p><u>Noise and visual disturbance</u></p> <ul style="list-style-type: none"> Avoid non-breeding period unless it can be demonstrated that there is sufficient evidence to demonstrate that noise and visual disturbance will not occur. Noise assessment and consideration of attenuation measures to reduce noise across the waterbody may be sufficient to allow some works to be undertaken in the non-breeding season. The severe weather warning restrictions imposed for wildfowl shooting should be adhered to. <p><u>Contamination – dust and NOx</u></p> <ul style="list-style-type: none"> Complete an air quality assessment of potential for N loading on sensitive habitats once details of plant and construction programme have been confirmed (e.g. using method outlined in DMRB Air Quality Appendix F). If air quality assessment identifies an exceedance of the critical load due to stationary traffic being held as pipeline is installed in road, traffic must be diverted or other traffic management measures put in place to ensure critical load, and therefore an adverse effect on the site, is avoided. Dust suppression measures including dampening and dust screens to be applied to reduce dispersion to minimum distance. <p><u>INNS</u></p> <ul style="list-style-type: none"> Best practice biosecurity measures, as recommended by the GB Non-Native Species Secretariat (http://www.nonnativespecies.org/index.cfm?sectionid=58) would guard against any potential for spreading invasive species as a result of construction. Where any INNS are identified as a risk of being introduced, spread within, or moved off site, ensure mitigation measures are considered at the early planning stage, and ensure enough time is given to implement them. Consider phasing construction to allow time to deal with the presence and/or risk of spread of INNS. Ensure INNS and locations (mapped) are incorporated within all relevant site method statements, including the site Ecological Protection Plan and Species Protection Plans, where appropriate. <p><u>General</u></p> <ul style="list-style-type: none"> A Construction Management Plan will be drawn up to detail all exclusion and protection measures. All of the above mitigation measures will be monitored and enforced by an on-site Environmental Clerk of Works. 	No adverse effects on conservation objectives or site integrity

16. STAGE 2 APPROPRIATE ASSESSMENT: RIVER DEE AND BALA LAKE SAC

16.1 INTRODUCTION

Option 503 has been screened in as potentially impacting River Dee and Bala Lake SAC during operation only.

Theoretical pathways for effects exist through:

- reduced freshwater input to the wider river catchment, therefore causing potential deterioration of habitat and supporting flows.

River Dee and Bala Lake SAC is designated for the following qualifying features, however on the basis of the above pathways and information on species presence in the impacted unit, only those qualifying features in bold have been taken through to the appropriate assessment:

- **Water courses of plain to montane levels with *R. fluitantis***
- **Sea lamprey *Petromyxon marinus***
- **Brook Lamprey *Lampetra planeri***
- **River lamprey *Lampetra fluviatilis***
- **Atlantic salmon *Salmo salar***
- **Bullhead *Cottus gobio***
- Otter *Lutra*; and
- Floating water plantain *Luronium natans*.

16.2 SITE SUMMARY

16.2.1 Site description

River Dee and Bala Lake is a 1309-hectare SAC and is legally underpinned by three SSSIs: Afon Dyfrdwy (River Dee) SSSI, Llyn Tegid SSSI, and River Dee (England) SSSI. The Afon Dyfrdwy-River Dee SSSI has its source in Snowdonia at the outflow of Llyn Tegid SSSI and it includes the Ceiriog, Meloch, Tryweryn and Mynach tributaries. Its catchment contains a wide spectrum of landscape from high mountains around Bala, rugged peaks near Llangollen, steep sided wooded valleys, and the plains of Cheshire and North Shropshire through to the vast mudflats of the estuary.

The tidal influence can be seen in Farndon with high tides regularly exceeding the Chester weir. It flows through broad valley near Corwen, and through the Vale of Llangollen where it meanders north towards the Cheshire plain to meet the River Dee (England) SSSI. Further downstream it includes the stretch below Chester to where the river meets the Dee Estuary.

The River Dee is thought to be the most regulated river in Europe in addition to providing water for the Shropshire Union Canal. Flow is mostly controlled by the reservoirs of Tegid, Celyn and Brenig. The river is an important fishing and tourist facility. In recent years there have been several pollution incidents arising from industrial and agricultural activity that have caused fish kills.

16.2.2 Qualifying features screened into Stage 2 Appropriate Assessment: baseline

16.2.2.1 *Watercourses of plain to montane levels with R.fluitantis*

This habitat type is characterised by the abundance of water-crowfoots *Ranunculus* spp., subgenus *Batrachium* (*Ranunculus fluitans*, *R. penicillatus* ssp. *penicillatus*, *R. penicillatus* ssp. *pseudofluitans*, and *R. peltatus* and its hybrids). Floating mats of these white-flowered species are characteristic of river channels in early to mid-summer. They may modify water flow, promote fine sediment deposition, and provide shelter and food for fish and invertebrate animals. There are several variants of this habitat in the UK, depending on geology and river type. In each, *Ranunculus* species are associated with a different assemblage of other aquatic plants, such as water-cress *Rorippa nasturtium-aquaticum*, water-starworts *Callitriche* spp., water-parsnips *Sium latifolium* and *Berula erecta*, water-milfoils *Myriophyllum* spp. and water forget-me-not *Myosotis*

scorpioides. In some rivers, the cover of these species may exceed that of *Ranunculus* species. Three main sub-types are defined by substrate and the dominant species within the *Ranunculus* community.

In the River Dee, the aquatic plant community includes Wirtgen's water-crowfoot *Ranunculus x bachii* and pond water-crowfoot *R. peltatus*, and also floating water-plantain *Luronium natans*. Water-crowfoot forms extensive beds along the whole length of the Dee where flow conditions are suitable. Other aquatic plants which occur within the site include intermediate water-starwort *Callitriche hamulata*, alternate-flowered water-milfoil *Myriophyllum alterniflorum* and bryophytes including *Rhynchostegium riparoides* and *Fontinalis antipyretica*.

16.2.2.2 *Sea lamprey, brook lamprey, and river lamprey*

The river and sea lamprey are a primitive type of fish having a distinctive suckered mouth but no jaws. Although numbers of lamprey have declined over the last 100 years, the UK is still one of their strongholds. River lamprey are distributed from the western Mediterranean to southern Norway, and sea lamprey can be found from northern Norway to western Mediterranean and eastern North America. In Britain, the ammocoetes of lamprey occur in silt beds in many rivers from northern Scotland southwards. Although for sea lamprey they are now absent from many northern rivers. Occasionally, they are found in suitable silts in large lakes. They are absent from a number of rivers because of pollution or obstacles that the adults cannot surmount during the spawning migration, such as natural waterfalls or artificial dams. Other threats include pollution and channelisation¹¹⁸.

Sea and river lampreys spend their adult life in the sea or estuaries but spawn and spend the juvenile phase in rivers. They use the Severn Estuary as a migratory passage to and from their spawning and nursery grounds in the rivers.

The sea, brook and river lamprey populations are found throughout the River Dee. Sea and river lamprey utilize the River Dee for migratory purposes. There are important populations of brook lamprey found in the River Dee.

16.2.2.3 *Atlantic salmon Salmo salar*

The Atlantic salmon *Salmo salar* is the only native salmon to the UK. It is an anadromous species, with the freshwater phase requiring cool, swift-flowing streams and rivers (although it can also occur in lakes), with good water quality, clean gravels, physical habitat complexity that provides shallow water and flow refuges for juveniles, deeper water for adults, and an unimpeded river corridor for adult and smolt migrations. Spawning takes place in shallow, gravelly areas where the water flows swiftly. The juvenile 'parr' spread out into other parts of the river. After a period of 1-6 years, the young salmon migrate downstream to the sea as 'smolts'. If they survive at sea, most salmon return to spawn in the river of their birth after 1-3 years. A small percentage of individuals do not return to their natal river and instead choose a different river in which to spawn¹¹⁹.

The River Dee is recognised as one of North Wales' premier rivers for Atlantic salmon *Salmo salar*. The Mynach, Meloch and Ceiriog tributaries are the most important salmon spawning tributaries in the Dee catchment. The condition of salmon in the River Dee SSSI are considered unfavourable for all SSSI units.

16.2.2.4 *Bullhead*

The bullhead is the only freshwater cottid species found in the UK, and is adapted to benthic habitats. This species predominantly occurs in stony streams and rivers where the flow is moderate, water is cool, and oxygen-rich. The bullhead spawn from February to June, and are territorial and tied to their nest. Shade and cover are important for this species which actively hides from light. The bulk of their diet is benthic invertebrates, particularly crustaceans. Their habitat requirements are variable depending on the life stage. Coarse substrates are essential for breeding, with shallow stony riffles used by young fish. Sheltered areas with woody debris and leaf litter are preferred by adult fish. The upper pH tolerance levels of 9.0 and lower limit of oxygen concentration of 40% is associated with bullhead. Water depth is not critical to this species, but high temperatures and/or low dissolved oxygen are likely to be fatal in shallow waters¹²⁰.

¹¹⁸ Maitland P. S (2003) *Ecology of the River, Brook and Sea Lamprey*. Conserving Natura 2000 Rivers. Ecology Series 5. English Nature, Peterborough.

¹¹⁹ Natural England and RSPB, 2019. Climate Change Adaptation Manual - Evidence to support nature conservation in a changing climate, 2nd Edition. Natural England, York, UK.

¹²⁰ Tomlinson, M. L., & Perrow, M. R. (2003). *Ecology of the Bullhead*. Conserving Natura 2000 Rivers Ecology Series No. 4 English Nature, Peterborough.

Important populations of bullhead exist throughout the River Dee.

16.2.3 Condition, threats, and pressures

The River Dee and Bala Lake SAC is legally underpinned by three Site of Special Scientific Interest (SSSI); Afon Dyfrdwy (River Dee) SSSI, River Dee (England) SSSI and Llyn Tegid SSSI.

- River Dee (England) SSSI: This SSSI is designated due to the presence Atlantic salmon *Salmo salar*, otter *Lutra lutra*, club-tailed dragonfly *Gomphus vulgatissimus* and fluvial geomorphology. There are four SSSI units associated with the site; all of which are classified as 'rivers and streams' and one unit has been assessed to be in 'favourable' condition with the remaining units assessed to be in 'unfavourable – no change' condition. Water abstraction and unknown sources of water pollution are known pressures to the site.
- Afon Dyfrdwy (River Dee) SSSI: This SSSI is designated due to the presence of Mesotrophic upland plateau rivers, Moderate gradient sand/shale rivers below uplands, Middle reaches of upland rivers traversing more base rich strata, Clay rivers with diverse substrates and flow patterns, Saltmarsh / freshwater transition habitats, Slender hare's-ear *Bupleurum tenuissimum*, Sea barley *Hordeum marinum*, Hard-grass *Parapholis strigose*, Club tailed dragonfly *Gomphus vulgatissimus*, Scare yellow sally *Isogenus nubecula*, and Yellow crucifer weevil *Aulacobaris lepidii*. Water quality and flow are known pressures to the site.

There are no pressures / threats with the outlined measures required to improve the condition of the feature listed within the River Dee and Lake Bala SAC Site Improvement Plan¹²¹:

- Water Quality: Salmon, sea lamprey, river lamprey bullhead
- Flow: Salmon, sea lamprey, river lamprey, brook lamprey, bullhead
- River morphology – Physical features: Salmon, sea lamprey, river lamprey, brook lamprey
- bullhead
- River morphology – artificial barriers: salmon, sea lamprey, River lamprey, brook lamprey, bullhead
- Artificial Stocking: Salmon, sea lamprey, river lamprey, bullhead
- Abstraction Entrainment: Sea lamprey, river lamprey, brook lamprey
- Exploitation: Salmon, sea lamprey
- Anthropogenic mortality: Otters

16.3 ASSESSMENT OF EFFECTS

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 16-1**.

Based on the proposed location of the borehole it has been assumed that the groundwater drawdown, could impact Unit 7852 Dee: Chester Weir to Ceiriog as identified by NRW's Core Management Plan¹²² for the site.

16.4 UNCERTAINTIES

There is limited understanding of the distribution of the qualifying features within the wider River Dee catchment and therefore extent of suitable habitat within the impacted reach. Baseline surveys of the affected reaches (habitat and barriers) should be undertaken to support the project-level HRAs. There is also uncertainty as to how the operation of the borehole, and groundwater drawdown, could affect flows to the River Dee. Further investigation and groundwater modelling will be required to support the development of the option.

¹²¹ Natural England. (2014). *Site Improvement Plan River Dee and Lake Bala SAC*. Improvement Programme for England's Natura 2000 Sites. Planning for the Future.

¹²² Natural Resources Wales (Sept. 2022) Core Management Plan including Conservation Objectives for River Dee and Bala Lake/Afon Dyfrdwy a Llyn Tegid SAC. V3.

Table 16-1 Information to inform an assessment of adverse effects on River Dee and Bala Lake SAC

Qualifying Feature	Attribute	Target	Potential Effect	Mitigation	Effect on site integrity?
OPERATION PHASE					
Watercourses of plain to montane levels	Water course flow	Restore the natural flow regime of the river	There is currently uncertainty as to the extent of the habitat within the management unit that could be impacted by groundwater drawdown, with the NRW Core Management Plan stating "Map extent of this feature and any of its sub-types within the SAC Identify units where substrate problems may be restricting the extent or quality of this feature from existing fluvial audit or other sources. Raise water quality to required standards" as a key action.	<ul style="list-style-type: none"> Relocate borehole within the Dee Permo-Triassic Sandstone groundwater body such that impact to flows in the River Dee can be avoided, but also accounting for potential interactions with the West Midlands SAC and Midland Meres and Mosses Phase 1 and 2 Ramsars. Further investigation undertaken to establish suitable borehole location in consultation with EA/NE/NRW. Alternatives, if a suitable borehole location is not found, could be 561 Kinsall transfer or 563 Whitchurch and Wem Transfer – as these would supply similar volumes and to similar water resource zones (currently in AMP12 in the Environmental stretch alternative plan). 	No adverse effects on conservation objectives or site integrity
	Water quality	Water quality should be compliant with the standards set out in JNCC's Common Standards Monitoring Guidance for Rivers	A reduction in freshwater input could result in water quality deterioration. Although the abstraction volume is small compared to flows in the River Dee, there is uncertainty as to the impact without groundwater modelling.		
Fish species (sea, brook and river lamprey, bullhead and Atlantic salmon)	Supporting habitat: structure/ function: Flow regime	Upper limit: +10% of recent actual flow. Lower limit: -10% of recent actual flow	<p>There is potential for the abstraction to alter the flow regime of the River Dee, however, the significance of the impact is uncertain at the time of writing this report.</p> <p>The Core Management Plan notes; "to a large extent, water flow in the Dee and certain of its tributaries, is regulated by NRW under a set of rules called the Dee General Directions, a requirement of the Dee and Clwyd River Authority Act 1973". It is noted however that the regulation relies on sufficient flow over Chester Weir, which is downstream of the reach which could be potentially impacted by this option.</p> <p>Although the nearest flow gauge for the River Dee at Manley Hall indicates average flows much larger than the proposed abstraction (2708 MI/d) vs 5 MI/d) it is unclear whether the abstraction could adversely impact the SAC and reduce flows over Chester Weir. As such it is recommended that further assessment is undertaken to confirm whether there could be an adverse on the environmental receptors.</p>		No adverse effects on conservation objectives or site integrity

17. STRATEGIC IN-COMBINATION ASSESSMENT

17.1 BETWEEN-OPTION 'IN-COMBINATION' EFFECTS

The effects of the WRMP24 options operating 'in-combination' have been explored through the screening and appropriate assessment phases (see from **Section 5** to **Section 16** where relevant), with an assessment on the impacts to the River Trent (relevant to offsite functionally linked habitat for the River Mease SAC qualifying features) and the Humber Estuary (relevant to the Humber Estuary European Marine Site migratory fish and freshwater input to estuaries) below. These assessments have concluded that adverse 'in-combination' effects are not likely to occur for any European sites or features based on the currently available information, although this may require updating with the development of the groundwater model.

17.1.1 River Trent and Humber Estuary in-combination assessment

There are 11 options within the preferred plan that have the potential to impact the river flows in the River Trent and thus into the Humber Estuary:

- 29 Homesford WTW capacity increase
- 44 New R Sow abstraction and WTW near Stafford
- 64 Rehabilitation Milton GW Source
- 84C Whitacre Minor Dam Extension
- 95B Ogston WTW Expansion
- 123B Raise Dam at Tittesworth Reservoir (25%)
- 187C Expand Carsington Reservoir (25000 MI)
- 406A New abstraction and WTW on River Trent - with licence transfer
- 426 Little Eaton WTW DO recovery
- 435 Whitacre WTW DO Recovery
- 528 New GW Source Soar - PT Sandstone nr Coalville

To determine the potential change to freshwater flow input to the Upper Humber Estuary (landwards of the Trent Falls – where the Trent arm and Ouse arm of the Humber Estuary converge), a baseline freshwater flow input series has been synthesised using the historic daily flows from the following flow gauges:

- Wharfe at Tadcaster (27089)
- Foss at Huntington (27083)
- Ouse at Skelton (27009)
- Derwent at Buttercrambe (27041)
- Blackfoss Beck at Sandhills Bridge (27044)
- Bielby Beck at Thornton Lock (27076)
- Trent at North Muskham (28022)
- Idle at Mattersey (28015)
- Torne at Auckley (28050)
- Don at Doncaster (27021)
- Went at Walden Stubbs (27064)
- Aire at Beal (27003)

The data has been sourced from the NRFA website¹²³ and has been used to synthesis a 30 year and 9 month (01/01/1992 to 30/09/2022) baseline daily flow series for the freshwater input to the Upper Humber Estuary. The series is 98.5% complete with the data for 165 days being removed. Data has been removed from the series where one or more of the significant inflows, gauges with catchment areas greater than 200km², have missing data. The gauges used capture 81% (18,155km²) of the 22,366km² catchment area of the Upper Humber Estuary so will underrepresent the freshwater input.

¹²³ <https://nrfa.ceh.ac.uk/data/search>

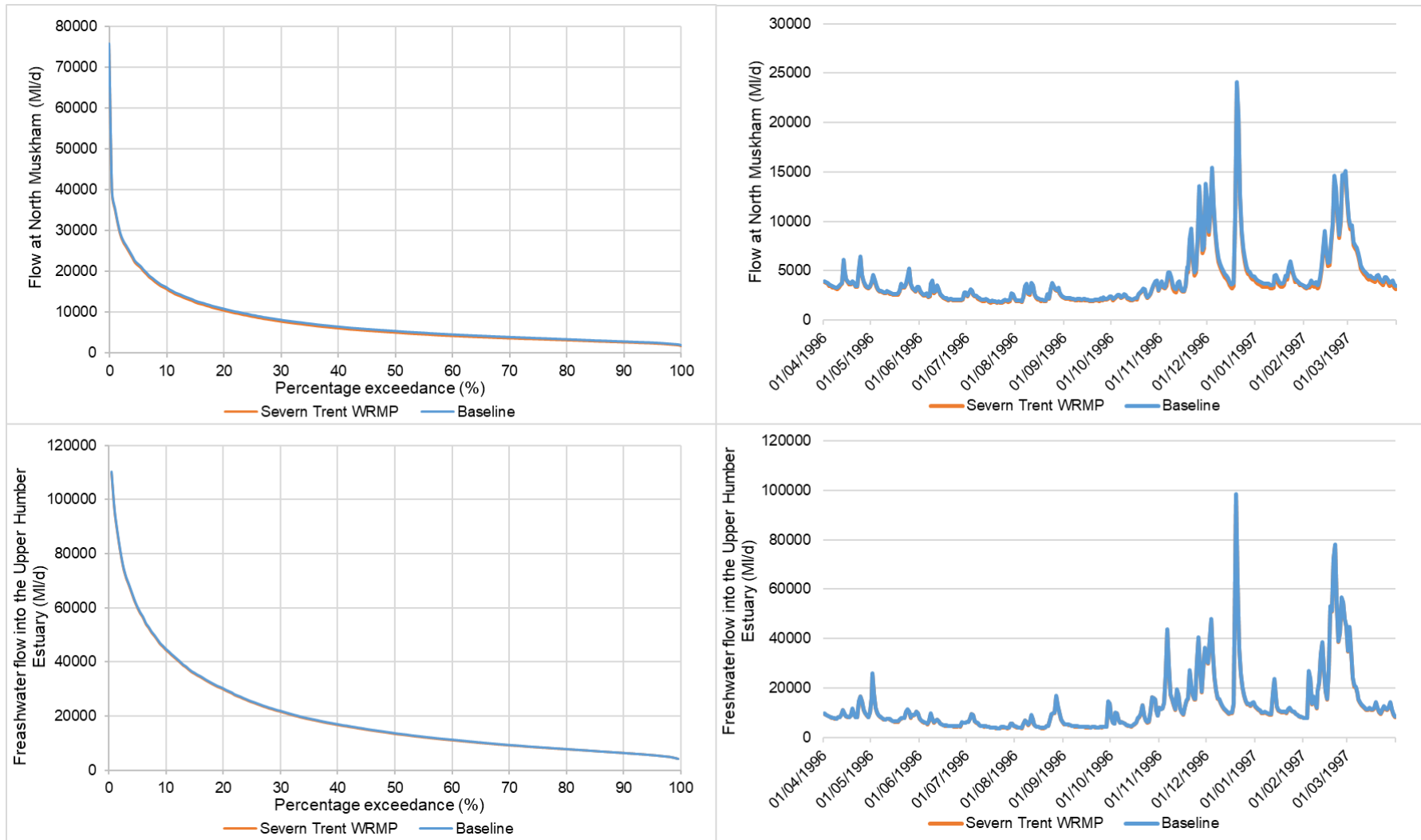
The assessment also reviews how the flows at North Muskham alone may be impacted to characterise the potential impact on the Trent arm of the Humber Estuary.

To understand how the flows might change as a result of the options within the Severn Trent WRMP, a parallel flow series (Severn Trent WRMP) to the baseline series has been developed. This series has assumed additional abstraction rates for the options that may impact the River Trent and Humber Estuary and deducted these rates from the baseline series. The abstraction assumptions are presented in the table below and, with there being significant uncertainty of the operation of the options cumulatively, have aimed to be precautionary. The Severn Trent WRMP series has not considered flow increases in the Trent catchment as a result of any environmental destination measures that are being delivered.

Table 17.1 Abstraction assumptions applied to the Severn Trent WRMP scenario for the assessment of the potential flow impacts on the River Trent at North Muskham and the Humber Estuary.

Option reference	Abstraction assumption
29	9MI/d abstraction when flow at the River Derwent at St. Mary Bridge gauge (28085) is greater than 680MI/d
44	25MI/d year round - not currently a HOF associated with the option
64	5MI/d year-round – this is a precautionary approach and assumes that the full 5MI/d groundwater abstraction will lead to a 5MI/d reduction in river flows.
84C	Deployable output is stated as 3MI/d - with no obvious abstraction rate, 3MI/d additional abstraction has been applied year-round
95B	Combined with 187C - great uncertainty around the operation of these options. It is assumed that 210MI/d additional abstraction will occur when flow at St Mary's Bridge is greater than 680MI/d. This is a precautionary assumption as this abstraction rate would likely be seasonally limited.
123B	Uncertain as it is not possible, without more detailed water resources modelling, to understand how the expansion of Tittesworth Reservoir will impact the flow in the River Churnet and downstream. There will not be a change to low flows as a result of this option as the compensation flow rate from the reservoir will not change. The catchment area of Tittesworth Reservoir is 28.2km ² which accounts for 0.3% of the catchment area at the North Muskham flow gauge (8,231km ²) and 0.1% of the catchment area of the Upper Humber Estuary. As such, even cumulatively, the potential reduction in high flows as a result of this option would have indiscernible impacts on the River Trent at North Muskham and the freshwater input to the Upper Humber Estuary.
187C	See 95B
406A	65MI/d year-round
426	10MI/d abstraction when flow at the River Derwent at St. Mary Bridge gauge (28085) is greater than 680MI/d
435	Deployable output is stated as 4MI/d - with no obvious abstraction rate, 4MI/d additional abstraction has been applied year-round
528	2MI/d year-round – this is a precautionary approach and assumes that the full 2MI/d groundwater abstraction will lead to a 2MI/d reduction in river flows.

Figure 17.1 Flow duration curves demonstrating the percentage exceedance of flows at the River Trent at North Muskham gauge and the freshwater flow into the Upper Humber Estuary in baseline and Severn Trent WRMP scenarios. Hydrographs for these locations and scenarios for a dry hydrological year (01/04/1996-01/03/1997) are also illustrated.



The figure above presents a pair of graphs demonstrating the flow at the River Trent at North Muskham under a baseline scenario compared to the Severn Trent WRMP scenario. The flow duration curve (top left) indicates that there is a slight reduction in flows, predominantly between Q70 and Q10 with flows below Q70 largely protected from significant abstraction by hands-off flow conditions (particularly the hands-off flow condition at St. Mary's Bridge restricting abstraction at the River Derwent). This is also illustrated in the hydrograph (top right) where there is a slight reduction in flows under the Seven Trent WRMP scenario year-round with the reduction becoming greater (even though still relatively small) towards the end of the hydrological year when river flows are higher (November – March). The hydrograph indicates that there would not be a change to the flow regime at North Muskham, and thus freshwater flow input to the Trent arm of the Humber Estuary, as a result of the Severn Trent WRMP scenario with flows reacting as they do under the baseline scenario just at a slightly lower magnitude. The timing and frequency of higher flows would not be impacted.

As for total freshwater flow input to the Upper Humber Estuary, the flow duration curve (bottom left) and the hydrograph (bottom right) indicate that there is an indiscernible difference between freshwater flow under the baseline scenario and the flows under the Severn Trent WRMP scenario.

17.2 IN-COMBINATION EFFECTS WITH OTHER SEVERN TRENT WATER PLANS

17.2.1 Drought Plan

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

- Operational actions;
- Demand-side actions (Closely monitor demand, flows and abstraction/ releases; Increase leakage detection and management; promoting water efficiency; increase water conservation campaign; and high profile promotion of meter option);
- Water use restrictions (temporary use bans; ordinary drought orders to ban non-essential use; and emergency drought orders);
- Supply-side actions (emergency drought sources; Drought Action Teams; Annual Review);
- Drought orders and permits (Demand- and Supply-side);
- Extreme drought measures.

There are seven potential drought permit/order sites included in the Severn Trent Drought Plan¹²⁴, these are summarised in **Table 17.2**.

Table 17.2 Draft Final Drought Plan 2022 – Potential Drought Permit/Order Sites

Name	Description
Derwent Reservoirs	Reduce the aggregate quantity of compensation water releases from Ladybower Reservoir to the River Derwent and the River Noe/Jaggers Clough from 74 MI/d (or 92 MI/d when flow at Derby is <340 MI/d) to 51 MI/d. Reduce compensation water flow releases from Ladybower Reservoir from 54 MI/d to 34 MI/d.
Ambergate on River Derwent	Partial relaxation of the control flows in the River Derwent at St Mary's Bridge (Derby). This will allow the abstraction of up to 320 MI/d at Ambergate when the flow in the River Derwent at Derby is not less than 500 MI/d, rather than the normal flow of 680 MI/d.
ittesworth Reservoir and River Churnet (Drought Order only)	Scenario 1: 8 MI/d compensation release from Tittesworth Reservoir, 3.3 MI/d augmentation release from Abbey Green groundwater source. Under this scenario there would be no

¹²⁴ Drought Plan (2022) Severn Trent Water: <https://www.severntrent.com/content/dam/stw-plc/water-resource-zones/drought-plan-2022-2027.pdf>

Name	Description
	<p>augmentation requirement from Deep Hayes groundwater source.</p> <p>Scenario 2: 8 MI/d compensation release from Tittesworth, 0 MI/d augmentation release from Abbey Green. As for Scenario 1 there would be no augmentation requirement from Deep Hayes groundwater source.</p>
Brownsover on River Avon	Reduce the hands-off flow conditions in the River Avon at Stareton from 45 MI/d to 35 MI/d exclusively to allow transfer of additional water from the River Avon at Brownsover into Draycote reservoir.
Eathorpe on River Leam	<p>Authorise abstraction at Eathorpe on the River Leam to Draycote Reservoir at any time of year when the lower storage condition at Draycote Reservoir would normally prohibit such abstraction.</p> <p>Relax the prescribed flow requirement in the River Leam at Princes Drive Weir in Leamington from 18 MI/d to 12 MI/d.</p>
Site on River Severn	<p>Suspend the daily abstraction licence restriction under maximum River Severn Regulation conditions and the constraint limiting abstraction over the first 100 days of River Severn Regulation (Special Conditions 2b and 2c of the Site abstraction licence).</p> <p>The drought permit is also to suspend the joint abstraction licence constraints at two locations under the maximum River Severn Regulation, reverting the daily maximum of 303 MI/d (maximum River Severn Regulation) to 431MI/d, and the seasonal abstraction licence limits equivalent to 273 MI/d (abstraction licences No's. 110 and 163) and 303 MI/d (abstraction licences No's.110, 163 and 584) will be temporarily suspended.</p>
River Dove	The proposed drought permit increases the aggregate annual abstraction volume from 73,200MI/a to 77,200MI/a. The abstraction rate should be such that a residual flow of at least 159MI/day is left in the River Dove downstream of the intake at all times, unless storage in the reservoirs is such that the lower residual flow of 90MI/day applies.

There are options in the WRMP24 preferred plan that affect the same watercourses, or are the same wider catchment, as the Severn Trent Drought Plan 2022 i.e. the River Severn and the River Derwent. It is considered unlikely that in-combination effects will occur as the purpose of the WRMP process is to develop a permanent scheme that therefore reduces the requirements for the drought orders and permits, improving overall resilience of the supply system. The Drought Plan period extends to 2027, whilst the operation of the first options in the preferred plan is not expected until 2030/31. As such the current options will not overlap and there is sufficient time to reassess any drought plan options which are required to be retained post-2027. Equally, none of the drought permits or orders have been selected for use within the WRMP process.

Within the WRMP, an allowance has been made to use Temporary Use Bans (TUBs) and Non-Essential Use Bans (NEUBs) during the two drought modelled scenarios. No LSEs were identified for these options in Drought Plan 2022, and therefore no in-combination effects considered likely.

17.2.1.1 *Severn Trent Water's Drainage and Waste Management Plan (DWMP)*¹²⁵

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

The draft DWMP was published in June 2022 and publication of the final DWMP in March 2023. The plan is based around a three-level management structure, starting at the most detailed level; "Level 3 – Tactical Planning Unit – Catchment". Severn Trent has identified 957 Tactical Planning Unit (TPU) catchments where drainage, flooding, pollution and treatment risks have been identified. At level 2 the TPUs will be amalgamated and referred to as Strategic Planning Area and Level 1 is Severn Trent's overarching company level DWMP. The DWMP sets out options that have been developed to address the identified risks at the TPU level.

No additional negative effects are expected from the implementation of the WRMP24 in combination with the DWMP. The WRMP24 includes a range of measures (such as WTW provision) which complement those set out in the draft DWMP. There may be specific instances where the schemes in the DWMP and WRMP24 are located in similar areas or catchments which may lead to localised in-combination effects at construction which will need to be addressed at project-level HRAs when locality and construction programmes are confirmed.

The DWMP options should at minimum do no harm to the water environment or communities in which they are located, and preferably make a (significant) contribution to enhancing the quality of each locality, by reducing the adverse effects arising from flooding and poor water quality. No additional, in-combination effects are therefore expected with regards to water quality.

17.3 BETWEEN-COMPANY IN-COMBINATION EFFECTS

17.3.1 WRMPs

The in-combination assessment with other water companies WRMPs is based on the available information at the time of undertaking the assessment to support Severn Trent's revised draft WRMP24. This is either other water companies published draft plans (dWRMPs) or where they have been made available, their revised draft plans (rdWRMPs). This is specified on a case by case basis below.

With regards the other water companies in WRW, the South Staffordshire Water revised draft WRMP24 includes demand management options only, therefore there is no potential for in-combination effects. The revised draft United Utilities plan does not impact the same European sites, and therefore no in-combination effects are currently anticipated.

Dŵr Cymru Welsh Water's revised draft WRMP includes two options with impact pathways to the Severn Estuary European Marine Site; SEW166 Memorial and Cefn Mably upgrade (construction only) and SEW052 Afon Lwyd (construction and operation). These options therefore have the potential to act in-combination with Severn Trent's options 33, 66, 143 and 429. With regards construction, both water companies are advocating the use of best-practice mitigation measures, and therefore in-combination effects to mobile species are considered unlikely. The second of DCWW's options, SEW052 is located close to Newport with an abstraction on the River Usk. This is therefore spatially separate from the Severn Trent options, the closest being Option 429 at Mythe WTW, c.75km upstream from Newport. Although there could be impacts to mobile species and freshwater flow into the estuary, However, DCWW concluded that the effects of SEW52 alone are too small to give rise to an in-combination effect.

Other water companies with potential options impacting the Severn Estuary EMS are still finalising the preferred plans. Bristol Water's emerging plan suggests that only demand management measures will be used, and as such, no in-combination effects possible. Wessex Water's draft WRMP24 identified three options with potential for effects on the Severn Estuary EMS. Two had construction related issues, and as discussed above, assuming implementation of best practice mitigation measures, no in-combination effects are likely. The third option, North Bath Resilience, was identified as offering a resilience benefit, and therefore no in-combination effects are likely. With regards the Humber Estuary European Marine Site, Yorkshire Water's preferred plan is also emerging, with potential for options on the River Ouse which may, in-combination with Severn Trent's options, affect pass-forward freshwater flow into the estuary. The WFD has currently not identified an issue for the waterbody from the combined use of the Yorkshire Water and Severn Trent options, and similarly further

¹²⁵ DWMP (2019) Severn Trent Water: [severn-trent-water-resource-management-plan.pdf](https://www.severntrent.com/severn-trent-water-resource-management-plan.pdf) ([severntrent.com](https://www.severntrent.com))

analysis of flow inputs from both draft preferred plans did not identify any issues. Further assessment work has been completed on both revised draft plans, with no discernible change in freshwater flows evident from Yorkshire Water's options or Severn Trent's options. Therefore an adverse effect on freshwater input to the Humber Estuary from both WRMPs is not anticipated.

A number of Strategic Resource Options are being progressed through the Regional Plans and WRMPs. Those which are considered to potentially overlap with Severn Trent's options are:

- Grand Union Canal
- South Lincolnshire Reservoir

Using the available Gate 2 submissions, no in-combination impacts have been identified with the Grand Union Canal as the plan and project do not impact the same designated sites. South Lincolnshire Reservoir however, impacts the Humber Estuary EMS and therefore there could be an in-combination effect with Severn Trent's options on the River Trent. The South Lincolnshire Reservoir WFD assessments indicated that "*A potential major adverse risk (risk of deterioration) to the Trent from Soar to Beck (ID: GB104028053110) was identified as a result of the new surface water abstraction. Abstraction rates are expected to be <10% of the total volume of the Trent catchment and the change in flow and velocity has the potential to impact biological elements*". Further assessments are being progressed through Gate 3, and therefore at this stage, it is uncertain if South Lincolnshire Reservoir would result in an adverse effect on integrity alone, and therefore would not be considered further within the in-combination assessment.

17.3.2 Drought Plans

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 Drought Plans are not anticipated.

17.4 IN-COMBINATION EFFECTS WITH OTHER PLANS AND PROGRAMMES

17.4.1 Effects with other strategic plans and water resource demand

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.

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).

Obviously 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.

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

17.4.2 Effects with major projects

Known major projects that are likely to increase demand have been taken into account during the development of Severn Trent's WRMP24 and determination of future deficits.

Reference has been made to the Planning Inspectorates National Infrastructure Projects (NSIP) database¹²⁶ 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;
- where a Development Consent Order (DCO) application has been determined.

There is one NSIP within a similar area to Option 6.13; Oaklands Farm Solar Project¹²⁷. The solar farm would be directly east of the proposed storage reservoirs. As such there may be elements of the construction programme which may overlap. However, given the solar farm's greater distance from the River Trent, it is considered that the Construction Environmental Management Plans will adequately mitigate adverse effects.

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

17.4.3 Minor projects

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.

17.4.4 Effects with strategic development pressure

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.

¹²⁶ <https://infrastructure.planninginspectorate.gov.uk/projects/>

¹²⁷ [Oaklands Solar Farm | About the Project | BayWa r.e. \(baywa-re.co.uk\)](#)

18. HRA CONCLUSIONS

18.1 OVERVIEW

Water company WRMPs are subject to the provisions of the *Conservation of Habitats and Species Regulations 2017*. Severn Trent has a statutory duty to prepare a WRMP and is therefore the Competent Authority for the HRA of that plan. This draft HRA report accompanies the WRMP24 that has been published for consultation, and summarises the current assessment of Severn Trent's preferred plan of options against the requirements of the Habitats Regulations. It also documents the iterative HRA process that has been applied through the development of the WRMP24.

For each option (or group of options, as appropriate) has included a high level HRA screening to inform Severn Trent in its plan development.

For those options within the preferred plan or alternative programmes (where the latter required before 2035), 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 option¹²⁸, 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).

Severn Trent has identified 38 options within its preferred plan, with those options required in AMPs 8 and 9 (prior to 2035) being the same in the alternative programmes. Of the 38 options:

- 19 preferred plan options do not require HRA Stage 2 Appropriate Assessments.
- 19 options have been identified as requiring a Stage 2 Appropriate Assessment for construction and/or operation.
- In addition, 3 in-combinations within plan for River Mease SAC, River Derwent/Peak District Dale SAC, and Severn Estuary EMS Stage 2 Appropriate Assessments have been completed.
- Between WRMP in-combination assessments has been considered for the Humber Estuary EMS, and the Severn Estuary EMS as revised draft WRMPs from other water companies have been made available. Given the complexities of the abstraction and discharges on the Severn in particular, additional hydrological modelling will be required, after WRMP24, to confirm effects and mitigation requirements.

18.2 PREFERRED PLAN STAGE 1 SCREENING

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 18-1 Summary of supply-side options and sites requiring Stage 2 Appropriate Assessment'

European site	Options	Alone or in-combination with other WRMP options?
Bredon Hill SAC	66: Strensham WTW Expansion	Yes – alone (construction)
Cannock Chase SAC	44: New R Sow abstraction and WTW near Stafford	Yes – alone (construction)
Dixton Wood SAC	66: Strensham WTW Expansion	Yes – alone (construction)
Fen Pool SAC	79B: Bham-Wolves Strategic Link Main (small)	Yes – alone (construction)
	29: Homesford WTW capacity increase	In-combination with other water company WRMPs

¹²⁸ Note, for options with 'no effects' or positive effects there is no possibility of 'in-combination' effects.

European site	Options	Alone or in-combination with other WRMP options?
Humber Estuary SAC and Ramsar ¹²⁹	64: Rehabilitation Milton GW source	In-combination with other water company WRMPs
	426: Little Eaton WTW DO Recovery	In-combination with other water company WRMPs
Pasturefields Salt Marsh SAC	44: New R Sow abstraction and WTW near Stafford	Yes – alone (construction)
Peak District Dales SAC	29: Homesford WTW capacity increase	Yes – alone and IC (construction and operation)
	95B: Ogston WTW Expansion	Yes – alone and IC (operation)
	128: Carsington to Tittesworth main (large)	Yes – alone and IC (construction)
	128Z: Carsington to Tittesworth main (small)	Yes – alone and IC (construction)
	187C: Expand Carsington Reservoir (25000 MI)	Uncertain – alone and IC (operation)
	305A: Heathy Lea to North Notts transfer (large)	Yes – alone and IC (construction)
	426: Little Eaton WTW DO Recovery	Yes – alone and IC (operation)
Peak District Moors (South Pennine Moors Phase 1) SPA	123B: Raise Dam at Tittesworth Reservoir (25%)	Yes – alone and IC (construction)
	128: Carsington to Tittesworth main (large)	Yes – alone and IC (construction)
	128Z: Carsington to Tittesworth main (small)	Yes – alone and IC (construction)
	305A: Heathy Lea to North Notts transfer (large)	Yes – alone and IC (construction)
River Clun SAC	33: Shelton WTW Expansion (large)	Yes – alone and IC (construction and operation)
	66: Strensham WTW Expansion	Yes – alone and IC (construction and operation)
	143: W.Midlands Raw Water Storage	Yes – alone and IC (construction and operation)
	429: Mythe WTW DO Recovery	Yes – alone and IC (operation)
River Dee and Bala Lake SAC	503: New GW source Middle Dee GWMU	Yes – alone (operation)
River Mease SAC	44: New R Sow abstraction and WTW near Stafford	Yes – alone and IC (operation)
	64: Rehabilitation Milton GW source	Yes – alone and IC (operation)
	556: ASL Capacity Increase - Hallgates to Oldbury	Yes – alone and IC (operation)
Rutland Water SPA and Ramsar	190: Eyebrook Reservoir and new WTW's	Yes – alone (construction)
Severn Estuary/Môr Hafren SAC and Ramsar ¹³⁰	33: Shelton WTW Expansion (large)	Yes – alone and IC (construction and operation)
	66: Strensham WTW Expansion	Yes – alone and IC (construction and operation)
	143: W.Midlands Raw Water Storage	Yes – alone and IC (construction and operation)
	429: Mythe WTW DO Recovery	Yes – alone and IC (operation)
South Pennine Moors SAC	305A: Heathy Lea to North Notts transfer (large)	Yes – alone (construction)

¹²⁹ Functionally linked habitat for the SPA is considered sufficiently distant to construction works such that won't be affected. Features not considered to be highly sensitive to changes in abstractions given distance from impact and lack of functionally linked habitat.

¹³⁰ Functionally linked habitat for the SPA is considered sufficiently distant to construction works such that won't be affected. Features not considered to be highly sensitive to changes in abstractions given distance from impact and lack of functionally linked habitat.

18.3 PREFERRED PLAN AND ALTERNATIVE PLAN STAGE 2 APPROPRIATE ASSESSMENTS

Stage 2 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, where they are within the preferred programme, or when in an alternative programme prior to 2035. None of the options differ between the preferred plan and alternative plans to the 2035.

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.

The results of the assessments of the **supply-side options** show that there are sufficient standard and best practice mitigation measures that can be implemented during construction to avoid adverse effects. Further hydrological assessment and surveys to confirm presence and use of offsite functionally linked habitat will be required for a number of options ahead of project-level HRAs. Mitigation measures, including restrictions on abstraction licences (volumes, timings) and reviews of Hand off flow may be required to avoid adverse effects. One option is currently concluded as uncertain in terms of adverse effects, although considered to be low risk based on current information; 503 New groundwater source Middle Dee GWMU112. The option is not 'on-line' until 2049-50 and therefore sufficient time, and subsequent WRMP cycles, where this option can be further investigated. Mitigation may involve the relocation of the borehole elsewhere in the groundwater body. A hydrogeological assessment and groundwater modelling is likely to be required to understand the impacts to the River Dee and Bala Lake SAC.

With regards the options requiring abstraction from the River Severn, with the release of 25Ml/d from Vyrnwy Reservoir (options 33 and 66), a pre-application for the licence arrangements was submitted by Severn Trent and partners at the end of January 2024 to progress the project-level assessment, including HRA, with the regulators (Environment Agency, Natural England and Natural Resources Wales). The Environment Agency sent their response in August 2024 and NRW responded in December 2024.

Both Yorkshire Water and Severn Trent have considered their plan's impacts on freshwater input to the Humber Estuary EMS. Neither plan has identified a discernible change, and therefore in-combination effects are considered unlikely. Further work on in-combination effects on the Humber Estuary European Marine Site, with other water company plans, may be required to extend beyond the WRMP24 submission when the potential interaction of WRMP options and SROs is better understood. Similarly, given the complexity of the flow regime on the River Severn and impacts to the Severn Estuary SAC and Ramsar, Severn Trent are committed to extend the work beyond WRMP24 submission. The extension will reflect that Severn Trent are scoping the work required for the drought plan options on the Severn, the STT SRO is progressing modelling work during Gate 3 of the RAPID process and there is the ongoing review of the River Severn Regulation by Environment Agency, Natural England and Natural Resources Wales. There needs to be a consistent approach across these workstreams to ensure outputs are appropriate to progress options under different planning regimes.

APPENDICES

APPENDIX A EFFECT PATHWAY ASSUMPTIONS

Table 2-1 within the main report (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.

In addition:

WATER RESOURCE SENSITIVE FEATURES

The Environment Agency has previously published advice on qualifying species and habitats that it considers to be water-resource dependent (National Environment Agency 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 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 movements), 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 area¹³¹.

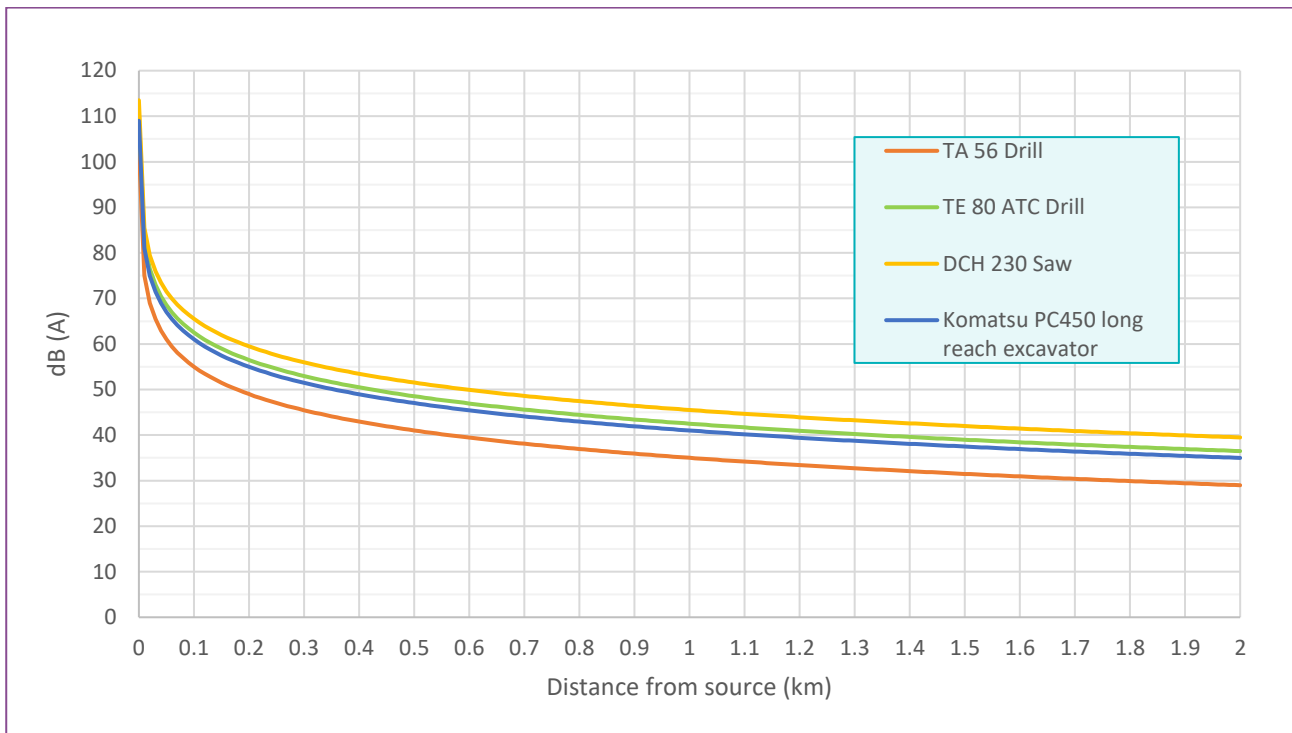
The sensitivity of the interest features will depend on their behavioural characteristics, their general tolerance / habituation to existing or new activities at a site, and the extent to which avoidance behaviours are achievable. This may also vary during the year (for example, most bird species will 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)¹³² within 600m due to distance alone (see **Figure A.1**).

¹³¹ Noise levels do not operate additively, so the dB levels in an area are not the sum of the component sources.

¹³² 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).

Figure A.1 Approximate attenuation of equipment noise with no barriers



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)¹³³ 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.

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 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.

The work has been consolidated as part of the TIDE toolbox, a result of the INTERREG IVB-Project “Tidal River Development” TIDE, which aims at the integrated management of estuaries by providing information on estuarine functioning, but also provides resources to support estuarine managers by providing experience, recommendations and tools for use in their work. The waterbird disturbance and mitigation toolkit is available at: [TIDE toolbox - TIDE tools \(tide-toolbox.eu\)](http://tide-toolbox.eu)

¹³³ 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

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).

APPENDIX B 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 Notes¹³⁴, 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);

¹³⁴ 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.

- 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 WRMP 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.
- 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 C HRA STAGE 1 SCREENING: INITIAL REVIEW

The table below presents the HRA Stage 1 screening outcomes of the feasible list of options, excluding those in the preferred plan (see **Table 4-2**).

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
5	Derwent Valley Transfer Main	Construct a new bi-directional raw water main between the inlet to Bamford WTW and Carsington Reservoir.	Bee's Nest and Green Clay Pits SAC Gang Mine SAC Peak District Dales SAC South Pennine Moors SAC Peak District Moors (South Pennine Moors Phase 1) SPA	0.054km - directly adjacent 4km 0.1km 0.5km 0.56km	Moderate negative effect as the pipeline is currently routed in close proximity to Bees Nest and Green Clay Pits SAC (54m), as such Likely Significant Effects (LSEs) have been identified. Pipeline has been re-routed to avoid direct impact upon the SAC, however the pipeline is likely to have an adverse effect upon functionally linked habitat supporting GCN (can travel up to 500m) through habitat loss and killing/injury individuals and may have an adverse effect on qualifying habitats through disturbance. LSEs have also been identified for the Peak District Dales SAC due to the proximity of construction work (0.1km at closest point) and hydrological connectivity, with potential downstream locations at risk of suspended sediment releases and pollution incidents. The pipeline works are within 0.5km of the South Pennine Moors SAC, with qualifying habitats sensitive to increases in nitrogen deposition. The proposed haul routes and timing of works are uncertain, and therefore air quality issues will need to be considered further. The pipeline is similarly within 0.5km of the Peak District Moors (South Pennine Moors Phase 1) SPA and therefore the potential for noise disturbance during construction will need to be considered further. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.	LSEs identified	The operational change in water supply for watercourses with hydrological connectivity to the Peak District Dales SAC and South Pennine Moors SAC will need further consideration (change in spill overflow from reservoir). The WFD has concluded that the changes in spill pattern, are considered as minor hydrological impacts which are WFD compliant. However, LSEs cannot be ruled out due to uncertainty over the operational regime and how this may affect migratory fish species in particular, and the extent of functionally linked habitat to be affected. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.	LSEs identified	Y - abstractions affecting the Peak District Dales SAC functionally linked habitat.
6	Upper Derwent Valley Reservoir Expansion (UDVRE)	Raise height of the existing Howden Dam to increase raw water storage in the Derwent Valley Reservoirs complex.	South Pennine Moors SAC Peak District Moors (South Pennine Moors Phase 1) SPA Peak District Dales SAC	0km - directly adjacent 0km - directly adjacent Downstream receptor/function al habitat	There are two European designated sites within 10km; South Pennine Moors SAC and Peak District Moors (South Pennine Moors Phase 1) SPA. Howden Reservoir is surrounded by the South Pennine Moors SAC and Peak District Moors (South Pennine Moors Phase 1) SPA. The construction of raising the dam walls (whichever method adopted) will need to be considered, with any resulting habitat loss compensated for and construction impacts (habitat degradation, sedimentation, noise, pollution incidents) mitigated. Although the additional area to be flooded appears to be just outside the designated site boundaries, and woodland plantation, the functional importance of this habitat cannot be ruled out and its level of importance would need to be assessed. Permanent landtake from within the SAC and SPA may be required for additional infrastructure (e.g. access roads, footpaths). Significant construction effects cannot obviously be excluded with standard measures and construction may require bespoke mitigation or detailed design inputs at the WRMP level. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken. The River Derwent flows downstream from the reservoirs and from this the Peak	LSE identified with likely adverse effects	The change in reservoir storage volume would impact on the outflow regime from Ladybower Reservoir to the River Derwent. Changes to the high flow regime of the river system could affect geomorphological processes and aquatic habitat function. This is considered to potentially affect the downstream Peak District Dales SAC and the mobile species (bullhead, brook lamprey and WCC), with the River Derwent providing functionally linked habitat. A new intake close to Ambergate, with abstraction of 60M/d, supported by releases from the reservoir, could also impact use of offsite functionally linked habitat of the Peak District Dales SAC (mobile species). Permanent changes to the hydrogeology and groundwater feeds could be caused when increasing the existing dam walls and flooding an area closer to the SAC and SPA boundary. It is uncertain how these changes	LSE identified	Y - abstractions affecting the Peak District Dales SAC functionally linked habitat.

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
					District Dales SAC is hydrologically connected. The River Derwent is therefore likely to provide functionally linked habitat for the fish species of the Peak District Dales SAC (bullhead and brook lamprey). Although Howden Reservoir is the further upstream of the series of reservoirs, standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases downstream.		would affect the qualifying features. The main watercourses draining the moors would remain unaffected. Significant operational effects cannot be obviously excluded, and further detailed design and scheme level investigations would need to be undertaken alongside a Stage 2 Appropriate Assessment.		
31C	E.Midlands Raw Water Storage (CQ)	Acquire hard rock quarry and convert to a pumped raw water storage reservoir. Supply with raw water from River Soar (option 31C) or River Trent (option 31D). Construct new WTW at Quarry site and deploy to the Strategic Grid via new pipeline.	Humber Estuary SAC, SPA and Ramsar	Downstream receptor	There are no European designated sites within 10km of the scheme components, or impact pathways over a greater distance.	No LSEs anticipated	Although hydrologically linked to the Humber Estuary SAC, qualifying features not known to be present on River Soar or River Trent. The SACO states the following: - Sea lamprey: <i>Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable.</i> - River lamprey: <i>Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey.</i> The reduction in flow is not considered to adversely affect the Humber Estuary SAC estuaries feature (SACO target for freshwater input) alone (based on WFD impact assessment).	No LSEs anticipated	Y – multiple abstractions affecting freshwater input to the Humber Estuary (freshwater input is an attribute/target in the SACO for the estuaries feature)
31D	E.Midlands Raw Water Storage (CHQ)	Acquire hard rock quarry and convert to a pumped raw water storage reservoir. Supply with raw water from River Soar (option 31C) or River Trent (option 31D). Construct new WTW at Quarry site and deploy to the Strategic Grid via new pipeline.	River Mease SAC Humber Estuary SAC, SPA and Ramsar	10km Downstream receptor	The River Mease SAC is just within 10km of the component. However, is at sufficient distance, and upstream, such that construction impacts will not occur.	No LSEs anticipated	A new 50Ml/d abstraction is required on the River Trent to fill Cliff Hill Quarry. The proposed abstraction point is c.26km downstream of the River Mease SAC confluence with the River Trent. The distribution of functionally linked habitat within the River Trent and it's use by the mobile species of the River Mease SAC (bullhead, spined loach and WCC) is unknown. Similarly, a long-term changes in flow could alter prey availability for otter within the wider catchment. LSEs cannot be ruled out due uncertainty over the operational regime and how this may affect fish species, and the extent of functionally linked habitat to be affected. Should this option be taken forward to the preferred	LSEs identified	Y - multiple abstractions affecting flow within River Trent and use of this as functional habitat by qualifying features of River Mease SAC. Abstractions affecting freshwater input to the Humber Estuary (freshwater input is an attribute/target in the SACO for the estuaries feature)

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
							<p>options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p> <p>Although hydrologically linked to the Humber Estuary SAC, qualifying features not known to be present on River Soar or River Trent. The SACO states the following:</p> <ul style="list-style-type: none"> - Sea lamprey: <i>Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable.</i> - River lamprey: <i>Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey.</i> <p>The reduction in flow is not considered to adversely affect the Humber Estuary SAC estuaries feature (SACO target for freshwater input) alone (based on WFD impact assessment).</p>		
33Z	Shelton WTW Expansion (small)	Construction of a new river intake and 10Ml/d process stream adjacent to Shelton WTW to utilise the full river abstraction licence. This will enable additional River Severn water to be treated and supplied to the network.	<p>Midlands Meres and Mosses Phase 1 Ramsar</p> <p>Severn Estuary/Môr Hafren SAC</p> <p>Severn Estuary SPA and Ramsar</p>	<p>3.3km</p> <p>Downstream receptor (>100km)/functional habitat</p> <p>Downstream receptor (>100km)/functional habitat</p>	<p>There is one European designated site within 10km; Midlands Meres and Mosses- Phase 1 Ramsar. The closest component is 3.3km to the north east. As such, there is considered to be sufficient distance between the designation and WTW site that no LSEs are anticipated (based on standard distance thresholds e.g. noise, visual etc).</p> <p>It is unclear whether the existing raw water intake from the River Severn will be used, or whether a new structure will be required. There is therefore potentially an impact pathway to the Severn Estuary/Môr Hafren SAC and functionally linked habitat within the River Severn itself. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases. Construction of a new intake may require bespoke mitigation to avoid adverse effects to functionally linked habitat and migration period. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>	LSEs identified	<p>The proposed scheme involves an additional 10Ml/d abstraction from the River Severn. LSEs therefore cannot be ruled out due to uncertainty over the operational regime and how this may affect migratory fish species of the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar and the extent of functionally linked habitat that could be affected for migratory fish. This includes the Annex II species listed under the SAC (sea lamprey (<i>Petromyzon marinus</i>), river lamprey (<i>Lampetra fluviatilis</i>) and twaite shad (<i>Alosa fallax</i>)) but also the fish assemblage under the Estuaries feature which includes the following migratory species; salmon, eel, sea trout and allis shad (also part of Ramsar criterion). The installation of a new intake will also require screening etc to avoid impingement and entrainment issues.</p> <p>Changes in the volume of water and flow into the Severn Estuary could also impact salmon movement to the River Clun SAC, designated for freshwater pearl mussel (<i>Margaritifera margaritifera</i>). Salmon provide a key role in the life-cycle of the freshwater pearl mussel. The River Clun discharges to the River Teme</p>	LSEs identified	Y - abstractions affecting freshwater input to the Severn Estuary EMS (freshwater input is an attribute/target in the Reg 33 package for the Severn Estuary European Marine Site for the estuaries feature) and River Clun SAC

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
							<p>which joins the River Severn downstream of Worcester.</p> <p>Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>		
38	Minworth effluent re-use (Large scheme)	Construction of new effluent re-use plant (90MI/d capacity WTW) at Minworth Sewage Treatment Works (STW), to deploy potable water into the Strategic Grid WRZ via new pumping stations and pipelines.	Ensor's Pool SAC River Mease SAC	5.1km Downstream receptors/functional habitat (River Tame)	There is one European designated site within 10km of the scheme components; Ensor's Pool SAC. However this is considered to be at sufficient distance from the pipelines (c. 5.1km) such that construction impacts are unlikely. The pipelines require crossings of the River Blythe and River Tame. The works are upstream of the confluence of the River Tame and River Mease SAC. As such, pollution incidents and suspended sediment releases could adversely affect the mobile species of the SAC (bullhead, spined loach and otter). Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases. As such, no LSEs are anticipated.	No LSEs anticipated	<p>Minworth STW discharges final effluent into the River Tame which forms a large proportion of the river flow. This scheme is to intercept a proportion of this flow before it is discharged to the river for treatment to potable standards via a new 90MI/d capacity water treatment works which is to be constructed on the existing STW Park Lane, Minworth site. The change in flow is likely to be detectable downstream to Carlton Trent. The River Mease SAC confluence at Croxall is downstream, within the reach to be affected. As such, movement of spined loach, bullhead and WCC within functionally linked habitat (River Tame) could be affected. Prey availability for otter may also be altered.</p> <p>Significant operational effects cannot be obviously excluded, and further detailed design and scheme level investigations would need to be undertaken alongside a Stage 2 Appropriate Assessment.</p>	LSEs identified and likely to be an adverse effect	Y - multiple abstractions affecting flow within River Tame and use of this as functional habitat by qualifying features of River Mease SAC

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
39	Minworth effluent re-use (Medium scheme)	Construction of new effluent re-use plant (30MI/d capacity WTW) at Minworth STW, to deploy potable water into the Strategic Grid WRZ via new pumping stations and pipelines.	Ensor's Pool SAC River Mease SAC	5.1km Downstream receptors/functional habitat (River Tame)	There is one European designated site within 10km of the scheme components; Ensor's Pool SAC. However this is considered to be at sufficient distance from the pipelines (c. 5.1km) such that construction impacts are unlikely. The pipelines require crossings of the River Blythe and River Tame. The works are upstream of the confluence of the River Tame and River Mease SAC. As such, pollution incidents and suspended sediment releases could adversely affect the mobile species of the SAC (bullhead, spined loach and otter). Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases. As such, no LSEs are anticipated.	Negligible	Minworth STW discharges final effluent into the River Tame which forms a large proportion of the river flow. This scheme is to intercept a proportion of this flow before it is discharged to the river for treatment to potable standards via a new 30MI/d capacity water treatment works which is to be constructed on the existing STW Park Lane, Minworth site. The change in flow is likely to be detectable downstream to Carlton Trent. The River Mease SAC confluence at Croxall is downstream, within the reach to be affected. As such, movement of spined loach, bullhead and WCC within functionally linked habitat (River Tame) could be affected. Prey availability for otter may also be altered. Significant operational effects cannot be obviously excluded, and further detailed design and scheme level investigations would need to be undertaken alongside a Stage 2 Appropriate Assessment.	LSEs identified	Y - multiple abstractions affecting flow within River Tame and use of this as functional habitat by qualifying features of River Mease SAC
54	River Soar to Cropston WTW	New abstraction from the River Soar and transfer to an upgraded Cropston WTW, with treated water supplying the Strategic Grid WRZ.	Humber Estuary SAC, SPA and Ramsar	Downstream receptor (>100km)	There are no European designated sites within 10km of the scheme components, or impact pathways over a greater distance.	No LSEs anticipated	The River Sour is a tributary of the River Trent. Although hydrologically linked to the Humber Estuary SAC, qualifying features not known to be present on River Trent (sea and river lamprey). The SACO states the following: - Sea lamprey: Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable. - River lamprey: <i>Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey</i> The reduction in flow is not considered to adversely affect the Humber Estuary SAC estuaries feature (SACO target for freshwater input) alone (based on WFD impact assessment).	No LSEs anticipated	Y – multiple abstractions affecting freshwater input to the Humber Estuary (freshwater input is an attribute/target in the SACO for the estuaries feature)

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
78	Aquifer Storage Recovery at Whitacre	Storage of surplus treated water from Frankley WTW in the Sherwood Sandstone Aquifer via new boreholes at Whitacre WTW, to enable re-abstracting during dry periods. Once treated again, water will be supplied to customers in the Strategic Grid WRZ.	None within 10km River Mease SAC Humber Estuary SAC, SPA and Ramsar	Downstream receptor (c.23km)/functional habitat Downstream receptor (>100km)/functional habitat	<p>The borehole itself is c.600m deep and therefore there is considered to be limited surface and groundwater interaction. As such, no LSEs have been identified for this component.</p> <p>A new discharge and outfall is required on the River Blythe which is a tributary of the River Tame, in turn a tributary of the River Trent, and upstream of the River Mease SAC and Humber Estuary SAC, SPA and Ramsar.</p> <p>The use of the River Blythe as functionally linked offsite habitat by spined loach (designated as part of the River Mease SAC) is uncertain. The construction of new outfall may need to consider loss of suitable habitat, timings for installation etc, alongside the implementation of standard best practice construction techniques and pollution prevention measures. Therefore construction phase LSEs cannot be ruled out for the River Mease SAC spined loach qualifying feature, and a Stage 2 Appropriate Assessment will be required.</p> <p>Although the River Tame is hydrologically linked to the Humber Estuary SAC, via the River Trent, the qualifying features are not known to be present in the watercourses (Cromwell Weir impassable), and as such the River Tame is not considered to be functionally linked habitat. The Humber Estuary SAC is >100km downstream and therefore considered to be sufficiently distanced such that construction related issues (increases in suspended sediments) would not adversely affect the site. Standard measures and best practice mitigation would be implemented during construction to reduce the risk.</p>	LSEs identified	<p>Although hydrologically linked to the Humber Estuary SAC, qualifying features not known to be present on the River Tame or River Trent. The SACO states the following:</p> <ul style="list-style-type: none"> - Sea lamprey: <i>Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable.</i> - River lamprey: <i>Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey.</i> <p>The change in water quality is unlikely to impact the Humber SAC, SPA or Ramsar given the distance and absence of qualifying features in the Tame.</p> <p>Consideration will need to be given to changes in water quality should the River Blythe and River Tame support offsite functionally linked habitat used by spine loach. Therefore operational LSEs cannot be ruled out for the River Mease SAC spined loach qualifying feature, and a Stage 2 Appropriate Assessment will be required.</p>	LSEs identified	
79A	Bham-Wolves Strategic Link Main - 79A (large)	Connect Frankley WTW in the Strategic Grid WRZ to Tettenhall Pumping Station in the Wolverhampton WRZ via new pipelines and using the existing network. To enable the 20Ml/d transfer, both existing and new assets will be utilised and some modification and recommissioning will be carried out of existing assets.	Fen Pools SAC	3.03km	The pipeline route is located c.4.1km to the north west of Fen Pools SAC. There are a number of waterbodies situated between the SAC and the pipeline route, and therefore there is the potential that these, and the surrounding terrestrial habitat, are used to support the GCN population. As such, LSEs to functionally linked habitat cannot be ruled out, however standard measures and best practice mitigation for GCN should avoid adverse effects.	LSEs identified	There will be no hydrological impact to the Fen Pools SAC. The scheme involves the transfer of treated water in the network from the upgrade of an existing reservoir.	No LSEs anticipated	
79C	Bham-Wolves Strategic Link Main (very large)	Connect Frankley WTW in the Strategic Grid WRZ to Tettenhall Pumping Station in the Wolverhampton WRZ via new pipelines and using the existing network. To enable the 35Ml/d transfer, both existing and new assets will be utilised and some modification and recommissioning will be	Fen Pools SAC	4km	The pipeline route is located c.4.1km to the north west of Fen Pools SAC. There are a number of waterbodies situated between the SAC and the pipeline route, and therefore there is the potential that these, and the surrounding terrestrial habitat, are used to support the GCN population. As such, LSEs to functionally linked habitat cannot be ruled out, however standard measures and best practice mitigation for GCN should avoid adverse effects.	LSEs identified	There will be no hydrological impact to the Fen Pools SAC. The scheme involves the transfer of treated water in the network from the upgrade of an existing reservoir.	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		carried out of existing assets.							
84A	Stanford Minor Dam Extension (84A)	Increase storage capacity of Stanford Reservoir by 147.4MI, by increasing Top Water Level (TWL) by 0.22m. Minor works consisting of modifications to spillways, embankments, over flow weir and pipework.	Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar River Clun SAC	Downstream receptor Downstream receptor Functional link (salmon)	There are no European sites within 10km of the scheme components. The River Avon is hydrologically linked to the Severn Estuary/Môr Hafren SAC and Severn Estuary SPA and Ramsar, and could provide functionally linked habitat (spawning gravels) for the migratory fish species.	No LSEs anticipated	There may be changes in the downstream flow contribution from the reservoirs due to changes in spill pattern; however, a hydrologist has identified that flows downstream of the reservoir are independent of the reservoir spill regime, and therefore there is expected to be a negligible hydrological impact on the downstream watercourse. The CAMS assessment indicates that there is water available for abstraction in this catchment under all flow conditions (Q95,Q70,Q50,Q30). As such, there is considered to be no adverse effect to flows within the Severn Estuary/Môr Hafren SAC and Severn Estuary SPA and Ramsar or functionally linked watercourses, downstream of the reservoir.	No LSEs anticipated	
84B	Lower Shustoke Minor Dam Extension (84B)	Increase storage capacity of Lower Shustoke Reservoir by 192MI, by increasing Top Water Level (TWL) by 0.52m. Minor works consisting of modifications to spillways, embankments, over flow weir and pipework.	Humber Estuary SAC, SPA and Ramsar	Downstream receptor (>100km)	There are no European designated sites within 10km of the scheme components. Although the River Tame is hydrologically linked to the Humber Estuary SAC, via the River Trent, the qualifying features are not known to be present in the watercourses (Cromwell Weir impassable), and as such the River Tame is not considered to be functionally linked habitat. The Humber Estuary SAC is c.130km downstream and therefore considered to be sufficiently distanced such that construction related issues (increases in suspended sediments) would not adversely affect the site.	Negligible	Although hydrologically linked to the Humber Estuary SAC, qualifying features not known to be present on the River Tame or River Trent. The SACO states the following: - Sea lamprey: <i>Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable.</i> - River lamprey: <i>Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey.</i> The reduction in flow is not considered to adversely affect the Humber Estuary SAC estuaries feature (SACO target for freshwater input) alone (based on WFD impact assessment).	Negligible	Y - abstractions affecting freshwater input to the Humber Estuary (freshwater input is an attribute/target in the SACO for the estuaries feature)

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
88	River Weaver to Tittesworth WTW	New abstraction point on the River Weaver (nr Northwich), new intake and pumping station. Raw water will be transferred (new pipeline) to a new settlement lagoon near Tittesworth WTW prior to treatment (upgraded for new raw water quality) and deployment into the network using existing assets.	Oak Mere SAC Peak District Dales SAC South Pennine Moors SAC West Midlands Mosses SAC Peak District Moors (South Pennine Moors Phase 1) SPA Midlands Meres and Mosses - Phase 1 and 2 Ramsar Mersey Estuary SPA and Ramsar	7km 9.8km 3.1km 4.5km 3.1km 3.1km Downstream receptors (c.28km)	There are seven European designated sites within 10km of the scheme components; Oak Mere SAC, Peak District Dales SAC, South Pennine Moors SAC, West Midlands Mosses SAC, Peak District Moors (South Pennine Moors Phase 1) SPA, Mersey Estuary SPA and Ramsar, and Midlands Meres and Mosses - Phase 1 and 2 Ramsar. Based on standard distance thresholds (e.g. noise, visual etc) no construction impacts are considered likely. The River Weaver discharges downstream into the Mersey Estuary SPA and Ramsar, with the scheme abstraction at c.28km upstream. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases. As such, no LSEs are anticipated.	No LSEs anticipated	The 48Ml/d reduction in flow within the River Weaver is predicted to influence a downstream reach until Sutton Weaver. The River Weaver discharges to the Manchester Ship Canal, with a set of sluices allowing excess water into the Mersey Estuary. The Mersey Estuary SPA and Ramsar is designated for saltmarsh and mudflats, and overwintering waterfowl. A reduction in flow within the River Weaver is estimated to be detectable downstream to Northwich. The downstream flows however would be protected by the hands-off flow constraint (17.3 Ml/d at Beam Bridge). The qualifying features of the SPA and Ramsar are not considered to be highly sensitive to changes in freshwater flows, which are currently managed by the sluice arrangement on the River Weaver into the Manchester Ship Canal. As such, no LSEs are anticipated.	No LSEs anticipated	
103	Mardy Support Link	The scheme is to enable Mardy WRZ to be supported by a transfer of water from Shelton WRZ. This is achieved through operating the existing pipeline in the reverse direction to the current conditioning flow. The resulting reduction in water available at Oswestry will be supported using the existing outputs from Shelton WTW and Pentre WTW.	Montgomery Canal SAC Midlands Meres and Mosses Phase 2 Ramsar River Dee and Bala Lake SAC	9.4km 6km 6.7km	The scheme is to upgrade a pumping station close to Oswestry. There are three European designated sites within 10km; Montgomery Canal SAC c.9.4km, Midlands Meres and Mosses Phase 2 Ramsar c.6km south east, and River Dee and Bala Lake SAC c6.7km north. All sites are considered to be at sufficient distance such that construction impacts will not occur (based on standard thresholds e.g. noise). There is no hydrological connectivity for downstream impacts to the River Dee and Bala Lake SAC.	No LSEs anticipated	The scheme does not involve any additional abstractions or discharges, as a result no LSEs are anticipated.	No LSEs anticipated	
104	Newark Support Link	Transfer of surplus treated water in Nottinghamshire WRZ to Newark WRZ, via new pipeline.	Humber Estuary SAC, SPA and Ramsar	Downstream receptor (c.54km)	There are no European designated sites within 10km of the scheme components. The pipeline crosses a watercourse which discharges downstream to the River Trent, which discharges to the Humber Estuary SAC (c.54km downstream). Although functionally linked to the Humber Estuary SAC, qualifying features not known to be present on the River Trent. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and increases in suspended sediments when works are in proximity to watercourses.	No LSEs anticipated	The scheme involves an interzonal transfer and it is therefore assumed that that no increase in abstraction is required, and that that transfer will be a network one. As such, no LSEs are anticipated.	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
108	Stoke to Stafford Link main	Construction of new pipelines and pumping stations to transfer surplus water in North Staffs WRZ to Stafford WRZ.	Cannock Chase SAC Pasturefields Salt Marsh SAC West Midlands Mosses SAC River Mease SAC Humber Estuary SAC, SPA and Ramsar	0km - immediately adjacent 2.9km 6.8km Downstream receptor (c.20km)/functional habitat (River Trent) Downstream receptor (>100km)	There are four European designated sites within 10km; Cannock Chase SAC, Pasturefields Saltmarsh SAC, West Midlands Mosses SAC and River Mease SAC. The Satnall DSR is on the boundary of Cannock Chase SAC, and therefore the pipeline construction will extend in close proximity and within potentially supporting offsite functional habitat (uncertain). Based on standard distance thresholds, no LSEs are anticipated to the Pasturefields Saltmarsh SAC or West Midlands Mosses SAC. The pipeline crosses the River Sow, a tributary of the River Trent. The River Mease discharges into the River Trent further downstream at Croxhall. Three of it qualifying features; otter, bullhead and spined loach, are found in the wider catchment. Standard measures and best practice mitigation would be implemented during construction, including installation using a trenchless technology if necessary, to reduce the risk of pollution incidents and suspended sediment releases. The River Trent is hydrologically connected to the Humber Estuary SAC. However, the watercourse has not been identified as supporting the migratory fish species, and as such are not considered to be functionally linked habitat (as per SACO). Standard measures and best practice mitigation would be implemented during construction, including installation using a trenchless technology if necessary, to reduce the risk of pollution incidents and suspended sediment releases.	LSEs identified	An additional 15Ml/d will be abstracted from the Swynnerton groundwater source. The WFD assessment has concluded that there is limited connectivity between the groundwater and surface water, and therefore impacts to the latter are considered to be low. The groundwater drawdown zone is uncertain, however the River Trent is c. 1.4km to the east. Although hydrologically linked to the Humber Estuary SAC, the qualifying features (sea and river lamprey) are not known to be present on River Trent (as per SACO). The reduction in flow is not considered to adversely affect the Humber Estuary SAC alone (based on WFD impact assessment). The remaining designated sites are >5km from the groundwater source location, and as such are not considered to be adversely affected by drawdown (based on EA threshold). As such, no LSEs are anticipated during operation.	No LSEs anticipated	Y - abstractions affecting freshwater input to the Humber Estuary (freshwater input is an attribute/target in the SACO for the estuaries feature)
110	Wolves to Stafford link main	Construction of new pipelines and pumping stations to transfer surplus water in Wolverhampton WRZ to Stafford WRZ and North Staffs WRZ.	Cannock Chase SAC Cannock Extension Canal SAC Fens Pools SAC Pasturefields Saltmarsh SAC Mottey Meadows SAC Midlands Meres and Mosses Phase 2 Ramsar Humber Estuary SAC, SPA and Ramsar	5km 8.1km 3.4km 8.9km 5km 9.7km Downstream receptor	There are six European designated sites within 10km; Cannock Chase SAC, Cannock Extension Canal SAC, Fens Pools SAC, Pasturefields Saltmarsh SAC, Mottey Meadows SAC and Midlands Meres and Mosses Phase 2 Ramsar. All sites are sufficiently distanced such that direct impacts from construction are unlikely (based on standard thresholds). However, the pipeline crosses watercourses upstream of Cannock Chase SAC (crosses River Sow) and Pasturefields Saltmarsh SAC (crosses River Trent) and as such there is a pathway for impact. The River Sow and River Trent are hydrologically connected to the Humber Estuary SAC. However, neither watercourses have been identified as supporting the migratory fish species, and as such are not considered to be functionally linked habitat. Standard measures and best practice mitigation would be implemented during construction, including installation using a trenchless technology if necessary, to reduce the risk of pollution incidents and suspended sediment releases.	No LSEs anticipated	This component is to transfer potable water between two WRZs with no new abstractions or discharges, as a result no LSEs are anticipated.	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
111	Melbourne to Staffs Link main	Construction of new pipelines and pumping stations to transfer surplus water in the Strategic Grid WRZ to Stafford WRZ and North Staffs WRZ.	Cannock Chase SAC Pasturefields Salt Marsh SAC West Midlands Mosses SAC River Mease SAC Humber Estuary SAC, SPA and Ramsar	0km - immediately adjacent 2.9km 6.8km 9.8km and downstream receptor (c.20km)/functional habitat (River Trent) Downstream receptor (>100km)	There are four European designated sites within 10km; Cannock Chase SAC, Pasturefields Saltmarsh SAC, West Midlands Mosses SAC and River Mease SAC. The pipeline construction will extend in close proximity the boundary of Cannock Chase SAC, and therefore and within potentially supporting offsite functional habitat (uncertain). The pipeline extends within c. 1km of the West Midlands Mosses SAC (Chartley Moss SSSI) and Midlands Meres and Mosses Ramsar. It is unclear what the hydrological catchment area of the site is, and therefore whether the pipeline construction could alter surface and groundwater hydrology that the site is reliant on. Re-routing may be required. Significant construction effects cannot obviously be excluded with standard measures and construction may require bespoke mitigation or detailed design inputs at the WRMP level. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken The pipelines both require crossings on the River Test, upstream of Pasturefields Saltmarsh SAC. The River Mease discharges into the River Trent further downstream at Croxhall. Three of it qualifying features; otter, bullhead and spined loach, are found in the wider catchment. Standard measures and best practice mitigation would be implemented during construction, including installation using a trenchless technology if necessary, to reduce the risk of pollution incidents and suspended sediment releases. The River Trent is hydrologically connected to the Humber Estuary SAC. However, the watercourse has not been identified as supporting the migratory fish species, and as such are not considered to be functionally linked habitat (based on SACO). Standard measures and best practice mitigation would be implemented during construction, including installation using a trenchless technology if necessary, to reduce the risk of pollution incidents and suspended sediment releases.	LSEs identified and likely adverse effects	This component is to transfer potable water between two WRZs with no new abstractions or discharges, as a result no LSEs are anticipated.	No LSEs anticipated	
121	Mythe to Mitcheldean main	Construction of new pumping station and raw water pipeline to utilise unused licence capacity at Mythe and transfer raw water for treatment at an upgraded Mitcheldean WTW.	Bredon Hill SAC Dixton Wood SAC Wye Valley and Forest of Dean Bat Sites SAC Wye Valley Woodlands SAC River Wye SAC Walmore Common SPA and Ramsar Severn Estuary/Môr Hafren SAC	6.9km 8.8km 0.65km 7.9km 5.3km 8.2km Downstream	There are six European designated sites within 10km; Bredon Hill SAC, Dixton Wood SAC, Wye Valley and Forest of Dean Bat Sites SAC, Wye Valley Woodlands SAC, River Wye SAC and Walmore Common SPA and Ramsar. All sites, with the exception of Wye Valley and Forest of Dean Bat Sites SAC are at sufficient distance (based on standard distance thresholds e.g. noise, visual etc) such that LSEs are not anticipated. Construction of the scheme components at Mitcheldean are in close proximity to two areas of the Wye Valley and Forest of Dean Bat Sites SAC; Wigpool Ironstone Mine SSSI and Westbury Brook Ironstone	LSEs identified and likely adverse effects	The objective of the scheme is to use the currently unused licence capacity at Mythe WTW. The WFD assessment has concluded that an additional 16Ml/d abstraction at Mythe is only expected to lead to small changes in river flow (<2% reduction in Q95 flows) on the River Severn; however, the CAMS assessment indicates that there is no water available for abstraction in Q95 conditions. LSEs therefore cannot be ruled out due uncertainty over	LSEs identified	Y - abstractions affecting freshwater input to the Severn Estuary EMS (freshwater input is an attribute/target in the Reg 33 package for the Severn Estuary European Marine Site for the estuaries feature) and River Clun SAC

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
			Severn Estuary SPA and Ramsar River Clun SAC	receptor (c.28km)/functional habitat Downstream receptor (c.28km)/functional habitat Functional link (salmon)	Mine SSSI. The Core Sustainance Zones have not been defined, but during the summer lesser horseshoe bats typically forage between 2-3km and during winter c.1.2km. The hibernation sites of the greater horseshoe bat are not as close, however this species has a larger foraging range. Significant construction effects cannot obviously be excluded with standard measures and construction may require bespoke mitigation or detailed design inputs at the WRMP level. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken. The pipeline requires the crossing of a number of watercourses that discharge to the River Severn, and are therefore hydrologically linked to the Severn Estuary EMS downstream. Longhope Brook, the River Leadon and the River Severn itself are crossed. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases. Construction of the intake modifications may require bespoke mitigation to avoid adverse effects to functionally linked habitat and migration period. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.		the operational regime and how this may affect migratory fish species of the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar and migratory fish species. This includes the Annex II species listed under the SAC (sea lamprey (<i>Petromyzon marinus</i>), river lamprey (<i>Lampetra fluviatilis</i>) and twaite shad (<i>Alosa fallax</i>)) but also the fish assemblage under the Estuaries feature which includes the following migratory species; salmon, eel, sea trout and allis shad (also part of Ramsar criterion). The River Avon is likely to support functionally linked habitat for the species (identified in Severn Estuary EMS Reg 33 package). The installation of a new intake will also require screening etc to avoid impingement and entrainment issues. Changes in the volume of water and flow into the Severn Estuary could also impact salmon movement to the River Clun SAC, designated for freshwater pearl mussel (<i>Margaritifera margaritifera</i>). Salmon provide a key role in the life-cycle of the freshwater pearl mussel. The River Clun discharges to the River Teme which joins the River Severn downstream of Worcester. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.		
122B	Draycote Reservoir WL increase (25%)	Increase storage capacity by raising Top Water Level by 2.5m, through various modifications. A 25% capacity increase equates to additional storage of 5800MI, which will be treated at Draycote WTW before deployment to the Strategic Grid WRZ.	Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar River Clun SAC	Downstream receptor (>150km) Downstream receptor (>150km) Functional link (salmon)	There are no European designated sites within 10km of the scheme components, or impact pathways over a greater distance.	No LSEs anticipated	There are unlikely to be any impacts on the downstream water bodies as Draycote Reservoir only has a small catchment area and the only outflow is compensation flow which will remain unchanged by this component. As such freshwater flows downstream and to the Severn Estuary EMS will not be affected. Therefore no LSEs are anticipated.	No LSEs anticipated	
122C	Draycote Reservoir WL increase (50%)	Increase storage capacity by raising Top Water Level by 5m, through various modifications. A 50% capacity increase equates to additional storage of 11500MI, which will be treated at Draycote WTW before deployment to the Strategic Grid WRZ.	Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar River Clun SAC	Downstream receptor (>150km) Downstream receptor (>150km) Functional link (salmon)	There are no European designated sites within 10km of the scheme components, or impact pathways over a greater distance.	No LSEs anticipated	There are unlikely to be any impacts on the downstream water bodies as Draycote Reservoir only has a small catchment area and the only outflow is compensation flow which will remain unchanged by this component. As such freshwater flows downstream and to the Severn Estuary EMS will not be affected.	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
							Therefore no LSEs are anticipated.		
123A	Raise dam at Tittesworth Reservoir (5%)	Increase storage capacity by raising Top Water Level by 0.42m through various modifications. A 5% capacity increase corresponds to an additional 320Ml of storage, enabling Tittesworth WTW to operate at higher capacity longer into dry seasons.	South Pennine Moors SAC Peak District Moors (South Pennine Moors Phase 1) SPA and Ramsar Peak District Dales SAC	1.3km 1.3km Functional habitat (River Churnet)	There are two European designated sites within 10km of the scheme components; South Pennine Moors SAC and Peak District Moors (South Pennine Moors Phase 1) SPA and Ramsar. Both are located c.1.3km north east of Tittesworth Reservoir. The expansion of the reservoir given the distance, will not adversely affect local hydrology supporting the habitats. The surrounding habitat may be functionally linked, and used by the SPA qualifying features. The new footprint of the reservoir to account for the 25% increase has not been confirmed, and therefore it is uncertain as to what type of habitat will be flooded. As such, significant construction effects cannot obviously be excluded with standard measures and construction may require bespoke mitigation or detailed design inputs at the WRMP level. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.	LSEs identified	The WFD has concluded an uncertain impact on flows in the River Churnet due to the reservoir expansion. The River Churnet is a tributary of the River Dove, the confluence being c.30km downstream. As the flow changes are uncertain, and the potential use of the lower reaches of the River Dove by the mobile species of the Peak District Dales SAC uncertain. LSEs cannot be ruled out. As such, should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.	LSEs identified	Y - abstractions affecting the Peak District Dales SAC functionally linked habitat.
142	Utilise Linacre Reservoirs	New raw water intake at Linacre Reservoir with new pumping station and pipeline to new WTW and new pipeline to deploy treated water.	South Pennine Moors SAC Peak District Moors (South Pennine Moors Phase 1) SPA	3.3km 3.3km	There are two designated sites within 10km; South Pennine Moors SAC and Peak District Moors (South Pennine Moors Phase 1) SPA. Both are located 3.3km to the east. Construction activities are unlikely to give rise to LSEs to the habitats of the South Pennine Moors SAC given the distance and no hydrological pathway. However, offsite functionally linked habitats, for example the woodland and heathland area around Linacre Reservoir could be used by the qualifying features of the SPA. The site of the new WTW and associated infrastructure has not been confirmed, and therefore LSEs cannot be ruled out. Should this option be taken forward to the preferred options stage, identification of the WTW site and possible scheme level investigations will be required, with a Stage 2 Appropriate Assessment to be undertaken.	LSEs identified	There may be changes in the downstream flow contribution to Holme Brook from the reservoir due to changes in spill pattern, but these are considered as minor hydrological impacts which are WFD compliant. The abstraction from Linacre Brook already exists, and the proposed scheme requires a small abstraction from the upper reservoir in a chain of three. Therefore the impacts on the flows in Linacre Brook will be negligible, and as such no LSEs are anticipated.	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
144A	Canals and Rivers Trust option: (C&RT) BCN Surplus to Milford	Third party offer of raw water from the Canal and Rivers Trust (C&RT) making use of a surplus in the Birmingham Canal Network and supported by the C&RT's Bradley and Perry Well borehole and Chasewater Reservoir. Water will be transferred via canal (with appropriate modifications) for abstraction at Milford and, following treatment at a new works, deployed into Stafford WRZ.	West Midlands Mosses SAC Midlands Meres and Mosses - Phase 1 Ramsar Pasturefields Salt Marsh SAC Cannock Chase SAC	4.8km 4.8km 0.7km 0.6km	<p>There are four European sites within 10km; Cannock Chase SAC, Pasturefields Saltmarsh SAC, West Midlands Mosses SAC, Midlands Meres and Mosses Phase 1 Ramsar.</p> <p>The route of the pipeline is considered to be sufficiently distant from the West Midlands Mosses SAC and Midlands Meres and Mosses Phase 1 Ramsar, such that there will be no dust or pollution related incidents during construction that could affect the site, and there will be no impacts to local drainage and water flows.</p> <p>The new canal abstraction point, pumping station and WTW will be required at Milford which is c.600m north of the Cannock Chase SAC. Given the topography, watercourses (River Sow) and existing development (Milford and railway line) it is unlikely that the construction areas are in hydrological connectivity. However, air quality emissions during construction will need to be considered further, including whether any critical loads will be exceeded. Therefore, should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken</p> <p>The pipeline extends c700m west of Pasturefields Saltmarsh SAC. The SAC is groundwater fed and therefore the pipeline is unlikely to alter flows. However, there are potentially functional linked areas of saltmarsh at: Ingestre (SJ980247) and Lion Lodge (SJ989239). The pipeline comes into closer proximity to these offsite areas. Consideration will need to be given to positioning and routing of the pipeline to ensure changes to local hydrology do not adversely affect these areas of saltmarsh. LSEs have been identified, and therefore a Stage 2 Appropriate Assessment is required.</p>	LSEs identified	CRT have identified a baseline surplus of water in the BCN of 15M/d that could be transferred to Milford using the Staffordshire and Worcester canal with appropriate modifications. The surplus would be further supported by the CRT's Bradley and Perry Well borehole and Chasewater reservoir. There are no water dependent European sites along the Staffordshire and Worcester canal, and it is assumed the CRT have completed any necessary HRA assessments to confirm a surplus is available for transfer to Severn Trent. Therefore no LSEs are identified.	No LSEs anticipated	
144B	C&RT BCN Surplus to Rugby	Third party offer of raw water from the Canal and Rivers Trust (C&RT) making use of a surplus in the Birmingham Canal Network and supported by the C&RT's Bradley and Perry Well borehole and Chasewater Reservoir. Water will be transferred to Rugby via canal (with appropriate modifications) for abstraction at Rugby and then transferred via a new pipeline for treatment at Draycote WTW.	None within 10km	N/A	No LSEs have been identified during construction as there are no European sites within 10km of the option components.	No LSEs anticipated	CRT have identified a baseline surplus of water in the BCN of 15M/d that could be transferred to Rugby using the Birmingham & Fazeley, Coventry, and Oxford canals with appropriate modifications. There are no water dependent European sites along the Oxford Canal, and it is assumed the CRT have completed any necessary HRA assessments to confirm a surplus is available for transfer to Severn Trent. Therefore no LSEs are identified.	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
144C	C&RT BCN Surplus to River Severn	Third party offer of raw water from the Canal and Rivers Trust (C&RT) making use of a surplus in the Birmingham Canal Network and supported by the C&RT's Bradley and Perry Well borehole and Chasewater Reservoir. Water will be transferred via canal (with appropriate modifications) to Stourport-on-Severn, before being discharged into the River Severn via a new pipeline, immediately downstream of the existing Lickhill abstraction.	No designated sites within 10km. Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar River Clun SAC	 Downstream receptor (c.65km)/functional habitat (River Severn) Downstream receptor (c.65km)/functional habitat (River Severn) Functional link (salmon)	A new intake structure will be required on the River Severn, and the pipeline will be constructed in close proximity to the river bank/within the floodplain. There is therefore potentially an impact pathway to the Severn Estuary/Môr Hafren SAC and functionally linked habitat within the River Severn itself. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases. Construction of a new intake and the pipeline in close proximity to the watercourse may require bespoke mitigation to avoid adverse effects to functionally linked habitat and migration period. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.	LSEs identified	The proposed scheme involves a new discharge into the River Severn from a canal system, and abstraction further upstream. LSEs therefore cannot be ruled out due uncertainty over the operational regime, and olfactory issues from a new water source, and how this may affect migratory fish species of the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar and the extent of functionally linked habitat that could be affected for migratory fish. This includes the Annex II species listed under the SAC (sea lamprey (<i>Petromyzon marinus</i>), river lamprey (<i>Lampetra fluviatilis</i>) and twaite shad (<i>Alosa fallax</i>)) but also the fish assemblage under the Estuaries feature which includes the following migratory species; salmon, eel, sea trout and allis shad (also part of Ramsar criterion). The installation of a new intake will also require screening etc to avoid impingement and entrainment issues. Changes in the volume of water and flow into the Severn Estuary could also impact salmon movement to the River Clun SAC, designated for freshwater pearl mussel (<i>Margaritifera margaritifera</i>). Salmon provide a key role in the life-cycle of the freshwater pearl mussel. The River Clun discharges to the River Teme which joins the River Severn downstream of Worcester. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.	LSEs identified	Y - abstractions affecting freshwater input to the Severn Estuary EMS (freshwater input is an attribute/target in the Reg 33 package for the Severn Estuary European Marine Site for the estuaries feature) and River Clun SAC
145B	Desalination in Dee estuary / Liverpool Bay	Construction of a new desalination treatment works, in the Mersey Estuary close to Liverpool, to abstract and treat brackish water for transfer south via a new pipeline to the North Staffs WRZ.	Mersey Estuary SPA and Ramsar Mersey Narrows and North Wirral Foreshore SPA and Ramsar The Dee Estuary SAC, SPA and Ramsar Liverpool Bay / Bae Lerpwl SPA <u>Pipeline</u> Midland Meres and Mosses Phase 2 Ramsar Deeside and Buckley Newt Sites SAC	Directly adjacent 7.1km 9.8km 2.7km 2.4km 8.3km 3.9km 7.8km 2.6km 2.6km	The desalination plant requires the construction of a new 1500mm diameter intake tunnel extending into the Mersey Estuary, estimated at 500m long (but potentially up to 1500m in length), capable of transferring on average 100M/d to the shoreline. A sub-sea/estuary intake structure will also be required. These works will be required within or in direct proximity to the Mersey Estuary SPA and Ramsar resulting in permanent loss of supporting habitat. The Mersey Narrow and North Wirral Foreshore SPA and	LSEs and AEol anticipated	The desalination plant will produce a hypersaline wastestream with other waste chemicals (e.g. chlorine) from the treatment process. The intake will also require careful design to minimise entrapment, entrainment and impingement of fish. Both impacts could adversely affect the bird populations of the Mersey Estuary SPA and Ramsar through a change to supporting habitats and change/loss of prey species.	LSEs and AEol anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
			River Dee and Bala Lakes/Afon Dyrddwy a Llyn Tegid SAC Oak Mere SAC Midland Meres and Mosses Phase 1 Ramsar West Midlands Mosses SAC		<p>Ramsar and Liverpool Bay SPA are downstream and offshore, however the habitats within the estuary may be used by the qualifying features, and therefore pathways for impact to these sites cannot be ruled out.</p> <p>The Dee Estuary SAC, SPA and Ramsar is located in a separate estuary, and therefore the option will not affect the habitats or habitats supporting the SPA and Ramsar.</p> <p>The pipeline construction works are sufficiently distanced from the Deeside and Buckley Newt Sites SAC, River Dee and Bala Lakes SAC and Oak Mere SAC such that no LSEs have been identified.</p> <p>Making the reasonable assumption that groundwater flow in the area follows the topography, there would be no hydraulic connection between the West Midlands Mosses SAC and Midland Meres and Mosses Phase 1 Ramsar and the pipeline. No LSEs have been identified.</p>		LSEs have been identified and therefore further work is required with a Stage 2 Appropriate Assessment undertaken.		
150	Little Haywood new WTW on Upper Trent	Construction of a new abstraction point on the River Trent to the east of Stafford, supporting a new 30MI/d treatment works for deployment into Stafford WRZ.	<p>Cannock Chase SAC</p> <p>Pasturefields Salt Marsh SAC</p> <p>West Midlands Mosses SAC</p> <p>Midlands Meres and Mosses Phase 1 and 2 Ramsar</p> <p>River Mease SAC</p> <p>Humber Estuary SAC, SPA and Ramsar</p>	<p>2.1km</p> <p>1.3km</p> <p>5.1km</p> <p>5.1km</p> <p>Downstream receptor (c.22km)/functional habitat</p> <p>Downstream receptor (>100km)</p>	<p>There are four European designated sites within 10km of the scheme components; Cannock Chase SAC, Pasturefields Saltmarsh SAC, West Midland Mosses SAC and Midland Meres and Mosses Phase 1 and 2 Ramsar.</p> <p>The pipeline extends c1.4km to the south west of Pasturefields Saltmarsh SAC. The SAC is groundwater fed and therefore the pipeline is unlikely to alter flows. However, there are potentially functional linked areas of saltmarsh at: Ingestre (SJ980247) and Lion Lodge (SJ989239). The pipeline and WTW come into close proximity to these offsite areas. Consideration will need to be given to positioning and routing structures to ensure changes to local hydrology do not adversely affect these areas of saltmarsh.</p> <p>The pipeline and WTW construction is sufficiently distant from the other designated sites (based on standard distance thresholds e.g. noise, visual etc) such that no construction impacts are anticipated.</p>	LSEs identified	<p>The scheme requires additional abstraction from the River Trent, which could lead to a major hydrological impact downstream to Branston, and a minor impact further downstream to Great Wilne. The major impacted reached coincides with the River Mease SAC confluence. Low flow conditions are protected by a Hands-Off-Flow condition at Yoxall which has been set at an appropriate level to safeguard the aquatic environment.</p> <p>Based on the predicted changes in flow, movement of the two qualifying fish species (bullhead and spined loach) and WCC within the wider catchment could be impeded. Similarly, a long-term reduction in flow could alter prey availability for otter within the wider catchment. LSEs cannot be ruled out due to uncertainty over the operational regime and how this may affect fish and WCC species, and the extent of functionally linked habitat to be affected. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>	LSEs identified	Y - abstractions affecting freshwater input to the Humber Estuary (freshwater input is an attribute/target in the SACO for the estuaries feature)

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
							Although hydrologically linked to the Humber Estuary SAC, qualifying features not known to be present on River Trent (sea and river lamprey). The reduction in flow is not considered to adversely affect the Humber Estuary SAC alone (based on WFD impact assessment), however in combination effects of multiple abstractions reducing flows may need to be considered.		
151A	Next Generation Coal Authority Mine Water Reuse – TCA - A Winning	Use of mine dewatering from a disused site near Mansfield, in the Nottinghamshire and Derbyshire coalfields, as a source of raw water. New treatment facilities will be constructed to enable potable water to be transferred to Whiteborough DSR and into supply in the Nottinghamshire WRZ.	None within 10km Peak District Dales SAC	Hydrologically connected/downstream receptor	Once the disused mine water has been treated, it is currently discharged to the Alfreton Brook, which feeds into the River Amber, a tributary of the River Derwent. The River Derwent is hydrologically connected to the Peak District Dales SAC. The mobile fish species brook lamprey <i>Lampetra planeri</i> and bullhead <i>Cottus gobio</i> could be impacted by pollution incidents or increases in sedimentation during construction, if using functionally linked offsite habitats. Standard best practice construction techniques and adherence to pollution prevention guidelines will mitigate for any impact.	No LSEs anticipated	The diversion of water away from the River Derwent will need to be assessed to ensure river lamprey migration in particular is not hindered. The existing discharge from Alfreton STW will also change as it will need to accommodate the process wastestream from the new WTW (including reverse osmosis and chlorination). Changes to water quality will again need to be considered in relation to the use of offsite functionally linked habitat within the River Derwent. As such, LSEs are identified and a Stage 2 Appropriate Assessment will be required.	LSEs identified	
152	Hampton Loade to Sedgley SR	New abstraction point on R Severn near Hampton Loade WTW (currently under utilised licence). New bankside storage reservoir, new raw water pipeline/pumping station to new WTW (sized at 50Ml/d). Treated water to be deployed via new pipeline.	Fens Pools SAC Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar River Clun SAC	5.1km Downstream receptor (c.28km)/functional habitat (River Severn) Downstream receptor (c.28km)/functional habitat (River Severn) Functional link (salmon)	There is one European designated site within 10km; Fen's Pools SAC. However this is located c. 5.2km from the pipeline route, and the built up urban area provides a barrier to great crested newt movement (typically within 500m of breeding pond). As such, no LSEs are anticipated. A new abstraction is required on the River Severn which is likely to provide functionally linked habitat to the migratory fish species of the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases. However, additional measures might be required for construction of the intake if suitable spawning habitat is located in the area, and therefore works may need to be timed to avoid migration periods. As such, should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken, with bespoke mitigation potentially required.	LSEs identified	The scheme will increase abstraction on the River Severn. LSEs cannot be ruled out due to uncertainty over the operational regime and how this may affect migratory fish species of the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar and the extent of functionally linked habitat that could be affected. This includes the Annex II species listed under the SAC (sea lamprey (<i>Petromyzon marinus</i>), river lamprey (<i>Lampetra fluviatilis</i>) and twaite shad (<i>Alosa fallax</i>)) but also the fish assemblage under the Estuaries feature which includes the following migratory species; salmon, eel, sea trout and allis shad (also part of Ramsar criterion). The installation of a new intake will also require screening etc to avoid impingement and entrainment issues. Changes in the volume of water and flow into the Severn Estuary could also impact salmon movement to the River Clun SAC, designated for freshwater pearl mussel	LSEs identified	Y - abstractions affecting freshwater input to the Severn Estuary EMS (freshwater input is an attribute/target in the Reg 33 package for the Severn Estuary European Marine Site for the estuaries feature) and River Clun SAC

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
							(Margaritifera margaritifera). Salmon provide a key role in the life-cycle of the freshwater pearl mussel. The River Clun discharges to the River Teme which joins the River Severn downstream of Worcester. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.		
187A& B	A: Expand Carsington Reservoir (10,000MI) B: Expand Carsington Reservoir (16,000MI)	A: Raising Carsington Reservoir full level by approximately 4.0m to provide an additional 10,000MI storage. B: Raising Carsington Reservoir full level by approximately 5.7m to provide an additional 16,000MI storage.	Bee's Nest and Green Clay Pits SAC Gang Mine SAC Peak District Dales SAC	1.7km 3.3km Upstream receptor (c.4.9km)/functional habitat (River Dove)	There are three European designated sites within 10km; Bee's Nest and Green Clay Pits SAC, Gang Mines SAC and the Peak District Dales SAC. All are sufficiently distant from the construction site such that construction impacts to the habitats are unlikely (based on standard distance thresholds e.g. noise, visual etc). Carsington Reservoir supplies the Scow Brook to the south west, which discharges to the River Dove. The River Dove at Dove Valley and Biggin Dale SSSI, is protected as part of the Peak District Dales SAC. Although this section is upstream of the discharge, the mobile species (bullhead, brook lamprey, WCC) are likely to use other reaches of the River Dove as functionally linked habitat. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases downstream. As such, no LSEs are anticipated.	No LSEs anticipated	The expansion of the reservoir (for the three different volumes) would not give rise to any adverse effects. However, it is uncertain whether additional abstraction would be required at Ambergate, on the River Derwent, and whether there would be a change in releases to Scow Brook which is hydrologically linked to the River Dove. Both the River Dove and River Derwent are likely to support functionally linked habitat for the mobile species of the Peak District Dales SAC (bullhead, brook lamprey and WCC). Any additional abstraction would be carried out at times of high river flow and it is not expected that this will increase above existing licence constraints. However LSEs are uncertain.	Uncertain	
191	Increase Diddlebury/Munslow GW sources	Increase abstraction from Diddlebury and Munslow GW sources resulting in combined output 2.2MI/d Average and 2.86 MI/d Peak. Upgrade high lift pumps to enable additional transfer of water from Diddlebury.	None within 10km Severn Estuary SAC, SPA and Ramsar River Clun SAC	Downstream receptor (>150km)/functional habitat Functional link (salmon)	There are no designated sites within 10km of the asset. The Severn Estuary SAC, SPA and Ramsar is considered sufficiently distant such that LSEs from construction are not anticipated.	No LSEs anticipated	The Severn Estuary EMS is the ultimate downstream receptor and migratory fish species associated with the SAC and Ramsar sites may utilise the River Teme and River Corve. A change to flows and volume of water may also affect passage of salmon to the River Clun SAC. The scheme involves an additional abstraction from the boreholes. The WFD has identified that the increased abstraction from the borehole would lead to a reduction in groundwater. There would also be a significant reduction in the surface water due to the high connectivity between the surface water and groundwater. Therefore LSEs as a result of deterioration to functionally linked habitat cannot be ruled out at this stage.	LSEs identified	Y - abstractions affecting freshwater input to the Severn Estuary EMS (freshwater input is an attribute/target in the Reg 33 package for the Severn Estuary European Marine Site for the estuaries feature) and River Clun SAC
303A	UU release from Vyrnwy (75 MI/d)	This scheme is to enable managed release of an additional raw water from Lake Vyrnwy into the River Vyrnwy that subsequently	Berwyn and South Clywd Mountains/Berwyn a Mynyddoedd De Clwyd SAC Berwyn SPA	Adjacent to Lake Vyrnwy	There are no physical works required as part of this component as it utilises the existing river channels to transfer the raw water. A raw water release is made from Lake Vyrnwy (United Utilities) into the	No LSEs anticipated	It is assumed that UU have the water available to allow the transfer, and have completed their own HRA.	LSEs identified and likely adverse effects	Y - abstractions affecting freshwater input to the Severn Estuary EMS (freshwater input is an attribute/target in the Reg

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		augments flow in the River Severn to support abstractions at Lickhill (for Frankley WTW).	<p>Tanat and Vyrnwy Bat Sites / Safleoedd Ystlumod Tanat ac Efyrnwy SAC</p> <p>Montgomery Canal SAC</p> <p>Severn Estuary/Severn Estuary/Môr Hafren SAC</p> <p>Severn Estuary SPA and Ramsar</p> <p>River Clun SAC</p>	<p>Adjacent to Lake Vyrnwy</p> <p>0.6km to River Vyrnwy</p> <p>0.1km to River Vyrnwy</p> <p>Downstream receptor (c.28km)/functional habitat</p> <p>Downstream receptor (c.28km)/functional habitat</p> <p>Functional link (salmon)</p>	River Vyrnwy and then the River Severn, for abstraction further downstream (by other components). As such, no LSEs during construction are anticipated.		<p>Berwyn and South Clywd Mountains SAC and Berwyn SPA is not hydrologically connected downstream of the proposed regulation release and the operation of regulation releases from Lake Vyrnwy Reservoir will not lead to any changes to the baseline water environment in the vicinity of the SAC or SPA. The Montgomery Canal SAC crosses the affected reach of the River Vyrnwy via an aqueduct but is not hydrologically dependent on the river flow for maintenance of the aquatic habitats within the SAC. Although lesser horseshoe bats (qualifying feature of Tanat and Vyrnwy Bat Sites SAC) utilise riparian habitats for foraging and commuting, they are not considered to be a water dependent species and are not considered to be sensitive to changes in flow velocity or water level in foraging habitats. As such, no LSEs are anticipated for these designated sites.</p> <p>There are potential impact pathways of this element on functional spawning and nursery habitats of the migratory fish species, not within the boundary of the Severn Estuary SAC during operation. The scheme will potentially alter flows within the River Vyrnwy and River Severn. LSEs cannot be ruled out due uncertainty over the operational regime and how this may affect migratory fish species of the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar and the extent of functionally linked habitat that could be affected. This includes the Annex II species listed under the SAC (sea lamprey (<i>Petromyzon marinus</i>), river lamprey (<i>Lampetra fluviatilis</i>) and twaite shad (<i>Alosa fallax</i>)) but also the fish assemblage under the Estuaries feature which includes the following migratory species; salmon, eel, sea trout and allis shad (also part of Ramsar criterion).</p> <p>Changes in the volume of water and flow into the Severn Estuary could also impact salmon movement to the River Clun SAC, designated for freshwater pearl mussel (<i>Margaritifera margaritifera</i>).</p>		33 package for the Severn Estuary European Marine Site for the estuaries feature) and River Clun SAC

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
							<p>Salmon provide a key role in the life-cycle of the freshwater pearl mussel. The River Clun discharges to the River Teme which joins the River Severn downstream of Worcester.</p> <p>Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>		
303D	UU release from Vyrnwy (14.5 Ml/d) to supply Frankley	This scheme is to enable managed release of an additional raw water from Lake Vyrnwy into the River Vyrnwy that subsequently augments flow in the River Severn to support abstractions at Lickhill (for Frankley WTW).	<p>Berwyn and South Clywd Mountains/Berwyn a Mynyddoedd De Clwyd SAC</p> <p>Berwyn SPA</p> <p>Tanat and Vyrnwy Bat Sites / Safleoedd Ystlumod Tanat ac Efyrynwy SAC</p> <p>Montgomery Canal SAC</p> <p>Severn Estuary/Severn Estuary/Môr Hafren SAC</p> <p>Severn Estuary SPA and Ramsar</p> <p>River Clun SAC</p>	<p>Adjacent to Lake Vyrnwy</p> <p>Adjacent to Lake Vyrnwy</p> <p>0.6km to River Vyrnwy</p> <p>0.1km to River Vyrnwy</p> <p>Downstream receptor (c.28km)/functional habitat</p> <p>Downstream receptor (c.28km)/functional habitat</p> <p>Functional link (salmon)</p>	There are no physical works required as part of this component as it utilises the existing river channels to transfer the raw water. A raw water release is made from Lake Vyrnwy (United Utilities) into the River Vyrnwy and then the River Severn, for abstraction further downstream (by other components). As such, no LSEs during construction are anticipated.	No LSEs identified	<p>It is assumed that UU have the water available to allow the transfer, and have completed their own HRA.</p> <p>Berwyn and South Clywd Mountains SAC and Berwyn SPA is not hydrologically connected downstream of the proposed regulation release and the operation of regulation releases from Lake Vyrnwy Reservoir will not lead to any changes to the baseline water environment in the vicinity of the SAC or SPA. The Montgomery Canal SAC crosses the affected reach of the River Vyrnwy via an aqueduct but is not hydrologically dependent on the river flow for maintenance of the aquatic habitats within the SAC. Although lesser horseshoe bats (qualifying feature of Tanat and Vyrnwy Bat Sites SAC) utilise riparian habitats for foraging and commuting, they are not considered to be a water dependent species and are not considered to be sensitive to changes in flow velocity or water level in foraging habitats. As such, no LSEs are anticipated for these designated sites.</p> <p>There are potential impact pathways of this element on functional spawning and nursery habitats of the migratory fish species, not within the boundary of the Severn Estuary SAC during operation. The scheme will potentially alter flows within the River Vyrnwy and River Severn. LSEs cannot be ruled out due uncertainty over the operational regime and how this may affect migratory fish species of the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar and the extent of functionally linked habitat that could be affected. This includes the Annex II species listed under the SAC</p>	LSEs identified	Y - abstractions affecting freshwater input to the Severn Estuary EMS (freshwater input is an attribute/target in the Reg 33 package for the Severn Estuary European Marine Site for the estuaries feature) and River Clun SAC

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
							<p>(sea lamprey (<i>Petromyzon marinus</i>), river lamprey (<i>Lampetra fluviatilis</i>) and twaite shad (<i>Alosa fallax</i>)) but also the fish assemblage under the Estuaries feature which includes the following migratory species; salmon, eel, sea trout and allis shad (also part of Ramsar criterion).</p> <p>Changes in the volume of water and flow into the Severn Estuary could also impact salmon movement to the River Clun SAC, designated for freshwater pearl mussel (<i>Margaritifera margaritifera</i>). Salmon provide a key role in the life-cycle of the freshwater pearl mussel. The River Clun discharges to the River Teme which joins the River Severn downstream of Worcester.</p>		
305	Heathy Lea to North Notts transfer (small)	Transfer of surplus treated water in the Strategic Grid WRZ to Nottinghamshire WRZ, via new pipeline and pumping station.	<p>Peak District Dales SAC</p> <p>South Pennine Moors SAC</p> <p>Peak District Moor (South Pennine Moors Phase 1) SPA</p>	<p>4.2km/ hydrological connectivity</p> <p><0.1km</p> <p><0.1km</p>	<p>There are three European designated sites within 10km of the scheme components; Peak District Dales SAC, South Pennine Moors SAC and Peak District Moors (South Pennine Moors Phase 1) SPA. The Peak District Dales SAC is c.4.2km to the north west, however the pipeline crosses a number of watercourses that discharge to the River Derwent. The River Derwent is likely to provide offsite functionally linked habitat for brook lamprey and bullhead (less so as not migratory). Standard measures and best practice mitigation would be implemented during construction, including installation using a trenchless technology if necessary, to reduce the risk of pollution incidents and suspended sediment releases.</p> <p>The routing of the pipeline comes within c.20m of the South Pennine Moors SAC and Peak District Moors (South Pennine Moors Phase 1) SPA, utilising the A619 and B6050 gap. Construction works are therefore in direct proximity to the designation at this point. The pipeline is within 1km of the sites for approximately 4km. The pipeline also crosses watercourses that drain into the sites, and the potentially for the pipeline to result in the temporary loss of offsite functionally linked habitat is unknown.</p> <p>Significant construction effects cannot obviously be excluded with standard measures and construction may require bespoke mitigation or detailed design inputs at the WRMP level.</p> <p>Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken</p>	LSEs identified	<p>This component involves the construction of a new link main from the Strategic Grid WRZ into the Nottinghamshire WRZ, with no changes in abstraction or discharges. As such, no LSEs are anticipated.</p>	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
305B	Heathy Lea to Nottingham transfer (very large)	Transfer of surplus treated water in the Strategic Grid WRZ to Nottinghamshire WRZ, via new pipelines, pumping stations and a new service reservoir.	Birklands and Bilhaugh SAC Peak District Dales SAC South Pennine Moors SAC Peak District Moor (South Pennine Moors Phase 1) SPA	<1km 4.2km/hydrological connectivity <0.1km <0.1km	There are four European designated sites within 10km. The routing of the pipeline comes within c.20m of the South Pennine Moors SAC and Peak District Moors (South Pennine Moors Phase 1) SPA, utilising the A619 and B6050 gap. Construction works are therefore in direct proximity to the designation at this point. The pipeline is within 1km of the sites for approximately 4km. The pipeline also crosses watercourses that drain into the sites, and the potential for the pipeline to result in the temporary loss of offsite functionally linked habitat is unknown. Significant construction effects cannot obviously be excluded with standard measures and construction may require bespoke mitigation or detailed design inputs at the WRMP level. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken. Birklands and Bilhaugh SAC is located c.1km to the south of the pipeline connection point. The site is designated for Old acidophilous oak woods with <i>Quercus robur</i> on sandy plains, which has an air quality target. This could be impacted during construction, and therefore further assessment will be required through a Stage 2 Appropriate Assessment.	LSEs identified	This component involves the construction of a new link main from the Strategic Grid WRZ into the Nottinghamshire WRZ, with no changes in abstraction or discharges. As such, no LSEs are anticipated.	No LSEs anticipated	
309Z	Transfer from Hampton Loade WTW to Nurton DSR (small)	New pipeline and connection to enable some of the potable supply from Hampton Loade WTW to be reduced towards the Shelton WRZ instead of it being delivered to the Wolverhampton WRZ.	Fen's Pools SAC Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar River Clun SAC	2.9km Downstream receptor (c.77km)/functional habitat (River Severn) Downstream receptor (c.77km)/functional habitat (River Severn) Functional link (salmon)	There is one European designated site within 10km; Fen's Pools SAC. The site is located c.2.9km to the south east of the pipeline. Given the distance of the works and lack of hydrological connectivity, no LSEs are anticipated. The scheme utilises the existing abstraction infrastructure on the River Severn, therefore no construction works are required which could affect the downstream Severn Estuary EMS and functionally linked habitat.	No LSEs anticipated	The scheme does not require an increase in abstraction from the River Severn, rather it changes the transfer of water between water resource zones. As such, no LSEs are anticipated.	No LSEs anticipated	
313	DVA capacity increase to Heathy Lea (reduce Rivelin export)	Improved conveyance in the DVA to increase maximum output flows from Bamford WTW, therefore releasing constrained treatment capacity. Includes triplication of DVA syphon pipes and interstage pumping upgrades at Bamford WTW.	South Pennine Moors SAC Peak District Moors (South Pennine Moors Phase 1) SPA Peak District Dales SAC	<03km <0.3km Downstream receptor	The DVA pipeline is already in place, and this scheme proposes to clean and re-line sections. To do this, launch and reception pits will likely be required to enable pipeline gauging, cleaning and lining apparatus (as appropriate) to be inserted and pulled through the pipeline. Exact locations for the excavations onto the existing pipeline are not known at this stage. During commissioning, large volumes of chlorinated water will require discharge.	LSEs identified	The operational change in water supply for watercourses with hydrological connectivity to the Peak District Dales SAC and South Pennine Moors SAC will need further consideration (change in spill overflow from reservoir). The WFD has concluded that the changes in spill pattern, are considered as minor hydrological impacts which are	LSEs identified	Y - abstractions affecting the Peak District Dales SAC functionally linked habitat.

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
					<p>The sections of DVA requiring works are in close proximity to the South Pennine Moors SAC and Peak District Moors (South Pennine Moors Phase 1) SPA. The Peak District Dales SAC is located downstream, hydrologically connected to the River Derwent. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases downstream which could impact bullhead and brook lamprey (Peak District Dales SAC).</p> <p>Although works will be small scale, the construction and commissioning period is c.1 year, and therefore disturbance (noise, visual and light) may occur to the bird qualifying features, particularly when working on the Oxhay Conduit/Bolehill Tunnel which is in closest proximity. The potential for the area surrounding this to provide functionally linked habitat is also uncertain. Construction effects cannot obviously be excluded with standard measures and construction may require bespoke mitigation (avoidance of breeding period) or detailed design inputs at the WRMP level. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>		<p>WFD compliant. However, LSEs cannot be ruled out due to uncertainty over the operational regime and how this may affect migratory fish species in particular, and the extent of functionally linked habitat to be affected. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>		
314	Expand Bamford WTW and DVA capacity increase (terminate Rivelin export)	New process stream and upgrades to Bamford WTW and new pipelines and pumping facilities to increase conveyance capacity of the DVA.	<p>Bee's Nest and Green Clay Pits SAC</p> <p>Gang Mine SAC</p> <p>Peak District Dales SAC</p> <p>South Pennine Moors SAC</p> <p>Peak District Moors (South Pennine Moors Phase 1) SPA</p>	<p>0.031km directly adjacent</p> <p>2.4km</p> <p>0.065km</p> <p>0.78km</p> <p>0.78km</p>	<p>There are five European designated sites within 10km: Bee's Nest and Green Clay Pits SAC, Gang Mine SAC, Peak District Dales SAC, South Pennine Moors SAC and Peak District Moors (South Pennine Moors Phase 1) SPA. The proposed pipeline has been re-routed to avoid direct impact to the South Pennine Moors SAC and Peak District Moors (South Pennine Moors Phase 1) SPA. However, the pipeline route is located 0.78km from these two designated and therefore adverse effects cannot be ruled out and a Stage 2 Appropriate Assessment will be required. Significant construction effects cannot obviously be excluded with standard measures and construction may require bespoke mitigation or detailed design inputs at the WRMP level.</p> <p>The new route of the pipeline is also in close proximity to Bee's Nest and Green Clay Pits SAC (31m) as such Likely Significant Effects (LSEs) have been identified. The pipeline is likely to have an adverse effect upon functionally linked habitat supporting GCN (can travel up to 500m) through habitat loss and killing/injury individuals and may have an adverse effect on qualifying habitats through disturbance.</p> <p>The new pipeline route is also located in close proximity to Peak District Dales SAC which may be impacted by construction disturbance including air pollution, dust and pollution incident.</p>	LSEs identified	<p>The operational change in water supply for watercourses with hydrological connectivity to the Peak District Dales SAC and South Pennine Moors SAC will need further consideration (change in spill overflow from reservoir). The WFD has concluded that the changes in spill pattern, are considered as minor hydrological impacts which are WFD compliant. However, LSEs cannot be ruled out due to uncertainty over the operational regime and how this may affect migratory fish species in particular, and the extent of functionally linked habitat to be affected. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>	LSEs identified	Y - abstractions affecting the Peak District Dales SAC functionally linked habitat.

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
					However mitigation measures would minimise these impacts. The pipeline crosses three watercourses which discharge to the River Derwent. The use of this watercourse by two qualifying features of the Peak District Dales SAC (bullhead and brook lamprey) cannot be discounted. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases downstream which could impact bullhead and brook lamprey.				
430	Ogston WTW DO Recovery	Removal of constraints at treatment works to increase capacity, enabling better use of the abstraction licence.	Gang Mine SAC Peak District Dales SAC South Pennine Moors SAC Peak District Moors (South Pennine Moors Phase 1) SPA Humber Estuary SAC, SPA and Ramsar	10km 8.5km 9.5km 9.5km Downstream receptor	There are four European designated sites within 10km; Gang Mine SAC, Peak District Dales SAC, South Pennine Moors SAC and Peak District Moors (South Pennine Moors Phase 1) SPA. The proposed works are contained within the existing site boundaries and are therefore at sufficient distance (based on standard distance thresholds e.g. noise, visual etc) that construction impacts are unlikely. As such, no LSEs are anticipated.	No LSEs anticipated	The scheme requires upgrades to increase deployable output from a reservoir, and does not require additional abstraction rather is simply the utilisation of available water. As such, it is assumed that all licence requirements (e.g. compensation releases, if required) will be maintained so that should be no LSEs alone. Although hydrologically linked to the Humber Estuary SAC, qualifying features are not known to be present on the River Trent. The SACO states the following: - Sea lamprey: <i>Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable.</i> - River lamprey: <i>Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey.</i>	No LSEs anticipated	Y - abstractions affecting freshwater input to the Humber Estuary (freshwater input is an attribute/target in the SACO for the estuaries feature)
437	Finham FE to expanded Draycote Reservoir and WTW	Enhanced Effluent Treatment at Finham STW, transfer to expanded Draycote Reservoir for additional raw water storage then treat at upgraded and expanded Draycote WTW. Potable water will then then deployed via new pipeline to the Strategic Grid WRZ to supply customers in Coventry.	Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar River Clun SAC	Downstream receptor Downstream receptor Functional link (salmon)	The pipeline route requires a crossing of the River Avon which is hydrologically linked to the Severn Estuary/Môr Hafren SAC and Severn Estuary SPA and Ramsar, and could provide functionally linked habitat (spawning gravels) for the migratory fish species. Standard measures and best practice mitigation would be implemented during construction, including installation using a trenchless technology, to reduce the risk of pollution incidents and suspended sediment releases. There is uncertainty as to whether the River Avon supports spawning populations of the migratory fish species. As such, should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken, with bespoke mitigation potentially required to allow pipeline construction.	LSEs identified	The proposed scheme involves an additional abstraction from the River Sowe which is hydrologically connected to the Severn Estuary EMS via the River Severn. LSEs therefore cannot be ruled out due uncertainty over the operational regime and how this may affect migratory fish species of the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar and the extent of functionally linked habitat. This includes the Annex II species listed under the SAC (sea lamprey (<i>Petromyzon marinus</i>), river lamprey (<i>Lampetra fluviatilis</i>) and twaite shad (<i>Alosa fallax</i>)) but also the fish assemblage under the Estuaries feature which includes the following migratory species; salmon, eel, sea trout and allis shad (also part of Ramsar criterion).	LSEs identified	Y - abstractions affecting freshwater input to the Severn Estuary EMS (freshwater input is an attribute/target in the Reg 33 package for the Severn Estuary European Marine Site for the estuaries feature) and River Clun SAC

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
							<p>Changes in the volume of water and flow into the Severn Estuary could also impact salmon movement to the River Clun SAC, designated for freshwater pearl mussel (<i>Margaritifera margaritifera</i>). Salmon provide a key role in the life-cycle of the freshwater pearl mussel. The River Clun discharges to the River Teme which joins the River Severn downstream of Worcester.</p> <p>The installation of a new intake will also require screening etc to avoid impingement and entrainment issues. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p>		
439	Longdon Marsh and increase Frankley output by 190 MI/d	Construction of a new raw water reservoir at Longdon Marsh, Gloucestershire, supplied by a new abstraction on the River Severn. Raw water will be transferred by a new pipeline to Frankley WTW, which will be upgraded and upsized. Treated water will be deployed via a new pipeline/pumping station.	<p>Bredon Hill SAC</p> <p>Lyppard Grange Ponds SAC</p> <p>Severn Estuary/Môr Hafren SAC</p> <p>Severn Estuary SPA and Ramsar</p> <p>River Clun SAC</p> <p>Humber Estuary SAC, SPA and Ramsar</p>	<p>6.4km</p> <p>1.7km</p> <p>Downstream receptor (c.31km)/functional habitat (River Severn)</p> <p>Downstream receptor (c.31km)/functional habitat (River Severn)</p> <p>Functional link (salmon)</p> <p>Downstream receptor (>100km)</p>	<p>There are two European designated sites within 10km of the scheme components (Longdon Marsh); Bredon Hill SAC and Lyppard Grange Ponds SAC. Bredon Hill SAC is c6.4km from the pipeline route, and therefore sufficiently distant (based on standard distance thresholds e.g. noise, visual etc) such that no LSEs are anticipated. Lyppard Grange Ponds SAC is located c.1.7km to the west of the pipeline route. This is considered to be outside the normal distance which great crested newts occupy terrestrial habitat migrate from breeding ponds (up to 500m). The intervening habitat between the pipeline route and SAC is urban, with the M5 and residential development providing a barrier to movement. As such, no LSEs are anticipated.</p> <p>A new raw water intake from the River Severn will be constructed, and the Longdon Marsh Reservoir is to be constructed in within the floodplain of the Longdon Brook. There is therefore an impact pathway to the downstream Severn Estuary/Môr Hafren SAC and to potentially functionally linked habitat within the River Severn itself. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases. Construction of a new intake may require bespoke mitigation to avoid adverse effects to functionally linked habitat and migration period. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.</p> <p>There are no European designated sites within 10km of the scheme components (Frankley WTW and pipelines). The pipeline between Highters Heath DSR and Meriden DSR crosses the River Blythe c.7 times. The River Blythe is</p>	LSEs identified	<p>The new 350MI/d intake on the River Severn could lead to a 26.1%, 13.2%, 7.6% reduction in Q95, Q70 and Q50 flows respectively. The CAMS for the area indicates that no water is available for abstraction at Q95 flow, restricted water is available for abstraction at Q70 flows and water is available for abstraction above Q50 flows. Although the CAMS indicates that there is a Hands-Off-Flow at Deerhurst of 2568MI/d, which is designed to protect the aquatic environment, this and the Severn River Regulation are the subject of a review by NE, NRW and EA.</p> <p>The reach affected would be between the abstraction point at Holdfast, to the tidal limit and upper boundary of the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar, and could therefore a reduction in flow could affect migratory fish as they transition between saline and freshwater. This includes the Annex II species listed under the SAC (sea lamprey (<i>Petromyzon marinus</i>), river lamprey (<i>Lampetra fluviatilis</i>) and twaite shad (<i>Alosa fallax</i>)) but also the fish assemblage under the Estuaries feature which includes the following migratory species; salmon, eel, sea trout and allis shad (also part of Ramsar criterion). The installation of a new intake will also require screening etc to avoid impingement and entrainment issues.</p>	LSEs identified and likely adverse effects	Y - abstractions affecting freshwater input to the Severn Estuary EMS (freshwater input is an attribute/target in the Reg 33 package for the Severn Estuary European Marine Site for the estuaries feature) and River Clun SAC

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
					hydrologically connected to the Humber Estuary SAC via the River Tame and River Trent. However, none of the watercourses have been identified as supporting the migratory fish species, and as such are not considered to be functionally linked habitat. The Humber Estuary SAC is c.144km downstream and therefore considered to be sufficiently distanced such that construction related issues (increases in suspended sediments) would not adversely affect the site. Standard measures and best practice mitigation would be implemented during construction to reduce the risk.		Changes in the volume of water and flow into the Severn Estuary could also impact salmon movement to the River Clun SAC, designated for freshwater pearl mussel (<i>Margaritifera margaritifera</i>). Salmon provide a key role in the life-cycle of the freshwater pearl mussel. The River Clun discharges to the River Teme which joins the River Severn downstream of Worcester. LSEs therefore cannot be ruled out due uncertainty over the operational regime and how this may affect migratory fish species of the Severn Estuary SAC and the extent of functionally linked habitat that could be affected. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken. The water from Longdon Marsh will be transferred to Frankley WTW. There are no proposed changes to abstraction at Frankley WTW itself.		
549A	Raw water transfer from Congleton to Tittesworth Reservoir (UU import)	Raw water is to be imported from United Utilities for storage at Tittesworth Reservoir, to enable increased utilisation of Tittesworth WTW, particularly during dry seasons. There are no capital assets proposed within the Severn Trent option, which will instead be delivered by a United Utilities WRMP option.	South Pennine Moors SAC Peak District Dales SAC Peak District Moors SPA (South Pennine Moors Phase 1) Humber Estuary SAC, SPA and Ramsar	1.53km 9.7km 1.53km Downstream receptor (>150km)	The component requires an import of raw water from UU source in Congleton to Severn Trent's Tittesworth Reservoir to maintain storage levels within the reservoir during dry weather. The component doesn't require construction works, treatment and deployment will be via existing assets and therefore there are no impact pathways.	No LSEs anticipated	The component will aim to maintain water level within Tittesworth Reservoir which will not adversely affect local hydrology supporting the habitats designated within the European sites. A minor change in the flow regime of the River Churnet is predicted, however this is considered to be unlikely to adversely affect the mobile populations of the Peak District Dales SAC, as the confluence of the River Dove is c.30km away.	No LSEs anticipated	
549B	Treated water transfer from Congleton to Tittesworth Reservoir (UU import)	Treated water import from United Utilities to Tittesworth WTW, enabling water production at Tittesworth WTW to be reduced, thereby reducing draw down at Tittesworth Reservoir. The treated water import will help to secure increased raw water availability at Tittesworth, particularly during dry seasons. There are no capital assets proposed within the Severn Trent option, which will instead be delivered by a United Utilities WRMP option.	South Pennine Moors SAC Peak District Dales SAC Peak District Moors SPA (South Pennine Moors Phase 1) Humber Estuary SAC, SPA and Ramsar	1.53km 9.7km 1.53km Downstream receptor (>150km)	The component required an import of treated water from UU source in Congleton to the outlet of Severn Trent's Tittesworth WTW's which would maintain reservoir levels at all time. While the component is not assumed to require construction works (i.e., treatment and deployment via existing assets), the network may need to be reinforced. Therefore, no impact pathways are anticipated from this component, unless reinforcement works are required. Further assessment with regards to location and distance from European sites would need to be carried out. Standard measures and best practice mitigation would be implemented during construction to reduce the risk.	LSEs identified	The component will aim to maintain water level within Tittesworth Reservoir which will not adversely affect local hydrology supporting the habitats designated within the European sites. A minor change in the flow regime of the River Churnet is predicted, however this is considered to be unlikely to adversely affect the mobile populations of the Peak District Dales SAC, as the confluence of the River Dove is c.30km away.	No LSEs anticipated	Y - abstractions affecting freshwater input to the Humber Estuary (freshwater input is an attribute/target in the SACO for the estuaries feature)

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
560	UU treated water import to Chester	Treated water import from United Utilities, making use of existing network connectivity with Severn Trent Water's Chester WRZ. This is an opex only option with no capital works required.	N/A	N/A	No capital works are required by Severn Trent. Therefore, no LSEs are anticipated.	No LSEs identified	The option will not require additional abstraction and therefore operational activities are not considered to have a significant impact upon the SACs.	No LSEs identified	
561	Kinsall Transfer	Transfer of potable water from Shelton WRZ to Kinsall WRZ, through construction of a new main to increase capacity.	Meres and Mosses Ramsar Phase 1 Meres and Mosses Ramsar Phase 2 West Midland Mosses SAC Fenn's, Whixall, Wem and Cadney Mosses SAC	4.2km 6km 6.3km 9.9km	The construction works are sufficiently distant from the designated sites (based on standard distance thresholds for noise, visual etc) that no LSEs are anticipated. Although component wetlands of the Meres and Mosses Ramsar Phase 1 are vulnerable to changes in water levels and water quality, the Llangollen Canal separates the catchments and therefore no LSEs are anticipated.	No LSEs identified	The option will not require additional abstraction and therefore operational activities are not considered to have a significant impact upon the SACs.	No LSEs identified	
563	Whitchurch & Wem Transfer	Transfer of potable water from Shelton WRZ to Whitchurch & Wem WRZ, through construction of a new pipeline, pumping stations and localised network connections.	Meres and Mosses Ramsar Phase 2 Meres and Mosses Ramsar Phase 1 Fenn's, Whixall, Wem and Cadney Mosses SAC	1.2km 8.6km 9.8km	There are three European designated sites within 10km. Meres and Mosses Ramsar Phase 2 is relatively close (1.2km) to the Harlescott Grange pipe end, but buffered by a sizable residential area, which is likely to already expose the Ramsar site to noise etc, and have changed local drainage patterns. It is therefore unlikely that the constructional phase will significantly impact the site.	No LSEs identified	The option will not require additional abstraction and therefore operational activities are not considered to have a significant impact upon the SACs.	No LSEs identified	



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