HABITATS REGULATIONS ASSESSMENT

Draft 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

Ricardo ref. ED14824 Issue: 2.1 12/10/2022

Ricardo Energy & Environment, Gemini Building, Fermi Avenue, Harwell, Oxfordshire, OX11 0QR, UK | +44(0)1235 75 3000 | ee.ricardo.com
Registered company no. 08229264 | VAT no. GB 212 8365 24

Customer:
SEVERN TRENT WATER (Severn Trent)

Customer reference:
WRW/WRMP24 Supply Options and Environmental Appraisal

Contact:
Rachel Ashmole, Ricardo Energy & Environment
Bright Building, Manchester Science Park, Pencroft Way, Manchester M15 6GZ, UK

T: +44 (0) 1235 753 085
E: rachel.ashmole@ricardo.com

Author:
Ryan Hale, Emilie Gorse, Esther Kendall, Claire Pitcher

Approved by:
Rachel Ashmole

Signed

Ricardo reference:
ED14824

Date:
12/10/2022

Ricardo is certified to ISO9001, ISO14001, ISO27001 and ISO45001.

Front cover image:
Upper Derwent Valley, Severn Trent

CONTENTS

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 the Severn Trent Water's draft Water Resources Management Plan 24 (Severn Trent's draft 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 programme and alternative programmes' list of options in the WRMP24 was completed. It also identifies those options where Stage 2 Appropriate Assessment would be needed if the option were to be included in the preferred programme 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.

For those options within the preferred plan or alternative plans required after 2050, a higher level assessment was completed as there is sufficient time and subsequent WRMP cycles to assess these options, some of which will require bespoke hydrological modelling to fully understand the effects alone and in-combination, including with other WRMPs.

In summary, there are 43 preferred plan options and 5 additional alternative plan options. Of these:

- 12 are in use before 2050 for at least one of the preferred plan/alternative plans (11 preferred plan options and one alternative option).
- These have been subject to HRA Stage 1 Screening and where necessary Stage 2 Appropriate Assessment (alone and in-combination), with the following sites considered:
    - Bredon Hill SAC and Dixton Wood SAC
    - Cannock Chase SAC
    - Midlands Meres and Mosses Phase 2 Ramsar
    - Pasturefields Salt Marsh SAC
    - Peak District Dales SAC
    - Peak District Moors (South Pennine Moors Phase 1) SPA
    - River Clun SAC
    - River Mease SAC
    - Rutland Water SPA and Ramsar
    - Severn Estuary SAC and Ramsar
    - South Pennine Moors SAC

- The exception is Option 6 which is part of the RAPID Gated process, and therefore already being assessed via this process. As such, a Stage 2 Appropriate Assessment will be completed between draft and final WRMP incorporating this information.
- 12 options (8 preferred plan options and four alternative plan options) are in use after 2050 and therefore have been assessed at a higher level, with an indication of mitigation measures and further assessment work required to support any Stage 2 Appropriate Assessments.
- 26 preferred plan options do not require HRA Stage 2 Appropriate Assessments.
- 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 will be required for the Humber Estuary EMS, and the Severn Estuary EMS as draft WRMPs from other water companies are made available. Given the complexities of the abstraction and discharges on the River Severn in particular, additional modelling is likely to be required to confirm effects.

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; 112 Croxton groundwater sources as the abstraction location of the groundwater sources is not confirmed, and further hydrogeological assessment will be required to understand the impacts to the River Sow and Midland Meres and Mosses Phase 2 Ramsar. However, this is an alternative option, and if required will not be developed until 2045/46, therefore there is sufficient time and subsequent WRMP cycles to confirm effects.

The in-combination assessment of other water company WRMPs will need to be progressed between draft and final WRMP as all plans are currently in preparation and so an 'in-combination' assessment cannot be completed at this stage.

The preferred programme 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') is preparing its WRMP 2024 and has published a draft ('the draft WRMP24') for consultation. The draft 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 draft 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 draft WRMP24 for further details).

Severn Trent's draft WRMP24 is being 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 (STW), South Staffordshire Water (SSW) and United Utilities Water (UU)[1] that is managed by Water Resources West (WRW). WRW is currently preparing a Regional Plan[2] 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.

Regulation 63 states that if a plan or project "*(a) is likely to have a significant effect on a European site*[4] *or a European offshore marine site*[5] *(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

[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.
[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.

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 HRA[6]. 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. Further consultation will be undertaken with both stakeholders as necessary between the draft and final plan and this section will be updated accordingly.

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 draft 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: Midlands Meres and Mosses Phase 2 Ramsar

Section 14: Stage 2 Appropriate Assessment: Rutland Water SPA and Ramsar

Section 15: Stage 2 Appropriate Assessment: Bredon Hill SAC and Dixton Wood SAC

Section 16: Strategic in-combination assessment

Section 17: Draft HRA conclusions

[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'.

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 plans[11] 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 programme of options only**. The overarching HRA *process* for the WRMP has therefore included the following key steps:

An initial **'risk review' of the supply-side**[13] **feasible options**, to assist Severn Trent's selection of the preferred programme options (i.e. 'HRA as a process'). The review of the feasible options applied the normal principles and practices associated with 'HRA screening' but also took account of the deliverability of the options including potential mitigation opportunities[14].

The **assessment of the preferred programme of options** against the provisions of Regulation 63, comprising formal 'screening' and an 'appropriate assessment' designed to meet the legislative tests (this report).

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 (2021). 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 designated[15], 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' case[16] 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/SACs[17]).
- Site Improvement Plans (SIPs).
- Regulation 33 information for European Marine Sites or Conservation Advice for Marine Protected Areas[18].
- 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 guidance[19] 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 abstraction[20].
- 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 Options[21] (Source: UKWIR, 2021)

Broad categories of potential impacts on European Sites, with examples	Examples of activities responsible for impacts *(example distance considerations in italics)*
Physical loss: • 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. *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).*
Physical damage: • 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. *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.*
Non-physical disturbance: • Noise • Visual presence • Human presence • Light pollution	Noise from temporary construction or temporary pumping activities. *Taking into consideration the noise level generated from general building activity (c. 122dB(A)) and considering the lowest noise level identified in appropriate guidance as likely to cause disturbance to estuarine bird species, it is concluded that noise impacts could be significant up to 1km from the boundary of the European site*[22,23] Noise from vehicular traffic during operation of an option. *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 site*[24]*.* Plant and personnel involved in in operation of the option.

[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.

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

Broad categories of potential impacts on European Sites, with examples	Examples of activities responsible for impacts *(example distance considerations in italics)*
	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). Options that might include artificial lighting, e.g., for security around a temporary pumping station. *Effects from light pollution[25] are more likely to be significant where the boundary of the option is within 500m of the boundary of the European site.*
Water table/availability: • Drying • Flooding/stormwater • Changes to surface water levels and flows • Changes in groundwater levels and flows • Changes to coastal water movement	Changes to water levels and flows due to increased water abstraction, reduced storage or reduced flow releases from reservoirs to river systems. Potential for changes to habitat availability, for example reductions in wetted width of rivers leading to desiccation of macrophyte beds. *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.*
Toxic contamination: • Water pollution • Soil contamination • Air Pollution	Reduced dilution in downstream or receiving waterbodies due to changes in abstraction or reduced compensation flow releases to river systems. *These effects are only likely to be significant where the boundary of the 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.* Air emissions associated with plant and vehicular traffic during construction and operation of options. *The effect of dust is only likely to be significant where site is within or in close proximity to the 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.* *Effects of road traffic emissions from the transport route to be taken by the project traffic are only likely to be significant where the protected site falls within 200 metres of the edge of a road affected[28].*
Non-toxic contamination: • Nutrient enrichment (e.g., of soils and water) • Algal blooms • Changes in salinity	Changes to water salinity, nutrient levels, turbidity, thermal regime due to increased water abstraction, discharges, storage, or reduced compensation flow releases to river systems. *These effects are only likely to be significant where the boundary of the option extends within the same ground or surface water*

[25] Institute of Lighting Professionals (2020) Guidance Notes for the Reduction of Obtrusive Light GN01/20.
[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

Broad categories of potential impacts on European Sites, with examples	Examples of activities responsible for impacts *(example distance considerations in italics)*
• Changes in thermal regime • Changes in turbidity • Changes in sedimentation/silting	*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.*
Biological disturbance: • Direct mortality • Changes to habitat availability • Out-competition by non-native species • Selective extraction of species • Introduction of disease • Rapid population fluctuations • Natural succession	Killing or injury due to construction activity. *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).* Creation of new pathway for spread of non-native invasive species. *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.*

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).

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.

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 draft 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 emerging Severn Trent's draft 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' 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 HRAs[29] suggests it may be acceptable to include preferred programme options with residual uncertainties provided that:

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

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.

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

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'[30] 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-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)[31]. This approach is intended to ensure unnecessary duplication is avoided, and pragmatism will be applied to address indirect, downstream effects and effects on functional habitat.

[30] 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.

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

3. SEVERN TRENT WATER'S DRAFT WRMP24

3.1 INTRODUCTION

This section provides an overview of the water resources management planning process, the Severn Trent's supply system and draft 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 will continue as the WRMP24 continues to be developed. The draft WRMP24 will be published for formal public consultation in autumn 2022.

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 21,000km^2 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 3.2** present the WRZs and their characteristics, showing the zones vary widely in scale.

Figure 3.1 Severn Trent's Water Resource Zones

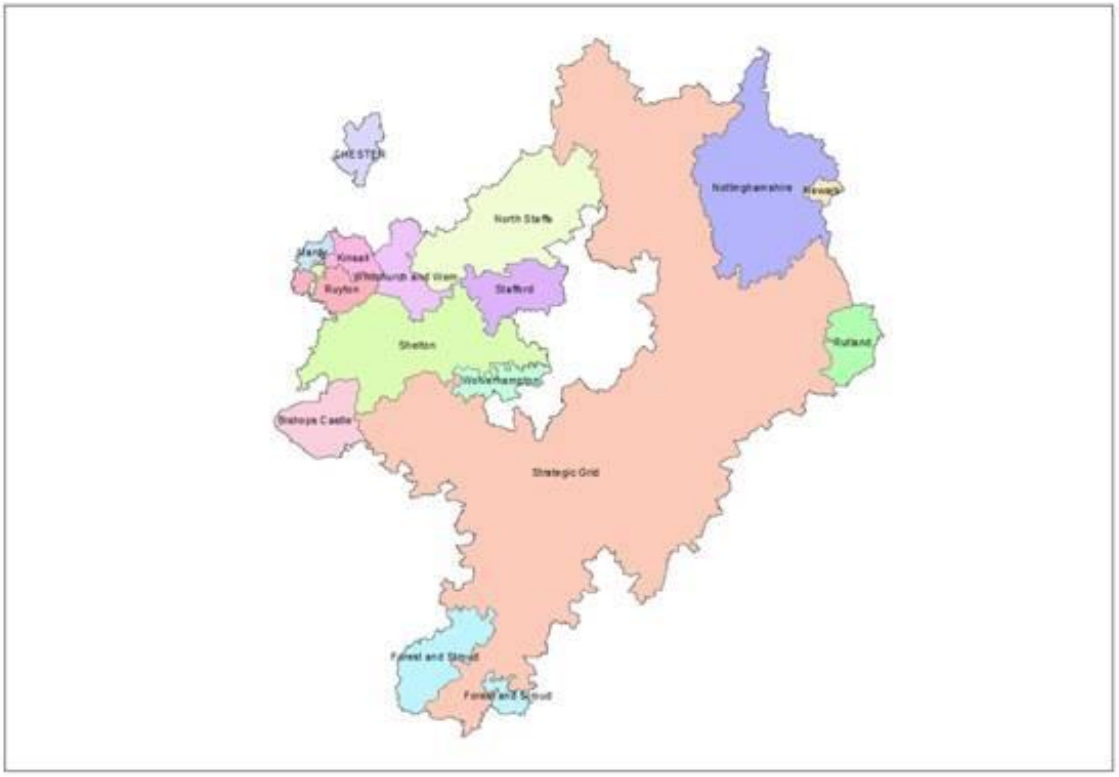


Table 3.1 Data characteristics for 2021-22 of Severn Trent's 15 Water Resource Zones

WRZ Name	WRMP24 1 in 500 Deployable Output (Ml/d)	Total Properties (000's)	Total Population (000's)	Leakage (Ml/d)	Distribution Input (Ml/d)
Bishops Castle	4.11	2.89	5.86	1.31	2.58
Chester	28.5	44.95	105.69	2.64	22.59
Forest & Stroud	38.82	57.76	132.97	18.31	43.58
Kinsall	5.00	5.62	12.25	1.84	4.40
Mardy	3.5	3.26	7.38	1.37	3.00
Newark	14.57	21.47	48.74	2.81	11.93
North Staffordshire	140.27	230.20	532.51	27.91	124.49
Nottinghamshire	256.32	452.94	1087.9	50.23	242.64
Rutland	0.00	12.42	27.23	4.23	9.75
Ruyton	5.32	5.12	12.35	3.00	5.54
Shelton	138	204.54	497.18	24.97	111.57
Stafford	25.8	41.98	95.52	5.65	20.38
Strategic Grid	1377.40	2172.80	5616.04	277.80	1264.08
Whitchurch & Wem	12.73	13.07	29.30	2.58	8.77
Wolverhampton	65.95	101.21	254.96	20.26	65.76

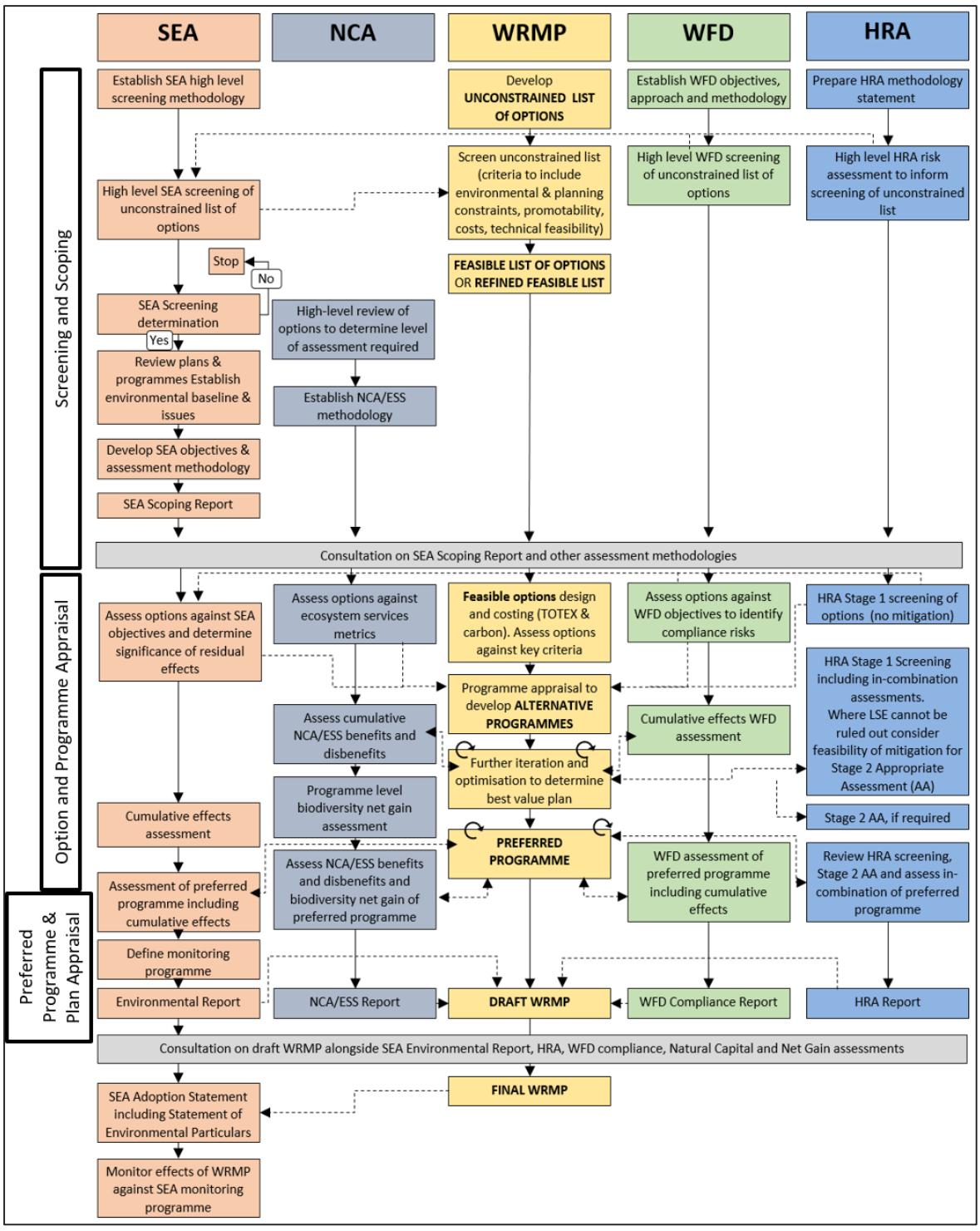
The data presented shows that the 15 zones vary widely in scale, from the Strategic Grid zone which supplies the majority of our customers, to the small zones of Mardy and Bishops Castle, which supply much smaller populated areas. These zones have very different water resources challenges, with some 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 draft 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**Error! Reference source not found. below, summarises the overall approach to the evolution of the draft WRMP24: from the initial "unconstrained" list of options through to the consideration of alternative programmes and the development of the draft WRMP24.

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



A total of 81 supply side options were assessed as part of the feasible options list alongside a collection of demand management measures. The demand management options requiring assessment as part of the feasible list of options are shown in **Table 3.2**Error! Reference source not found. and the supply side options are shown in **Table 3.3** Feasible options: supply side options**.**

Table 3.2 Feasible options: demand management options

Option ID	Option name	Description
176	WE004 - Social housing HWECs - Option 1_15000 audits	This option is to complete home audits for social housing customers. This is working with social housing providers to fit suitable water efficiency products for them and offering water saving advice. The scheme can be delivered to customers through external company providing this service or inhouse teams. The scheme is based on an average delivery cost including products and based on an average property water saving.
	WE004 - Social housing HWECs - Option 2_20000 audits	
177	WE005 - Infrastructure charges discount scheme	The infrastructure charges scheme gives a discount on connection charges for developers showing they have worked to a 110 litre per person per day water use rather than the higher 125l/p/d building regs standard. This is done through fitting of water efficiency fixtures and fittings to the building.
181	WE009 - WHOLESALE non household water efficiency	Provision of water efficiency products and advice to non-household customers. This includes fitting products such as showerheads, retro fitting toilets and urinals with more water efficient options. Also checking for leaks and repairing on internal fittings. We will also advise where we find or suspect leaks on supply pipes but will not repair these free of charge. This assessment assumes no construction at this stage, rather the installation of internal fixtures and fittings.
	WE009 - RETAIL non household water efficiency	

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)
32	Water treatment works capacity increase	Little Eaton Expansion (supported by Carsington Reservoir)
33Z	Water treatment works capacity increase	Shelton WTW Expansion
38	Water reuse	Minworth effluent re-use (Large scheme)
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

WRMP24 Ref.	Option Category	Option Name
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
79A	Internal potable transfer	Wolves-Bham Strategic Link Main (large)
79B	Internal potable transfer	Wolves-Bham Strategic Link Main (small)
84A	Reservoir enlargement	Stanford Minor Dam Extension (84A)
84B	Reservoir enlargement	Lower Shustoke Minor Dam Extension (84B)
84C	Reservoir enlargement	Whitacre Minor Dam Extension (84C)
88	New surface water	River Weaver to Tittesworth WTW
95B	Water treatment works capacity increase	Ogston WTW Expansion
101	External potable bulk supply/transfer	Kinsall Additional Resource (UU import)
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
112	Internal potable transfer	Croxton GW to Hob Hill DSR
117	External potable bulk supply/transfer	Peckforton Bulk Import from UU
120	Trunk mains renewal/new	River Severn to Draycote
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)
132	Internal potable transfer	Whaddon to Forest Transfer
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
150	New surface water	Little Haywood new WTW on Upper Trent
152	New surface water	Hampton Loade to Sedgley SR

WRMP24 Ref.	Option Category	Option Name
169	External raw water bulk supply/transfer	Terminate raw water export to Yorkshire Water
187A	Reservoir enlargement	Expand Carsington Reservoir (10000 Ml)
187B	Reservoir enlargement	Expand Carsington Reservoir (16000 Ml)
187C	Reservoir enlargement	Expand Carsington Reservoir (25000 Ml)
190	New surface water	Third party reservoir purchase and new WTW's
191	Groundwater enhancement	Increase Diddlebury/Munslow GW sources and remove network constraints.
301A	External potable bulk supply/transfer	UU import from Llanforda to Shelton (small)
301B	External potable bulk supply/transfer	UU import from Llanforda to Shelton (large)
303A	External raw water bulk supply/transfer	UU release from Vyrnwy (75 Ml/d)
303B	External raw water bulk supply/transfer	UU release from Vyrnwy (40 Ml/d)
303C	External raw water bulk supply/transfer	UU release from Vyrnwy (25 Ml/d)
304	Internal potable transfer	Ambergate to Mid-Notts transfer
305	Internal potable transfer	Heathy Lea to North Notts transfer
309	Internal potable transfer	Transfer from Hampton Loade WTW to Nurton DSR (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)
406	New surface water	New abstraction and WTW on River Trent
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
431	Water treatment works capacity increase	Shelton WTW DO Recovery
434	Water treatment works capacity increase	Trimpley WTW DO Recovery
435	Water treatment works capacity increase	Whitacre WTW DO Recovery

WRMP24 Ref.	Option Category	Option Name
437	Reservoir enlargement	Finham FE to expanded Draycote Reservoir and WTW
439	Reservoir enlargement	Longdon Marsh and increase Frankley output by 190 Ml/d
523	External potable bulk supply/transfer	UU Mow Cop BH Treated water import
528	New groundwater	New GW Source Soar - PT Sandstone nr Coalville
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)
552	External potable bulk supply/transfer	UU Bearstone treated water Import
556	Trunk mains renewal/new	ASL Capacity Increase - Hallgates to Oldbury
557	Trunk mains renewal/new	ASL Capacity Increase - Oldbury to Meriden

4. HRA STAGE 1 SCREENING

4.1 POTENTIAL LIKELY SIGNIFICANT EFFECTS OF DWRMP24 FEASIBLE OPTIONS

The approach to HRA screening is described above in Section 2 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 draft WRMP24 is provided in Section 4.1.1 and for potential water supply options in Section 4.1.2. 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.

4.1.1 Demand management options

The demand side options are summarised in Error! Reference source not found., 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 development[32]).

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.

4.1.2 Supply-side options

The initial 'risk review' of the supply-side[33] options, to assist Severn Trent's selection of the feasible and preferred programme 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 4.1**. .

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

[33] 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

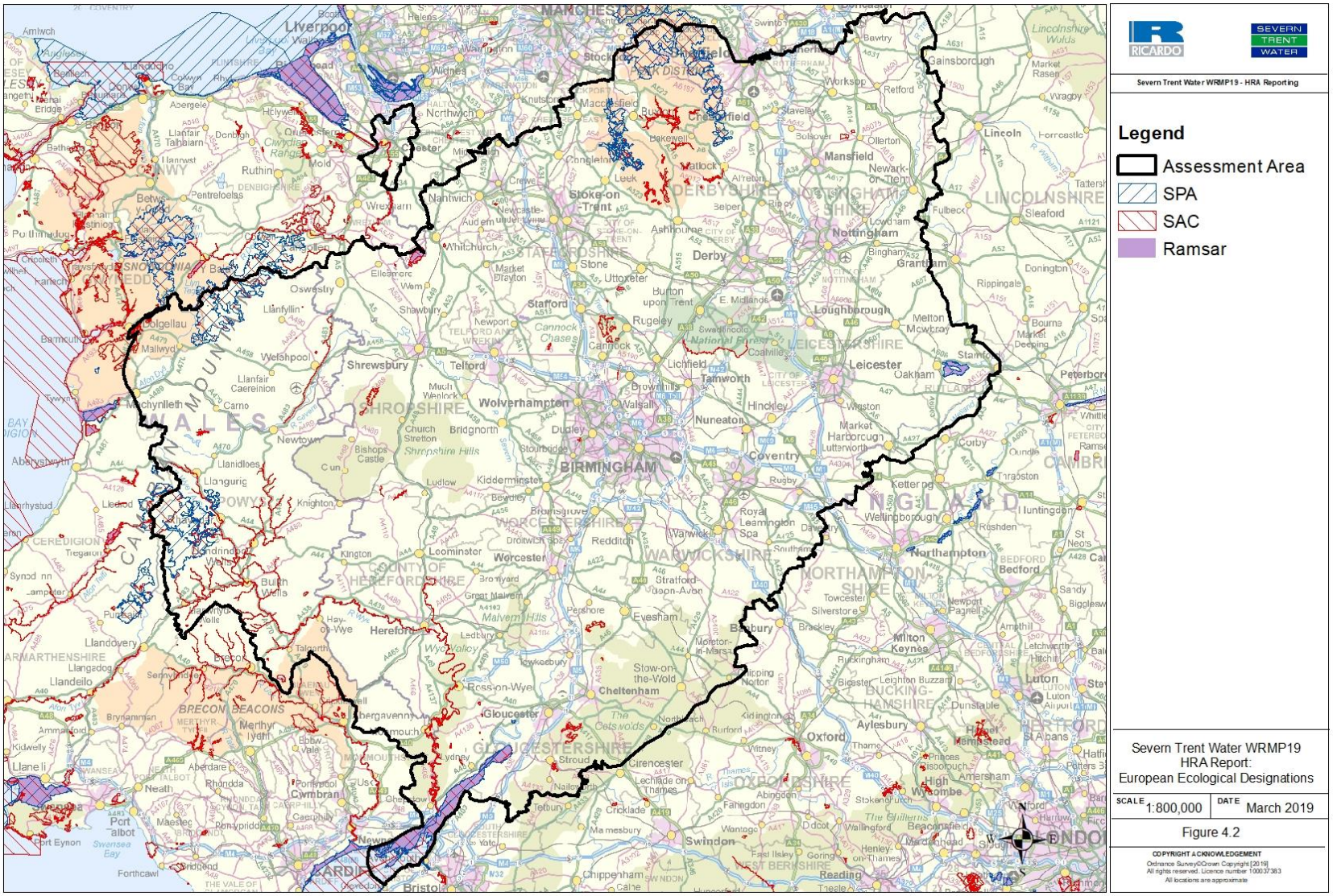


Table 4.1 High-level screening summary of feasible options for impacts on European sites

Option ID	Option Name	High level screening outcome
5	Derwent Valley Transfer Main	LSEs identified during construction and operation.
6	Derwent Valley Storage Increase	LSEs identified with potential habitat loss within SAC and SPA.
22	Elmhurst BH Recommissioning (Potable)	No LSEs anticipated during construction or operation.
29	Homesford Conjunctive Use	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)
32	Little Eaton Conjunctive Use	LSEs identified as potential operational impacts to functionally linked habitat (watercourse)
33	Shelton WTW Expansion	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 river WTW nr. 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 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	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.
79A	Wolves-Birmingham Strategic Link Main Include Frankley main to Central Area (Goldthorne DSR). Cross Wolverhampton strategic transfer solution (20 Ml/d)	LSEs identified during construction as potential for site-derived pollutants to impact waterbodies.
79B	Wolves-Birmingham Strategic Link Main Include Frankley main to Central Area (Goldthorne DSR). Cross Wolverhampton strategic transfer solution (10 Ml/d)	
84A	Minor Dam Extensions (Stanford Reservoir)	No LSEs anticipated during construction or operation.
84B	Minor Dam Extensions (Lower Shustoke Reservoir)	
84C	Minor Dam Extensions (Whitacre Reservoir)	
88	River Weaver to Tittesworth WTW	No LSEs anticipated during construction or operation.
95	Ogston WTW Output Increase	LSEs identified as potential operational impacts to functionally linked habitat (watercourse)
101	Kinsall additional resource	No LSEs anticipated during construction or operation.

Option ID	Option Name	High level screening outcome
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	LSEs identified during construction as potential for site-derived pollutants to impact waterbodies.
110	Wolverhampton-Staffs Link	No LSEs anticipated during construction or operation.
111	Melbourne to Staffs Link	LSEs identified during construction as the pipeline will extend in close proximity and within potentially supporting offsite functional habitat.
112A	Croxton BH to Hob Hill DSR	LSEs identified during construction and operation due to proximity to water dependent European site and uncertainty over hydrological catchment supporting it.
117	Peckforton Bulk Import	No LSEs anticipated during construction or operation.
120	Middle Severn to Draycote (120A)	LSEs identified during construction and operation due to proximity to functionally linked habitat (watercourse) and changes to discharges and abstractions.
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	Raise water levels at Draycote Reservoir	No LSEs anticipated during construction or operation.
122B	Raise water levels at Draycote Reservoir	
122C	Raise water levels at Draycote Reservoir	
123A	Raise Dam at Tittesworth Reservoir by 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 by 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.
125	Unlock unused Carsington storage /Lower Derwent to Melbourne/ L. Eaton/ C. Wilne (125A)	LSEs identified during construction and operation due to site-derived pollutant issues and abstraction from functionally linked habitat (watercourse).
128	Carsington to Tittesworth main	LSEs identified during construction due to site derived pollutant issues and potential disturbance to bird species using offsite functionally linked habitat.
132	Whaddon to Forest Transfer	No LSEs anticipated during construction or operation.
134	Use Blackbrook reservoir to provide additional supply of raw water to Cropston WTW	No LSEs anticipated during construction or operation.
142	Use Linacre reservoirs and abstraction licence as a supply to the gird either permanently or as a temporary drought resilience option	LSEs identified during construction due to potential disturbance issues to bird species using offsite functionally linked habitat.

Option ID	Option Name	High level screening outcome
143	W.Midlands Raw Water Storage	LSEs identified during construction and operation due to proximity to functionally linked habitat (watercourse) and changes to abstractions.
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.
152	Use currently underutilised R. Severn abstraction licences. We may choose to consolidate these licence entitlements at Hampton Loade or at other existing river intakes/ WTWs on the R. Severn	LSEs identified during construction and operation due to proximity to functionally linked habitat (watercourse) and changes to abstractions.
169A	Termination of transfer to Yorkshire Water	No LSEs anticipated during construction or operation.
187A	Expand Carsington (10,000Ml)	LSEs identified during operation due to potential changes to spill regime and effects to functionally linked habitat (watercourse).
187B	Expand Carsington (16,000Ml)	
187C	Expand Carsington (25,000Ml)	
190	Third party reservoir purchase and new WTW's	LSEs identified during construction and operation as Reservoir potentially used as offsite functionally linked habitat.
191	Diddlebury BH/Munslow DSR Network Constraints	LSEs identified during operation due to changes in abstraction and impacts to functionally linked habitat (watercourse).
301A	UU import to Shelton - 12Ml/d (301A)	No LSEs anticipated during construction or operation.
301B	UU import to Shelton - 25Ml/d (301B)	
303A	UU release from Vyrnwy - 75Ml/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.
303B	UU release from Vyrnwy - 40Ml/d	LSEs identified during operation due to impacts of release on functionally linked habitat used by migratory fish species.
303C	UU release from Vyrnwy – 25Ml/d	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	LSEs identified during construction due to proximity of pipeline to European sites.
309&309Z	Transfer from Hampton Loade WTW (SSW) to Nurton DSR (309 = 18Ml/d)	No LSEs anticipated during construction or operation.
309Z	Transfer from Hampton Loade WTW (SSW) to Nurton DSR (309Z = 10Ml/d)	
313	DVA improvements to Heathy Lea (for 27Ml/d)	LSEs identified during construction and operation due to proximity to European sites and changes to abstractions affecting functionally linked habitat.
314	DVA Bamford to Ambergate enhancement plus Bamford expansion (60Ml/d)	LSEs identified during construction and operation due to proximity to European sites and changes to abstractions affecting functionally linked habitat.
406	New abstraction and WTW on River Trent	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.

Option ID	Option Name	High level screening outcome
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.
431	Shelton WTW DO Recovery	LSEs identified during operation due to abstraction impacts to functionally linked habitat.
434	Trimpley WTW DO Recovery	No LSEs anticipated during construction or operation.
435	Whiteacre WTW DO Recovery	No LSEs anticipated during construction or operation.
437	Transfer from Hampton Loade WTW (SSW) to Nurton DSR (10 Ml/d)- Finham FE to Draycote -Draycote WTW Expansion	LSEs identified during construction and operation due to site-derived pollutant issues and abstraction from functionally linked habitat (watercourse).
439	Longdon Marsh Reservoir -Increase Frankley WTW by 190Ml/d	LSEs identified during construction and operation due to site-derived pollutant issues and large new abstraction from functionally linked habitat (watercourse).
523	Mow Cop BH - treated water transfer or licence trade with United Utilities	No LSEs anticipated during construction or operation.
528	New Source - Soar - PT sandstone	No LSEs anticipated during construction or operation.
549A	Raw water import from Congleton to Tittesworth (from UU)	No LSEs anticipated during construction or operation.
549B	Treated water import from Congleton to Tittesworth (from UU)	No LSEs anticipated during construction or operation.
552	UU Bearstone treated water Import	No LSEs anticipated during construction or operation.
556	Hallgates to Oldbury	LSEs identified during construction due to site-derived pollutant issues.
557	Oldbury to Meriden	No LSEs anticipated during construction or operation.

4.2 HRA STAGE 1 SCREENING CONCLUSIONS FOR PREFERRED PROGRAMME OPTIONS

Severn Trent have presented six plans all together (see Section 4.3) where the Preferred Programme and Least Cost Programme are the same.

4.2.1 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 4.1.1.

4.2.2 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 Programme, along with their first year of use, are listed below.

- 29 Homesford WTW capacity increase 2030-31
- 33Z Shelton WTW Expansion 2030-31

- 66 Strensham WTW Expansion 2030-31
- 122A Draycote Reservoir WL increase (6%) 2030-31
- 128 Carsington to Tittesworth main (large) 2030-31
- 303C UU release from Vyrnwy (25 Ml/d) 2030-31
- 305 Heathy Lea to North Notts transfer 2030-31
- 426 Little Eaton WTW DO Recovery 2030-31
- 434 Trimpley WTW DO Recovery 2030-31
- 435 Whitacre WTW DO Recovery 2030-31
- 103 Mardy Support Link 2035-36
- 169 Terminate raw water export to Yorkshire Water 2035-36
- 301B UU import from Llanforda to Shelton (large) 2040-41
- 44 New R Sow abstraction and WTW near Stafford 2045-46
- 95B Ogston WTW Expansion 2045-46
- 6 Upper Derwent Valley Reservoir Expansion (UDVRE) 2050-51
- 22 Recommission Elmhurst GW source 2050-51
- 31C E. Midlands Raw Water Storage (CQ) 2050-51
- 58 River Weaver to New WTW at Stoke 2050-51
- 64 Rehabilitation Milton GW Source 2050-51
- 79A Wolves-Bham Strategic Link Main (large) 2050-51
- 84A Stanford Minor Dam Extension (84A) 2050-51
- 84B Lower Shustoke Minor Dam Extension (84B) 2050-51
- 84C Whitacre Minor Dam Extension (84C) 2050-51
- 105 Ruyton Support Link 2050-51
- 117 Peckforton Bulk Import from UU 2050-51
- 123B Raise Dam at Tittesworth Reservoir (25%) 2050-51
- 128Z Carsington to Tittesworth main (small) 2050-51
- 143 W.Midlands Raw Water Storage 2050-51
- 190 Third party reservoir purchase and new WTW's 2050-51
- 304 Ambergate to Mid-Notts transfer 2050-51
- 309Z Transfer from Hampton Loade WTW to Nurton DSR (small) 2050-51
- 406 New abstraction and WTW on River Trent 2050-51
- 423 Draycote WTW DO Recovery 2050-51
- 523 UU Mow Cop BH Treated water import 2050-51
- 528 New GW Source Soar - PT Sandstone nr Coalville 2050-51
- 552 UU Bearstone treated water Import 2050-51

- 557 ASL Capacity Increase - Oldbury to Meriden 2050-51
- 134A Blackbrook reservoir to Cropston WTW 2057-58
- 420 Campion Hills WTW DO Recovery 2059-60
- 31D E. Midlands Raw Water Storage (CHQ) 2060-61
- 101 Kinsall Additional Resource (UU import) 2062-63
- 187C Expand Carsington Reservoir (25000 Ml) 2067-68

4.2.2.1 Plan period 2025-2049

The full HRA Stage 1 Screening is provided in **Table 4.2** for those preferred plan options required before 2050.

Table 4.2 Preferred programme: supply side options screening of 'Likely Significant Effects' (LSE) 2030 - 2049

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
29	Homesford Conjunctive Use	The scheme is to increase the capacity of Homesford WTW to 54Ml/d to enable treatment of the high flows from the source which are understood to be primarily during spring/summer. Treated water is then to be deployed into the DVA via a new booster station. The scheme requires the following: - Chlorine and Phosphate dosing - Storage reservoir of 800m3 - 325kW pumping station to life water to DVA - Ultrafiltration system	Peak District Dales SAC	3.7km	**Construction:** 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. **Operation:** 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. 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. Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.	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)	**Construction:** 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). **Operation:** 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: - 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 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.	No	Yes – other WRMPs
33z	Shelton WTW Expansion	This scheme is to utilise the full existing River Severn abstraction licence at the Shelton WTW site and construct a new 10Ml/d process stream at or near Shelton WTW to treat the additional water. This new treatment stream will be connected to the existing network through integration with the existing Shelton WTW and connections to the existing network. Water will be deployed into the Shelton WRZ using the existing network.	Midlands Meres and Mosses Phase 1 Ramsar	3.3km	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).	No	No
			Severn Estuary/Môr Hafren SAC	Downstream receptor (>100km)/functional habitat	**Construction** 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. **Operation:** The proposed scheme involves an additional 10Ml/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 (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and twaite shad (*Alosa fallax*)) 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.	Yes	Yes

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
			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 (*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.	Yes	Yes
66	Strensham WTW Expansion	This scheme is to expand Strensham Water Treatment Works (WTW) by 30Ml/d and is to include the construction of a new intake at Upton-upon-Severn. This additional water will be transferred to the expanded Strensham WTW predominantly in winter when there is greater water availability in the River Severn. The following activities are required for the scheme. • New 30Ml/d river intake and pumping station on the River Severn near Upton-upon-Severn. • 5km of 800mm diameter pipeline from the River Severn Intake to Strensham WTW. • 30Ml/d expansion of Strensham WTW to treat additional water. Pumping Station at Strensham WTW.	Bredon Hill SAC	2km	There is one European designated site within 10km; Bredon Hill SAC which is designated for Violet click beetle *Limoniscus violaceus*. The closest component is located c.2km to the west of the site. Dixton 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. 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.	Yes	No
			Disxton Hill SAC	Functionally linked to Dixton Hill SAC			
			Severn Estuary/Môr Hafren SAC	Downstream receptor (>100km)/functional habitat	**Construction** 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. **Operation:** The proposed scheme involves an additional 30Ml/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 (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and twaite shad (*Alosa fallax*)) 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.	Yes	Yes
			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 (*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.	Yes	Yes
122A	Raise water levels at Draycote Reservoir (increase 6%)	"The scheme is to increase the storage capacity of Draycote Reservoir by 6% by raising the top water level (TWL) by 0.6m from 93.88m AOD to 94.48m AOD. This increase in water level will add 1,400 Ml of capacity to the current reservoir capacity of 22,730Ml. The additional raw water	Severn Estuary/Môr Hafren SAC	Downstream receptor (>100km)/functional habitat	There are no European designated sites within 10km of the scheme components, or impact pathways over a greater distance. 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	No
			Severn Estuary SPA and Ramsar	Downstream receptor (>100km)/functional habitat		No	No

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
		will be treated at Draycote WTW and deployed to the Strategic Grid WRZ. The scheme requires the following activities: - Raise the overflow weir sill by 0.6m - Raise a bridge by 0.6m to retain its existing clearance from the water."	River Clun SAC	Downstream receptor/functional habitat		No	No
128	Carsington to Tittesworth main	This scheme is to enable the transfer of raw water from the River Derwent and Carsington Reservoir to Tittesworth WTW through the provision of a new pumped raw water pipeline. The additional raw water will enable water in Tittesworth Reservoir to be conserved for dry periods thus enabling Tittesworth WTW to operate longer into dry seasons. Additional potable water will be deployed into the North Staffs WRZ. The scheme is sized for a maximum raw water transfer of 30Ml/d and a new treated water pipeline is proposed within the scheme due to anticipated network constraints. The scheme requires: - 42.6km of new 800mm dia pipeline between Carsington Reservoir and Tittesworth WTW with an associated new 30Ml/d pumping station. - New settlement lagoon near to Tittesworth Reservoir to receive raw water from Carsington Reservoir. - Connection to the inlet of Tittesworth WTW. - New pumping station - 14.8km of new 700mm pipeline.	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)	**Construction:** There will be no impacts to the qualifying habitat features given the distance and features not sensitive to hydrological changes, nor hydrologically connected. 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. **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.	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	**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. **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.	Yes	No
303C	UU release from Vyrnwy - 25Ml/d	This scheme is to enable managed release of an additional 25Ml/d of 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). Abstracted water will be treated at Frankley WTW and deployed to customers in the Strategic Grid WRZ via the existing network. No new assets are proposed for the release, abstraction, transfer, treatment and deployment of water. The additional raw water release will only occur when flows in the River Severn are unable to accommodate the Lickhill abstraction. This transfer is proposed to be utilised for 55 days per year. This scheme assumes 10% transmission losses, enabling 22.5Ml/d of additional raw water at Frankley WTW.	Berwyn and South Clywd Mountains/Berwyn a Mynyddoedd De Clwyd SAC	Adjacent to Lake Vyrnwy	**Construction:** 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. **Operation:** It is assumed that UU have the water available to allow the transfer, and have completed their own HRA. Berwyn and South Clywd Mountains SAC 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.	No	No
			Berwyn SPA	Adjacent to Lake Vyrnwy	**Construction:** 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. **Operation:** It is assumed that UU have the water available to allow the transfer, and have completed their own HRA. 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 SPA.	No	No

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
			Tanat and Vyrnwy Bat Sites / Safleoedd Ystlumod Tanat ac Efyrnwy SAC	0.6km to River Vyrnwy	**Construction:** 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. **Operation:** 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.	No	No
			Montgomery Canal SAC	0.1km to River Vyrnwy	**Construction:** 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. **Operation:** 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.	No	No
			Severn Estuary/Severn Estuary/Môr Hafren SAC	Downstream receptor (c.28km)/functional habitat	**Construction:** 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. **Operation:** 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 (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and twaite shad (*Alosa fallax*)) 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).	No	Yes
			Severn Estuary SPA and Ramsar	Downstream receptor (c.28km)/functional habitat	**Construction:** 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. **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.	No	Yes - Ramsar
			River Clun SAC	Functional link (salmon)	**Construction:** 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. **Operation:** 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 (*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.	No	Yes
305	Heathy Lea to North Notts transfer	This scheme is to transfer water from the Strategic Grid WRZ to Nottinghamshire WRZ, enabled by a surplus of supply in the Strategic Grid WRZ that is either currently present or will be created by other schemes. The transfer will be enabled by making a new connection from the Derwent Valley Aqueduct (DVA) in the Strategic Grid WRZ to the distributions system in Nottinghamshire WRZ (sized at a maximum transfer of 25Ml/d). The scheme requires the following:	Peak District Dales SAC	4.2km/ hydrological connectivity	**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. **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.	Yes	No

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
		- 36.9km of new 700mm dia pipeline. - A new 633kW pumping station.	South Pennine Moors SAC	<0.1km	**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. 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:** 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.	Yes	No
			Peak District Moor (South Pennine Moors Phase 1) SPA	<0.1km	**Construction:** As above for South Pennine Moors SAC. **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.	Yes	No
426	Little Eaton WTW DO Recovery	This scheme is to increase Little Eaton WTW treatment capacity to enable the site to sustainably operate at 88Ml/d output. The current maximum capacity is estimated at 78Ml/d. The scheme requires: - Two new GAC adsorbers to give total GAC throughput of 98Ml/d - One Lamella clarifier (same size as the ones currently installed). Total throughput of 97Ml/d - Rapid gravity filters. Total throughput capacity of 95Ml/d - WRc thickeners sufficiently sized for increased flow	Peak District Dales SAC	Upstream receptor (c.17.6km)/functional habitat	**Construction:** 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. **Operation:** The scheme upgrades to increase deployable output are unlikely to require additional abstraction beyond existing licenced volumes, however an increase (from c.78Ml/d to 88Ml/d, within the existing average daily licence of 90Ml/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.	No	Yes
			Humber Estuary SAC, SPA and Rams	Downstream receptor (c.96km)	**Construction:** 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). **Operation:** 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: - 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 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.	No	Yes – other WRMPs
434	Trimpley WTW DO Recovery	This scheme is to increase Trimpley WTW treatment capacity to enable the site to sustainably operate at 60Ml/d output. The current maximum sustainable capacity is estimated at 52Ml/d. The scheme requires: - Rapid Gravity Filters (RGFs) (Install 2 x RGF the same size as already installed to increase RGF throughput capacity to 78.6Ml/d) - Replacement of current interstage pumps (Replace four interstage pumps to increase the capacity to 75.9Ml/d) - Granular Activated Carbon (GAC) adsorbers (2 x new adsorbers to increase capacity to 79.5Ml/d) - Washwater tank (540m^3)	There are no European designated sites within 10km of the scheme components, or impact pathways over a greater distance. 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.				
			Severn Estuary/Môr Hafren SAC	Downstream receptor (c.90km)/functional habitat	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.	No	No
			Severn Estuary SPA and Ramsar	Downstream receptor (c.90km)/functional habitat		No	No

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
435	Whiteacre WTW DO Recovery	This scheme is to increase Whitacre WTW treatment capacity to enable the site to sustainably operate at 49Ml/d output. The current maximum sustainable capacity is estimated at 41Ml/d. The scheme requires: - Granular activated carbon adsorbers (4nr GAC adsorbers to give a total capacity of 50.4Ml/d) - Low lift pumps at Whitacre reservoir (2 x new low lift pumps to replace existing pumps at Whitacre reservoir) - Replacement of existing interstage pumps (like for like pump replacement for delivering 27.9Ml/d) - Additional 2 x new pumps at River Blythe PS - Additional capacity of Eel screen	There are no European designated sites within 10km of the scheme components, or impact pathways over a greater distance. 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.				
			River Mease SAC	Downstream receptor (c.30km)/functional habitat	The confluence of the River Mease SAC with the River Trent is approximately 30km downstream of Whiteacre 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 .	No	No
			Humber Estuary SAC, SPA and Ramsar	Downstream receptor (>100km)	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. 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.	No	No
103	Mardy Support Link	The scheme is to enable Mardy WRZ to be supported by a transfer of water from Shelton WRZ, enabled by a surplus of supply in Shelton WRZ that is either currently present or will be created by other schemes. This is achieved through operating the existing pipeline (~5km of 250mm dia) linking the WRZs 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. The scheme does not produce any net additional water. The scheme requires the installation of a new 6kW pumping station to enable this transfer.	Montgomery Canal SAC	9.4km	The site is considered to be at sufficient distance such that construction impacts will not occur (based on standard thresholds e.g. noise), with no hydrological connectivity.	No	No
			Midlands Meres and Mosses Phase 2 Ramsar	6km	The site is considered to be at sufficient distance such that construction impacts will not occur (based on standard thresholds e.g. noise), with no hydrological connectivity.	No	No
			River Dee and Bala Lake SAC	6.7km	There is no hydrological connectivity for downstream impacts to the River Dee and Bala Lake SAC.	No	No
169	Termination of transfer to Yorkshire Water	This scheme is to completely terminate the Derwent Valley Reservoirs export agreement with Yorkshire Water Service Limited (YWSL). This will provide STWL with an anticipated additional 21,550Ml/yr (59Ml/d) raw water in the Derwent Reservoirs. This additional water will be stored and utilised during dry periods. This will enable STWL to keep operating Bamford WTW at higher capacity during dry seasons. No capital works are required by STWL for this scheme, although there will be an operational change associated with abstracting and treating additional raw water.	Peak District Dales SAC	10.7km/functionally linked habitat	**Construction:** 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. **Operation:** 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.	No	No
			South Pennine Moors SAC	0.06km (adjacent)	**Construction:** The component does not require construction works. **Operation:** 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).	No	No
			Peak District Moors SPA (South Pennine Moors Phase 1)	0.06km (adjacent)	**Construction:** The component does not require construction works. **Operation:** 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).	No	No
			Humber Estuary SAC, SPA and Ramsar	Downstream receptor (>200km)	**Construction:** The component does not require construction works. **Operation:** 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.	No	No
301B		This scheme is to import 25Ml/d from United Utilities' Llanforda WTW using the existing	Montgomery Canal SAC	8.6km	**Construction:**	No	No

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
	UU import to Shelton - 25Ml/d (301B)	Llanforda booster pumping station to serve customers in and around Oswestry in the Shelton WRZ. It is expected the import will fully replace the existing sources of supply to Oswestry enabling this supply to be utilised elsewhere in the WRZ. The scheme requires the following: - New agreement to be established with UU for this import. It is assumed that water will be available. - Pumping station upgrade at the Llanforda booster pumping station to deliver 12Ml/d towards Oswestry. - The connection between the Llanforda booster pumping station and STWL network is to be investigated to establish the requirements of potential upgrades. - Hydraulic modelling to confirm the operational requirements regarding deployment of imported water towards Pant DSR.	Midlands Meres and Mosses Phase 2 Ramsar	5.8km	It is assumed that only minor network interventions are required to receive the bulk supply, and that these will be carried out in the site, with minimal construction works required. All designated sites 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). As such, no LSEs are anticipated. **Operation:** It is assumed that UU have the water available to allow the transfer, and have completed their own HRA. This component involves the transfer of treated water into the network via new pipeline connections. There are no proposed changes to abstraction within Severn Trent's water resource zones, and therefore no LSEs are anticipated.	No	No
			River Dee and Bala Lake SAC	7.5km		No	No
			Tanat and Vyrnwy Bat Sites SAC	11km		No	No
			Midlands Meres and Mosses Phase 1 Ramsar	3.3km		No	No
			Severn Estuary/Môr Hafren SAC	Downstream receptor (>100km)/functional habitat		No	No
			Severn Estuary SPA and Ramsar	Downstream receptor (>100km)/functional habitat		No	No
44	New river WTW nr. Stafford	This scheme will provide benefit to Stafford WRZ which is currently supplied exclusively by groundwater sources. The notional scheme is to construct a new abstraction point on the River Sow near Little Haywood with an adjacent WTW and transfer of treated water. The scheme requires the following: - 25Ml/d raw water intake and pumping station on the River Sow - 25Ml/d new water treatment works - 14.9km (total) of new 700mm diameter pipelines. - A new 515kW pumping station to transfer the potable water	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 functional 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	The site is considered to be at sufficient distance such that construction impacts will not occur (based on standard thresholds e.g. noise), with no hydrological connectivity.	No	No
			Midlands Meres and Mosses Ramsar - Phase 2	9.9km	The site is considered to be at sufficient distance such that construction impacts will not occur (based on standard thresholds e.g. noise), with no hydrological connectivity.	No	No
			River Mease SAC	Downstream receptor (c.21km)/functional habitat (River Trent)	**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 it 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. **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 uncertainty over the operational regime and how this may affect fish species, and the extent of functionally linked habitat to be affected.	Yes	Yes
			Humber Estuary SAC, SPA and Ramsar	Downstream receptor (>100km)	**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.	No	Yes – other WRMPs

Option No.	Name	Description	European site	Approximate distance from option	Screening Summary	LSE (construction)?	LSE (operation?)
					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.		
95B	Ogston WTW Output Increase	This scheme is to expand Ogston WTW and make better use of raw water in the River Derwent sources. Ogston WTW is supplied with raw water from Ogston Reservoir that in turn receives both natural inflow and a pumped supply from the River Derwent (or transfer from Carsington Reservoir). The additional output from Ogston WTW can be used to support customers in the Strategic Grid WRZ and incorporate an element of operational flexibility with the large number of groundwater sources to the east of Mansfield (in Nottinghamshire WRZ). To enable the additional transfer, treatment and deployment of water from Ogston WTW, it is anticipated that the following will be required: - Modify raw water pumps at the Ambergate River Derwent intake to achieve a reliable 130Ml/d peak winter transfer to Ogston Reservoir and 110Ml/d from Carsington Reservoir direct to Ogston in the summer periods (Carsington licence may need to be modified). - Upgrade the existing New Ogston WTW to achieve 55Ml/d - Build a third 40 Ml/d WTW process stream at Ogston WTW, giving a total output of 120Ml/d (including 25 Ml/d from Old works and 55 Ml/d from New works with software modifications). It should be possible to deploy up to 30 Ml/d peak. - If required, clean mains to enable flows to be reversed in winter. - Install any pipelines/boosters required to transfer an additional 40 Ml/d summer output from Ogston WTW to the Derwent Valley Aqueduct (DVA).	Bee's Nest and Green Clay Pits SAC	9.8km	**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. **Operation:** No pathways for impact nor is the site hydrologically connected and/or qualifying features sensitive to changes in volumes of water.	No	No
			Gang Mine SAC	5.8km	**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. **Operation:** No pathways for impact nor is the site hydrologically connected and/or qualifying features sensitive to changes in volumes of water.	No	No
			Peak District Dales SAC	6.1km and functional habitat (River Derwent)	**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. **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.	No	Yes
			South Pennine Moors SAC	9.6km	**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. **Operation:** No pathways for impact nor is the site hydrologically connected and/or qualifying features sensitive to changes in volumes of water.	No	No
			Peak District Moors (South Pennine Moors Phase 1) SPA	9.6km	**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. **Operation:** There is no pathway for impact to the SPA through changes in the River Derwent. As such, no LSEs are anticipated.	No	No

4.2.2.2 Plan period 2050/51 and beyond

The initial screening review of the preferred programme options from 2050 onwards is provided in **Table 4.3** for the 9 options where LSE has been identified. The maximum lead in time for a number of the larger option is 15 years, and therefore there are several WRMP cycles through which the assessments can be refined. In addition, one of the options (Option 6) is part of the Regulatory Alliance for Progressing Infrastructure Development (RAPID) process, and therefore further assessment work and consultation on this option will be forthcoming as the Strategic Resource Option is developed under this process.

Following further review, the initial screening remained valid, with no LSEs identified for the following options:

- 22 Recommission Elmhurst GW source
- 31C E. Midlands Raw Water Storage (CQ)
- 58 River Weaver to New WTW at Stoke
- 84A Stanford Minor Dam Extension (84A)
- 84B Lower Shustoke Minor Dam Extension (84B)
- 84C Whitacre Minor Dam Extension (84C)
- 105 Ruyton Support Link
- 117 Peckforton Bulk Import from UU
- 304 Ambergate to Mid-Notts transfer
- 309Z Transfer from Hampton Loade WTW to Nurton DSR (small)
- 406 New abstraction and WTW on River Trent
- 423 Draycote WTW DO Recovery
- 523 UU Mow Cop BH Treated water import
- 528 New GW Source Soar - PT Sandstone nr Coalville
- 552 UU Bearstone treated water Import
- 134A Blackbrook reservoir to Cropston WTW
- 420 Campion Hills WTW DO Recovery
- 101 Kinsall Additional Resource (UU import)
- 557 ASL Capacity Increase - Oldbury to Meriden

Table 4.3 Initial review of 'Likely Significant Effects' (LSE): plan period 2050/51 and beyond

Option No.	Name	Description	Screening Summary	LSE (construction)?	LSE (operation?)
6	Derwent Valley Storage Increase	The concept of this scheme is to increase the storage at Howden Reservoir in the Derwent Valley Reservoirs complex by increasing the height of the existing Howden Dam. This will enable storage of more raw water in the Derwent Reservoirs, and enable a higher output from Bamford WTW to be maintained for longer into dry seasons. For the purpose of the WRMP scheme a 10m raising has been selected. The proposed construction methodology assumed for the raising is the use of post tensioned anchors to add a structure onto the crest of the existing dam.	Construction impacts as a result of raising the dam wall may result in habitat loss within **South Pennine Moors SAC** and **Peak District Moors (South Pennine Moors Phase 1) SPA** in addition to functionally linked habitat within the **Peak District Dales SAC**. 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. Permanent changes to the hydrogeology and groundwater feeds could be caused when increasing the existing dam walls and flooding an area closer to the **South Pennine Moors SAC** and **Peak District Moors (South Pennine Moors Phase 1) SPA** boundary. It is uncertain how these changes would affect the qualifying features.	Yes	Yes
64	Rehabilitation Milton GW Source	The scheme concept is to recommission the STWL Milton groundwater source and use the raw water to support Melbourne Water Treatment Works (WTW) and supply the Strategic Grid WRZ. The scheme requires rehabilitation of Milton source (re-drill groundwater sourcesif necessary) and abandon the Stanton by Bridge groundwater source. A new pipeline (2.1 km length) will be required to connect the Milton site to existing pipeline infrastructure that connects with Melbourne WTW. A new pumping station will be required to lift raw water from Milton through the new pipeline and into the existing mains to Melbourne WTW.	The component requires recommission of Milton groundwater source and new pipeline to connect Milton BPS and Melbourne STW, and abandoning Stanton by Bridge. No construction works within the River Trent located 1.1km from Milton BPS would be required. The **River Mease SAC** is located 11km from the component and despite being designated for mobile species (otter *Lutra lutra*), the option is not considered to have a major negative effect upon the **River Mease SAC**. 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	No - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)	Yes
79A	Wolves-Bham Strategic Link Main (large)	This scheme is to connect Frankley WTW in the Strategic Grid WRZ to Tettenhall Pumping Station in the Wolverhampton WRZ via Goldthorne Hill DSR. To enable this transfer, both existing and new assets will be utilised and some modification and recommissioning will be carried out of existing assets. This scheme is sized for a maximum 20Ml/d transfer. The scheme will require: • Internal cleaning of existing 600mm mains. • New tee onto the existing network for connection of a new pipeline and new Pressure Reducing Valve (PRV). • 18.9km of new 750mm • Recommission Cell 1 at an existing DSR • 7.7km of new 750mm pipeline • Pipework and pump control modifications to allow bi-directional flow at Tettenhall Pumping Station	The pipeline route is located c.4.1km to the north west of **Fens 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. 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.	Yes	No - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
123B	Raise Dam at Tittesworth Reservoir by 25%	This scheme is to increase the storage capacity of Tittesworth Reservoir by 25%. The capacity increase will enable additional water in Tittesworth Reservoir to be conserved for dry periods thus enabling Tittesworth WTW to operate at higher capacity longer into dry seasons. The additional raw water will be treated at Tittesworth WTW and deployed to the North Staffs WRZ. This scheme will raise the top water level (TWL) by 2.3m from 196.90m AOD to 199.2m AOD. This increase in water level will add 1,610 Ml of storage to the current reservoir (6,400Ml). The scheme requires the following: • Demolishing the existing wave wall and constructing a new wall. • Raise existing embankment by 2.3m. • Increase bellmouth weir crest level. • Modify the draw-off tower with extension of pipework, reconstruction of control house and provision of additional valves. • Install an internal lining to strengthen the draw-off culvert. • Provide a longer access bridge from the raised crest levels. • Placement of rip rap along the toe of the road embankment near to the expanded reservoir.	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**. 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 WFD has concluded a 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.	Yes	Yes

Option No.	Name	Description	Screening Summary	LSE (construction)?	LSE (operation?)
128Z	Carsington to Tittesworth main (small)	This scheme is to enable the transfer of raw water from the River Derwent and Carsington Reservoir to Tittesworth WTW through the provision of a new pumped raw water pipeline. The additional raw water will enable water in Tittesworth Reservoir to be conserved for dry periods thus enabling Tittesworth WTW to operate longer into dry seasons. Additional potable water will be deployed into the North Staffs WRZ. The scheme is sized for a maximum raw water transfer of 14Ml/d. Deployment is expected to be from Tittesworth WTW to Meir DSR via Ladderedge DSR. A new treated water pipeline from Ladderedge DSR to Meir DSR is proposed within the scheme due to anticipated network constraints. The scheme requires: • 42.6km of new 600mm dia pipeline between Carsington Reservoir and Tittesworth WTW with an associated new 14Ml/d pumping station. • New settlement lagoon near to Tittesworth Reservoir to receive raw water from Carsington Reservoir. • - Connection to the inlet of Tittesworth WTW.	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. 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. 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). 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.	Yes	No - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
143	W.Midlands Raw Water Storage	This scheme is to convert an existing third-party owned quarry site to a pumped raw water storage reservoir. To achieve a water resource benefit, the scheme will enable raw water abstraction of 100 Ml/d at times of high flow in the River Severn that can be stored until such times as there are low flows when a return release of up to 50Ml/d can be made to the River Severn. In turn this will be used to support existing abstractions downstream at Trimpley or Lickhill, near Kidderminster, where water can be transferred for treatment at Frankley Water Treatment Works (WTW). This option includes the construction of a dam around part of the quarry structure. Initial estimates of working volume provided by this option will be approximately 4,900Ml subject to the ground levels once mineral extraction ceases. The scheme comprises the following functional components: • A new abstraction site on the River Severn with associated structure. • New bi-directional pipeline and associated pumping station. • Discharge mechanism into the quarry. • Quarry conversion and dam, with emergency drawdown provision as required. • Abstraction from the quarry and connection into the bidirectional pipeline • Discharge into the River Severn • Abstraction from the River Severn for treatment and subsequent distribution of potable supply to customers.	A new abstraction would be required on the River Severn which is hydrologically connected to the **Severn Estuary/Môr Hafren SAC and Severn Estuary SPA and Ramsar** and likely to provide functionally linked habitat for the migratory fish species. 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 (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and twaite shad (*Alosa fallax*)) 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.	Yes	Yes
187C	Expand Carsington Reservoir (25000 Ml)	This option involves enlargement of the existing Carsington Reservoir to provide an additional: 187C: 24,500 Ml. This will require raising the reservoir full supply level by approximately 7.9 m.	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). 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).	No - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)	Uncertain LSE and therefore have been screened in.
190	Third Party Reservoir and new WTW's	This scheme is to agree purchase of an existing reservoir located to the north-west of Corby. The reservoir would provide raw water to a new 18Ml/d WTW constructed close to the reservoir. Treated water will be deployed to the existing trunk main system and also towards customers in Market Harborough via two new pipelines. The scheme requires: • Engagement with existing owners and subsequent purchase of reservoir • A new intake structure at the reservoir and new 226kW raw water pumping station. • A new 18Ml/d WTW located near the reservoir with pipeline connection to the new intake. • 7km of new 600mm dia pipeline • A new 570kW pumping station • 13.4km of new 450mm dia pipeline	Based on the proximity of the reservoir to **Rutland Water SPA and Ramsar** (2.9km), it is considered to potentially provide offsite functionally linked habitat. 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, during construction works. Operation of the reservoir is not considered to change. The current level of abstraction is 7Ml/d, whilst the licenced abstraction is 36Ml/d from the River Welland. The ultimate downstream receptor of is The Wash and North Norfolk Coast European Marine Site. There is no attribute or target within the Regulation 33 package for freshwater input to support any of the qualifying features. Given this, and the distance downstream (c.62km) no LSEs on The Wash are anticipated.	Yes	No – no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

Option No.	Name	Description	Screening Summary	LSE (construction)?	LSE (operation?)
		• A new 137kW pumping station to transfer water from the new WTW to customers in Beanfield and Market Harborough • Reline 3km of existing pipeline • Clean 4km of existing pipeline.			
31D	E. Midlands Raw Water Storage (CHQ)	This scheme will provide provision of additional raw water storage in the Strategic Grid WRZ by converting an existing quarry into a raw water storage reservoir. This new reservoir will be supplied with raw water abstracted from the River Trent near Weston-on-Trent. Raw water in the reservoir will be abstracted and treated at new WTW adjacent to the site and deployed to the Strategic Grid WRZ. The scheme requires the following: • Conversion of the quarry to enable storage of raw water • 50Ml/d raw water intake and pumping station on the River Trent • 19km of 1050mm raw water pipeline from the new intake to the quarry • New 50Ml/d WTW at the quarry • 726kW pumping solution (potentially floating pontoon pumps) to lift water out of the quarry and transfer to the new WTW. • Connecting pipework between the quarry abstraction pumps and WTW. • 10.2km of 1050mm pipeline from WTW • 686kW pumping station to transfer potable water	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. 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.	No - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)	Yes

•

4.3 HRA STAGE 1 SCREENING CONCLUSIONS FOR ALTERNATIVE PROGRAMMES

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

- Least Cost Programme (same options as Preferred Programme)
- Ofwat Core Programme
- Environmental Stretch
- Climate Adjustment
- Gated Success

These comprise a mixture of the preferred programme options, as well as several additional options from the feasible list as follows:

- 112 Croxton GW to Hob Hill DSR 2045-46
- 187B Expand Carsington (16,000Ml) 2074-75
- 303A UU release from Vyrnwy 75Ml/d 2050-51
- 429 Mythe WTW DO recovery 2056-57
- 556 Hallgates to Oldbury 2051-52

The initial screening review of these alternatives is provided in **Table 4.4**.

Table 4.4 Initial review of 'Likely Significant Effects' (LSE): Alternative programmes additional options

Option No.	Name	Description	Screening Summary	LSE (construction)?	LSE (operation?)
112	Croxton GW to Hob Hill	This scheme is to refurbish the existing Croxton groundwater sources (GWS) in North Staffs WRZ and transfer 3Ml/d of potable water to Stafford WRZ via a new pipeline and pumping station. The scheme requires the following: • Re-drilling Croxton groundwater sources • Treatment of raw water from Croxton groundwater sources within the existing GWS and WTW site. • 10.4kW (3Ml/d) pumping station • 7.8km of new 300mm diameter pipeline	It is unclear what the hydrological catchment area of the **Midland Meres and Mosses Phase 2 Ramsar** 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. The scheme proposes the redrilling of the Croxton groundwater sources. Given the proximity of the groundwater sources to the **Midland Meres and Mosses Phase 2 Ramsar** (Cop Mere SSSI), and the reliance of this habitat on groundwater levels, LSEs cannot be ruled out.	Yes	Yes
187B	Expand Carsington Reservoir (16000 Ml)	This option involves enlargement of the existing Carsington Reservoir to provide an additional: 187B: 16,900 Ml. This will require raising the reservoir full supply level by approximately 5.7 m.	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). The expansion of the reservoir 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).	No - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)	Uncertain LSE and therefore have been screened in.
303A	UU release from Vyrnwy (75 Ml/d)	This scheme is to enable managed release of an additional 75Ml/d of 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). Abstracted water will be treated at Frankley WTW and deployed to customers in the Strategic Grid WRZ via the existing network. No new assets are proposed for the release, abstraction, transfer, treatment and deployment of water. The additional raw water release will only occur when flows in the River Severn are unable to accommodate the Lickhill abstraction. This transfer is proposed to be utilised for 55 days per year. This scheme assumes 10% transmission losses, enabling 68Ml/d of additional raw water at Frankley WTW.	There are no physical works required as part of this component as it utilises the existing river channels to transfer the raw water. 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. There is 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. 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.	No - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)	Yes
429	Mythe WTW DO Recovery	This scheme is to increase Mythe WTW treatment capacity to enable the site to sustainably operate at 125Ml/d output (which includes a sweetening flow from Strensham of ~5Ml/d). The current maximum sustainable capacity is estimated at 104Ml/d which is less than the abstraction licence of 136Ml/d (of which 120 Ml/d is for public water supply). The scheme requires: • UV disinfection plant (Currently there are 2 Nr. D/D reactor. This is additional reactor to bring the treatable flow up to 140Ml/d) • Actiflo Clarifiers (3 x new clarifiers with total capacity of 22.5Ml/d) • Renewal of booster pumps (Increase capacity up to 48Ml/d)	There are no European designated sites within 10km of the scheme components. The Severn Estuary EMS is the ultimate downstream receptor. It is unlikely that construction works would be required outside the WTW site, with the additional capacity to be achieved through upgrades to various process streams. 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. Changes in the volume of water and flow into the Severn Estuary could also impact salmon movement to the **River Clun SAC**	No - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)	Yes
556	ASL Capacity Increase - Hallgates to Oldbury	This scheme is to increase the capacity in the STWL Strategic Grid potable supply network downstream of Melbourne WTW. The scheme will provide capacity of up to 65Ml/d enabling potable supply surplus in the eastern grid to be transferred to the southern parts of the Strategic Grid. The scheme will serve to increase the capacity of the existing trunk mains. The scheme requires the following: • 32.3km of new 1000mm dia pipeline from Melbourne WTW • A new 1,409kW pumping station at Melbourne WTW • A new break pressure tank • A new 764kW booster station	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. The option will not require additional abstraction and therefore operational activities are not considered to have a significant impact upon the SACs.	Yes	No - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

4.4 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 and Dixton Wood SAC
- Midlands Meres and Mosses Phase 2 Ramsar
- Peak District Dales SAC
- River Clun SAC
- Rutland Water SPA and Ramsar
- South Pennine Moors SAC
- Cannock Chase SAC
- Pasturefields Salt Marsh SAC
- Peak District Moors (South Pennine Moors Phase 1) SPA
- River Mease SAC
- Severn Estuary SAC and Ramsar

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	Yes – alone (construction)
Cannock Chase SAC	44: New river WTW nr. Stafford	Yes – alone (construction)
Dixton Wood SAC	66: Strensham WTW Expansion	Yes – alone (construction)
Fen Pool SAC	79: Wolves-Bham Strategic Link Main (large)	Yes – alone (construction)
Humber Estuary SAC and Ramsar[34]	29: Homesford Conjunctive Use	In-combination with other water company WRMPs
	426: Little Eaton WTW DO Recovery	In-combination with other water company WRMPs
	64: Rehabilitation Milton groundwater source	In-combination with other water company WRMPs
Midland Meres and Mosses Phase 2 Ramsar	112A: Croxton GW to Hob Hill DSR	Yes – alone (construction and operation)
Pasturefields Salt Marsh SAC	44: New river WTW nr. Stafford	Yes – alone (construction)
Peak District Dales SAC	6: Derwent Valley Storage Increase	Yes – alone and IC (construction and operation)
	29: Homesford Conjunctive Use	Yes – alone and IC (construction and operation)
	95: Ogston WTW Output Increase	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)
	187B: Expand Carsington Reservoir (16000 Ml) (alt.)	Uncertain – alone and IC (operation)
	187C: Expand Carsington Reservoir (25000 Ml)	Uncertain – alone and IC (operation)
	305: Heathy Lea to North Notts transfer	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	6: Derwent Valley Storage Increase	Yes – likely to have adverse effects
	123B: Raise Dam at Tittesworth Reservoir by 25%	Yes – alone and IC (construction)

[34] 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?
	128: Carsington to Tittesworth main (large)	Yes – alone and IC (construction)
	128Z: Carsington to Tittesworth main (small)	Yes – alone and IC (construction)
	305: Heathy Lea to North Notts transfer	Yes – alone and IC (construction)
River Clun SAC	33Z: Shelton WTW Expansion	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)
	303A: UU release from Vyrnwy (75 Ml/d) (alt.)	Yes – alone and IC (operation)
	303C: UU release from Vyrnwy (25 Ml/d)	Yes – alone and IC (operation)
	429: Mythe WTW DO Recovery (alt.)	Yes – alone and IC (operation)
River Mease SAC	31D: E.Midlands Raw Water Storage (31D)	Yes – alone and IC (operation)
	44: New river WTW nr. Stafford	Yes – alone and IC (operation)
	64: Rehabilitation Milton groundwater source	Yes – alone and IC (operation)
	556: ASL Capacity Increase - Hallgates to Oldbury (alt.)	Yes – alone and IC (operation)
Rutland Water SPA and Ramsar	190: Third party reservoir purchase and new WTW's	Yes – alone (construction)
Severn Estuary/Môr Hafren SAC and Ramsar[35]	33Z: Shelton WTW Expansion	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)
	303A: UU release from Vyrnwy (75 Ml/d) (alt.)	Yes – alone and IC (operation)
	303C: UU release from Vyrnwy (25 Ml/d)	Yes – alone and IC (operation)
	429: Mythe WTW DO Recovery (alt.)	Yes – alone and IC (operation)
South Pennine Moors SAC	6: Derwent Valley Storage Increase	Yes – likely to have adverse effects
	305: Heathy Lea to North Notts transfer	Yes – alone (construction)

*IC – 'In combination'

[35] 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

5.1.1 Preferred Programme period 2025-2049

The following options have been screened in as potentially impacting the Peak District Dales SAC within the statutory 25-year planning period:

- 29 Homesford WTW capacity increase: **construction and operation**
- 95 Ogston WTW Output Increase: **operation only**
- 128 Carsington to Tittesworth main (large): **construction only**
- 305 Heathy Lea to North Notts transfer: **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***

5.1.2 Preferred Programme period 2050/51+ and alternatives

Those options beyond the 25 year period and/or are within the alternative programmes which could also give rise to effects are as follows:

- 6 Derwent Valley Storage Increase: **construction and operation**
- 123B Raise Dam at Tittesworth Reservoir by 25%: **construction and operation**
- 187B Expand Carsington (16,000Ml) (alternative): **operation (uncertain)**
- 187C Expand Carsington (25,000Ml): **operation (uncertain)**

These have not been subject to a Stage 2 Appropriate Assessment as there is sufficient time to complete assessments of the options within the next cycles of the WRMP process, allowing the latest baseline and condition status to be included, and development of hydrological models for those watercourses currently under-studied (e.g. River Derwent).

Option 6 is subject to the RAPID Gated process, and as such, the adverse effects from this scheme are currently being considered separately, and will inform subsequent iterations of the Severn Trent WRMP when available.

Best practice construction methods and standard mitigation measures are considered to be available for **Option 123B**, to avoid adverse effects.

Further development of the design and engineering specification is required on **Options 187B** and **187C** to determine whether an increase in abstraction from the River Derwent is needed; hence the Stage 1 Screening currently recording uncertainty.

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 Dale[36].

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 crustacean[37]. 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 England[38]. Populations are known within South Wales, Suffolk, East Midlands, Dorset, Somerset, Gloucestershire, Exmoor and the North York Moors[39].

WCC can live for more than 10 years[40]. Breeding occurs in the autumn and early winter when the water temperature drops below 10ºC 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 months[94]. 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 6.5-9.0[94].

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

[36] 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.

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

[38] 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.

[39] Buglife. (2015). *Crayfish Identification, Distribution and Legislation.* Environment Agency.

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

be barriers for signal crayfish *Pacifastacus leniusculus* as this species can walk over land and are less vulnerable to desiccation[91].

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 bullhead. Water depth is not critical to this species, but high temperatures and/or low dissolved oxygen are likely to be fatal in shallow waters[41]. 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,

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

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 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 species[42]. 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 depth[43]), are very slow (records: 0.07 m s-1 to 0.4 m s-1[44,45]), 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 km[46]) upstream into suitable spawning grounds, however, complete life-cycle requirements of the species is often found in quite short stretches of river[47]. 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-1[48](note: assumed to be surface velocities), to a more probable 0.3 m s-1 – 0.5 m s-1[49], while depth is less than 0.4 m. During breeding season (March – June, when water temperatures reach 10 – 11 ºC), 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 streams[50]. Upland streams typically support lower densities of bullhead. Habitat requirements differ according to life-stage. Coarse substrates with large stones are essential for breeding[51] (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 eggs[52]. Shallow, stony riffles are used by young-of-the-

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

[43] Entec (2000). Generically acceptable flows for British lamprey. Environment Agency, Penrith.

[44] 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.

[45] Schroll F (1959). Zur Ernahrungsbiologie der steirischen Ammocoten Lampetra planeri (Bloch) und Eudontomyzon danfordi (Regan). Int. Rev. ges. Hydrobiol. Hydrogr. 44, 395–429.

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

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

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

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

[50] 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.

[51] 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.

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

year fish[53], whereas adults show preference for sheltered regions[54]. 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-1[55] and many preferring velocities greater than 0.6 m s -1[56]. 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 densities[57].

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.

[53] Punchard 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.

[54] Perrow MR, Punchard 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.

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

[56] Roussel 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.

[57] 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.

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	*Option 29* 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. Due to the WTW being downstream of the SAC, it is unlikely that pollution incidents will impact the designation. 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. 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. 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. 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 or pollution incidents.	▪ 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
		Option 128 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. Due to the proposed pipeline crossing being downstream of the SAC, it is unlikely that pollution incidents will impact the designation. 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. 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 lamprey[58], and bullhead[59] 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.	▪ 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.	
		Option 305 Construction of Option 305 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. 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.	▪ 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	

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

[59] 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?
		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 associated with the Peak District Dales SAC. The presence of weirs will limit the ability of lamprey[60], and bullhead[61] 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. 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. 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. 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. 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.	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.	
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	*In-combination: Options 29, 128 and 305* All three options area required for 2030/31 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 three options increase the potential for spread of INNS within the catchment. The extent over which the impacts can occur simultaneously is therefore considered to be greater with all three 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.	▪ 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	*Option 29* Homesford Water Treatment Works (WTW) near Matlock, 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 45Ml/d and it deploys water into the DVA and customers in the adjacent Chadwick Nick Control Group. The site is licenced to abstract 55Ml/d average and 65Ml/d peak, with a condition that abstraction is restricted to 45Ml/d when the Derwent flows at Derby are less than 340Ml/d. This scheme would increase the capacity of Homesford WRW to 54Ml/d, enabling 9Ml/d more of the inflow from Meerbrook Sough to the River Derwent to be captured. The 28117 - Derwent at Whatstandwell flow gauge, located 1.5km downstream of the Meerbrook Sough confluence, indicates that the Q95 flows are 384Ml/d. If an additional 9Ml/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.	None required	No adverse effects on conservation objectives or site integrity
		Option 95 Ogston Water Treatment Works (WTW) is located to north of Alfreton, Derbyshire and to the south-east of Ogston Reservoir. The treatment works is sited adjacent to this 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 ~69Ml/d which would be increased to 120Ml/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 51Ml/d from the River Derwent is used for this assessment	None required.	No adverse effects on conservation objectives or site integrity

[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?
		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 629Ml/d. If an additional 51Ml/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.		
		Option 426 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. Little Eaton WTW currently operated at a sustainable output of 78Ml/d which would increase to 88Ml/d following the implementation of this option. As such, there would be an increase abstraction, and therefore decrease in flows, up to a maximum of 10Ml/d. 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: • 28117 - Derwent at Whatstandwell • 28055 - Ecclesbourne at Duffield • 28048 - Amber at Wingfield Park Based on this, Q95 flows for the abstraction point would be 417Ml/d and Q70 flows would be 693Ml/s. A 10 Ml/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.	None required.	No adverse effects on conservation objectives or site integrity
		In-combination: Options 29, 95 and 426 Each of option (Option 29, Option 95B and Option 429) involves the increase in capacity of a WTW that is sourced from the River Derwent (or, in the case of Option 29, a tributary to the River Derwent). Option 29, the most upstream option, would increase the capacity of Homesford WRW to 54Ml/d, enabling 9Ml/d more of the inflow from Meerbrook Sough to the River Derwent to be captured. The current capacity of Ogston WTW is ~69Ml/d which would be increased to 120Ml/d under the implantation of Option 95B. 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. Option 426 would increase the capacity of Little Eaton WTW allowing for additional water to be abstracted from the River Derwent. Little Eaton WTW currently operates at a sustainable output of 78Ml/d which would increase to 88Ml/d following the implementation of this option. As such, there would be an increase abstraction, and therefore decrease in flows, up to a maximum of 10Ml/d. The River Derwent between the Ambergate and Little Eaton intake would be impacted by Option 29, Option 95B and Option 426. Based on the assessments presented above, there would be a total reduction in flow downstream of the Little Eaton intake by 70Ml/d as a result of the three options being operated cumulatively. 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: • 28117 - Derwent at Whatstandwell • 28055 - Ecclesbourne at Duffield • 28048 - Amber at Wingfield Park Based on this, Q95 flows for the abstraction point would be 417Ml/d and Q70 flows would be 693Ml/d. The Little Eaton intake is also restricted by the hand-off flow condition at St. Mary's Bridge, Derby so Q95 flows would be protected. A 70 Ml/d reduction would account for a 10% reduction in Q70 flows, with this impact only on moderate-low flows. This hydrological change is minor and unlikely to introduce any pathways to impacting the aquatic environment in the River Derwent. Further assessment is required to understand the impacts of Option 95B acting in-combination with Option 29 and Option 426. It is worth noting that there is uncertainty around this assessment, predominantly driven by the complexity of the operation of Option 95B. Option 95B would not be implemented until later in the programme (implemented in 2045-46), than Option 29 and Option 426 (implemented in 2030-31). Option 95B can therefore be refined further in future WRMPs to determine, with more confidence, the hydrological impact. Cumulatively, Option 29 and Option 426 would only result in a 2.7% reduction in Q70 flows downstream of the Little Eaton WTW intake which would be negligible and would not impact the aquatic ecology in the River Derwent.	None required for Option 29 and Option 426. Hydrological modelling should be undertaken to fully assess the impacts of Option 95B when in-combination with Options 29 and 426, whereby refinement of the operating pattern may be required. Baseline surveys of the reach to be impacted, should also be undertaken to determine potential for offsite functionally linked habitat.	No adverse effects on conservation objectives or site integrity

6. STAGE 2 APPROPRIATE ASSESSMENT: SOUTH PENNINE MOORS SAC

6.1 INTRODUCTION

6.1.1 Preferred Programme period 2025-2049

The following options have been screened in as potentially impacting the South Pennine Moors SAC within the statutory 25-year planning period:

- 305 Heathy Lea to North Notts transfer: **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

6.1.2 Preferred Programme period 2050/51+ and alternatives

Those options beyond the 25 year period which could also give rise to effects are as follows:

- 6 Derwent Valley Storage Increase: **construction**

This option has not been subject to a Stage 2 Appropriate Assessment as **Option 6** is progressing through the RAPID Gated process, and as such, the adverse effects from this scheme are currently being considered separately, and will inform subsequent iterations of the Severn Trent WRMP when available. The Stage 1 Screening has highlighted significant concerns around this option's potential encroachment on habitats within the boundary of the European site from the new top water level and repositioned infrastructure.

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 cottongrass *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 conservation objectives and 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	*Offsite habitat degradation* 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. 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. An Arboricultural Implications Assessment will be required to ensure root protection zones are not compromised by the pipeline construction. *Water quality – pollution incidents, runoff* 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. *Contamination - dust and NOx* 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[62],[63]. 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. 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 loading[64]. 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 *Quercus* 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. *Biological Disturbance – Invasive non-native species* The works have the potential to spread invasive non-native species given the close proximity of the works	*Offsite habitat loss and degradation* • 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). *Water quality* • 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). *Contamination – dust and NOx* • 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 *INNS* • Best practice biosecurity measures, as recommended by	No adverse effects on conservation objectives or site integrity

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

[63] Technical Statement TS/AQ1, Association of British Ports (ABP), 2000

[64] 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 conservation objectives and site integrity
			to the SAC and watercourse crossings required. Works, particularly in aquatic habitats should follow best practice biosecurity measures as standard.	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. *General* • 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.	
H4030 European dry heaths H4010 Northern Atlantic wet heaths with *Erica tetralix*; Wet heathland with cross-leaved heath H7130 Blanket bogs H7140 Transition mires and quaking bogs	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	Around 2km from the western start of the pipeline (located immediately east of the village of Robin Hood) 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. 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. 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. The hydrogeology of the area around the pipeline consists entirely of the Millstone Grit Group and Pennie 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. 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	Best practice construction methods to avoid preferential flow of water along pipeline.	No adverse effects on conservation objectives or site integrity

Qualifying features	Attribute	Target	Potential Effects	Mitigation	Effect on conservation objectives and site integrity
			construction and operation of the pipeline.		

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

7.1 INTRODUCTION

7.1.1 Preferred Programme period 2025-249

The following options have been screened in as potentially impacting the Peak District Moors (South Pennine Moors Phase 1) SPA within the statutory 25-year planning period:

- 128 Carsington to Tittesworth main: **construction only**
- 305 Heathy Lea to North Notts transfer: **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.

7.1.2 Preferred Programme period 2050/51+ and alternatives

Those options beyond the 25 year period which could also give rise to effects are as follows:

- 6 Derwent Valley Storage Increase: **construction**
- 123B Raise Dam at Tittesworth Reservoir by 25%: **construction**
- 128Z Carsington to Tittesworth main (small): **construction**

These have not been subject to a Stage 2 Appropriate Assessment given they are significantly in the future such that the baseline, and condition, is likely to have changed.

These have not been subject to a Stage 2 Appropriate Assessment as there is sufficient time to complete assessments of the options within the next cycle of the WRMP process, allowing the latest baseline and condition status to be included. Best practice construction methods and standard mitigation measures are considered to be available to avoid adverse construction effects for **Options 123B and 128Z**. The potential for habitat around Tittesworth Reservoir to provide offsite functionally linked habitat for the qualifying bird species will need further consideration and potentially bespoke mitigation.

The Stage 1 Screening for **Option 6** has highlighted significant concerns around this option's potential encroachment on habitats within the boundary of the European site from the new top water level and repositioned infrastructure. **However,** this option is progressing through the RAPID Gated process, and as such, the adverse effects from this scheme are currently being considered separately, and will inform subsequent iterations of the Severn Trent WRMP when available.

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)[65]. 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.

[65] Breeding Birds Survey Project | Moors for the Future

Survey results suggest a decline in breeding pairs from 28 in 2004/05, to 20 in 2010 and 18 in 2014[66]. 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)[67]. 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 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 site[68], 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.

[66] Breeding Birds Survey Project | Moors for the Future

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

[68] Natural England (2014) Site Improvement Plan South Pennine Moors.

- 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 128

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

7.3.2 Option 305

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 Penning Moors Phase 1) SPA

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on conservation objectives and site integrity
CONSTRUCTION PHASE					
A098 *Falco columbarius;* Merlin (Breeding) A140 *Pluvialis apricaria*; European golden plover (Breeding) A222 *Asio flammeus*; Short-eared owl (Breeding)	Supporting habitat (both within and outside the SPA): disturbance - Minimising disturbance caused by human activity	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.	*Noise and visual disturbance* 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. 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 literature[69]. There is no evidence available regarding dispersion distances/flight responses to noise. 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 receptor[70]. 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 presence[71]. There is no evidence available regarding dispersion distances/flight responses to noise. 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. 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. *Contamination – dust and NOx loading* 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. Guidance provided by the Institute of Air Quality Management[72] 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,	*Noise and visual disturbance* • 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. *Contamination – dust and NOx* • 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. *General* • 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

[69] 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.
[70] 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.
[71] 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.
[72] Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction. IAQM, London

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on conservation objectives and site integrity
			and 25m with mitigation[73]. 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. 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.		

[73] Technical Statement TS/AQ1, Association of British Ports (ABP), 2000.

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

8.1 INTRODUCTION

8.1.1 Preferred Programme period 2025-249

The following options have been screened in as potentially impacting the Severn Estuary/Môr Hafren SAC and Severn Estuary Ramsar within the statutory 25-year planning period:

- 33 Shelton WTW Expansion: **construction and operation**
- 66 Strensham WTW Expansion: **construction and operation**
- 303C UU release from Vyrnwy - 25Ml/d: **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 maritimae)*
- S1095 Sea lamprey, *Petromyzon marinus*
- S1099 River lamprey, *Lampetra fluviatilis*
- S1103 Twaite shad, *Alosa fallax*

8.1.2 Preferred Programme period 2051/51+ and alternatives

Those options beyond the 25 year period and/or are within the alternative programmes which could also give rise to effects are as follows:

- 143 W.Midlands Raw Water Storage: **construction and operation**
- 303A UU release from Vyrnwy - 75Ml/d (alternative): **operation**
- 429 Mythe WTW DO Recovery (alternative): **operation**

These have not been subject to a Stage 2 Appropriate Assessment as there is sufficient time to complete assessments of the options within the next cycle of the WRMP process, allowing the latest baseline and condition status to be included, and development of hydrological models for those watercourses that will be impacted by changes/new abstractions.

A significant modelling exercise will be required to understand the impacts of all the new, or altered, abstractions on the River Severn both alone and in-combination, such that adverse effects to the migratory fish populations are avoided and pass-forward freshwater flows to the estuary is maintained. A model has been developed for the Severn Thames Transfer (STT) SRO, however this has yet to be made available and adapted for use by Severn Trent for the WRMP process. In addition, the Severn Regulation Releases and existing Hands off flows will also need to be considered with engagement from the Environment Agency and Natural England.

8.2 SITE SUMMARY

8.2.1 Site description[74]

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.

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

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 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 channelisation[75].

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' lifecycle[54].

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 has 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.

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.

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

- 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.

8.3 ASSESSMENT OF EFFECTS

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 8.1**.

8.3.1 Construction

The 303C UU Vyrnwy release requires no construction works. It is unclear whether Option 33Z will require any works to the existing intake at Shelton WTW to facilitate the additional abstraction, or if a new intake will be required. A new intake is required for the Strensham WTW Expansion. 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 a 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.

8.3.2 Operation

8.3.2.1 Option 33Z

Option 33Z would lead to the expansion of Shelton WTW by 12Ml/d. 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.

8.3.2.2 Option 66

Option 66 would lead to the expansion of Strensham WTW by 30Ml/d. 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.

8.3.2.3 Option 303C

The HRA Screening concluded that implementation of 303C Vyrnwy Reservoir regulation releases has the potential to result in likely significant effects on the Severn Estuary SAC and Ramsar Site.

The following qualifying features of the Severn Estuary SAC and Ramsar site were screened in for further assessment through Appropriate Assessment:

- **Sea lamprey:** increase in water flow could cause disturbance and/or displacement of ammocoetes present in nursery habitats in the River Vyrnwy, increase energy expenditure required to successfully migrate to spawn upstream during severe drought conditions and alter the structure and function of suitable spawning habitats.
- **River lamprey:** increase in water flow could cause disturbance and/or displacement of ammocoetes present in nursery habitats in the River Vyrnwy, increase energy expenditure required to successfully

migrate to spawn upstream during very dry weather, drought conditions and severe drought conditions, and alter the structure and function of suitable spawning habitats.

- **Twaite shad:** increase in water flow could increase energy expenditure required to successfully migrate to spawn upstream during very dry weather, drought conditions and severe drought conditions, and alter the structure and function of suitable spawning habitats.
- **Allis shad:** increase in water flow could increase energy expenditure required to successfully migrate to spawn upstream during severe drought conditions and alter the structure and function of suitable spawning habitats. Migration upstream occurs from April – June typically[76].
- **Atlantic salmon:** increase in water flow could alter the structure and function of suitable spawning habitats. Migration upstream occurs from November – December typically[77].
- **Sea trout:** increase in water flow could increase energy expenditure required to successfully migrate to spawn upstream during dry weather periods, drought conditions and severe drought conditions, and alter the structure and function of suitable spawning habitats. Migration upstream occurs from September – December typically[77].

There will be no impacts to the qualifying habitat features (with the exception of estuaries and the migratory fish populations sub-feature) as there will be no change in volume of water downstream of the abstraction at Lickhill.

Information on the 303C release has been obtained from the Gate 1 and Gate 2 Severn Thames Transfer (STT) Strategic Resource Option (SRO) as the same volume of water has been assessed between Lake Vynrwy and Oswestry. Larger volumes of water have been assessed as part of the STT SRO downstream of Oswestry and Deerhurst, which provide a benchmark for the types of effects It is also worth noting that the SRO assessment uses an operational regime that is based on the demand from the Water Resources South East region which is likely to differ from that of Severn Trent's so the option assessment is not directly transferrable from the STT assessment.

8.4 UNCERTAINTIES

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.

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.

[76] Maitland, P. S and Hatton-Ellis, T. S (2003). *Ecology of the Allis and Twaite Shad*. Conserving Natura 2000 Rivers Ecology Series No. 3. English Nature, Peterborough.
[77] Miller, P. J and Loates, M. J (1997) Fish of Britain and Europe. *Harper Collins Publishers*, 1 – 288.

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 conservation objectives and site integrity
CONSTRUCTION PHASE					
H1130 Estuaries (encompassing all sub-features)	Water quality –physico-chemical parameters (Including temperature, salinity, oxygen, nutrients, pH and turbidity etc)	Physico-chemical parameters should not pose a risk to the ecology* of the habitats and species of the SAC, SPA or Ramsar Site. Levels should comply with targets established under the EA Review of Consents and the Water Framework Directive.	*Options 33Z and 66* 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. 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.	<u>*Loss of functionally linked habitat*</u> • Design intakes to minimise loss of functionally linked habitat, the presence of which will need to be identified through site specific surveys. <u>*Disturbance*</u> • 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. <u>*Water quality*</u> • 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). <u>*Impingement and entrainment*</u> • Intake to be screened and designed in accordance with best practice[78]. <u>*General*</u> • 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	– 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	*Option 33Z* This option would lead to the expansion of Shelton WTW by 12Ml/d. 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. As a precautionary approach, this option would result in a 12Ml/d reduction in flows on the River Severn downstream of the Shelton WTW intake. 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 386.2Ml/d and the Q70 is 646Ml/d. A reduction in these flows by 12 Ml/d would lead to a 3.2% reduction and 1.9% 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.	None required.	No adverse effects on conservation objectives or site integrity

[78] Environment Agency (

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on conservation objectives and site integrity
		spawning grounds or juveniles from moving downstream.	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 33Z. The Q95 flows at Haw Bridge are 1805.8Ml/d and Q70 flows are 3594.2Ml/d. A reduction of these flows by up to 12Ml/d would lead to a 0.7% reduction in Q95 flows and a 0.3% reduction in Q70 flows. These reductions would have negligible impacts on the Severn Estuary. It should be noted that the abstraction at Shelton WTW at low flows would be supported by the River Severn regulation releases so the impact at Q95, at either the abstraction point or Severn estuary, would not be realised. The licensed amount is part of the Clywedog agreement and is therefore entitled to be augmented by the Environment Agency's River Severn Regulation scheme.		
			Option 66 This scheme is to expand Strensham Water Treatment Works (WTW) by 30Ml/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 30Ml/d. 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 1342.7Ml/d and the Q70 is 2661.1Ml/d. A reduction in these flows by 30Ml/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. 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 1805.8Ml/d and Q70 flows are 3594.2Ml/d. A reduction of these flows by up to 30Ml/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. 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.	None required.	No adverse effects on conservation objectives or site integrity.
			Option 303C 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[79]. As such, water quality impacts on migration are considered negligible. Monitoring completed during trial releases for the STT SRO to inform physical losses, identified that a support release of 75Ml/d will not have a negative impact on velocity and depths (alone). Further modelling for the STT SRO Gate 2 submission has shown that the potential changes in flow via a direct release of 25Ml/d into the Vyrnwy, is not considered to be distinct from the baseline pattern or substantial in magnitude and will likely be within the inter annual variations that would be observed under reference conditions. A 25Ml/d release is therefore unlikely to impact on river lamprey migration. There also remains some uncertainty with regards to the extent of spawning habitat for lamprey species in the River Vyrnwy and the subsequent extent to which the lamprey populations in the River Vyrnwy contribute to the lamprey community of the Severn SAC. Available data suggests that the lamprey population in the River Vyrnwy are very limited when compared to the other supporting watercourses (e.g. River Wye and River Usk). The release from Vyrnwy Reservoir will be 25Ml/d, and is only a small percentage of the natural flow variation in the River Severn. In the summer, flows can exceed 8000Ml/d (e.g. in 2011), so the addition of 25Ml/d during lower flows (when the abstraction is likely to be required) is so small a change within the context of the natural flow variation of the River Severn as to be insignificant in relation to availability of conditions suitable for lamprey migration. Should support releases coincide with other regulation releases from Vyrnwy Reservoir (e.g. Severn Regulation) these could cause major negative flow effects in the 24km reach of the River Vyrnwy to the River Banwy confluence, moderate negative effects further downstream in the River Vyrnwy and effects reducing to negligible in the River Severn. At times when the support releases from the Vyrnwy reservoir coincide with regulation releases for extended periods, the risk to migration will be higher, however it is noted that upstream migration of both river and lamprey species generally occur at much higher flows than the compensation flows of the River Vyrnwy. This is particularly relevant when support releases and regulation releases exceed 175Ml/d for continuous periods. This is in consideration of a precautionary approach and assumes that the River Vyrnwy provides significant	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 form the Vyrnwy Reservoir. 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.	No adverse effects on conservation objectives or site integrity alone. Further assessment required for in-combination effects with other options WRMPs and regulation releases.

[79] Ricardo Energy & Environment (2019). Vyrnwy water quality monitoring study Interim Report – September 2019. Report on behalf of Thames Water. 26 September 2019.

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on conservation objectives and site integrity
			spawning habitat resulting in the lamprey communities of the River Vyrnwy significantly contributing to the lamprey community of the Severn SAC.		
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 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.	*Option 33Z* As above for sea and river lamprey.	None required.	No adverse effects on conservation objectives or site integrity
			Option 66 As above for sea and river lamprey.	None required.	No adverse effects on conservation objectives or site integrity.
			Option 303C Depending on the operational pattern, the operation of the Vyrnwy release could result in the following: • Increased velocity and depths at spawning sites; • Direct washout/loss of incubating eggs and damage to spawning habitats; • Increased erosion and siltation in some areas or the loss of spawning habitat; • Changes in water quality (in particular temperature and dissolved oxygen) as a result of support flows. The literature review completed by APEM[80] identified that twaite shad spawning activity on the lower main stem River Severn is well documented in the scientific literature, although the spatial extent of spawning activity appears to be quite restricted compared to historical accounts. On the River Severn, twaite shad spawning activity has been observed in the lower catchment, downstream of Upper Lode weir. It was previously believed that a lack of observed spawning activity upstream of the weir may have been attributable to the weir posing a physical barrier to upstream migration. It is unclear to what extend the twaite shad population of the lower River Severn contributes to the twaite shad population of the Severn estuary. It is, however, noted that the Unlocking the Severn scheme could result in an increase in the distribution for twaite shad. Mature adults enter the estuaries of many European rivers from April onwards and migrate some distance upstream, though the exact distance is variable. In the River Wye, some fish travel over 190 km to reach their spawning grounds at Builth Wells. Unlike salmonids, however, shads do not enter narrow streams even when these are accessible. It is, therefore, likely that twaite shad could in the future reach the River Vyrnwy. Assuming that spawning habitat is available, twaite shad could also potentially spawn in the River Vyrnwy. The operation of the releases could coincide with migration periods (within the current and future migration limits). The River Vyrnwy is expected to provide limited spawning habitat, especially in the lower reaches. Regardless, the velocity and depths changes are expected to remain within the required spawning conditions for twaite shad. It is concluded that there will be no risk to the twaite shad population as a result of the operation of the Vyrnwy release.	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 form the Vyrnwy Reservoir. 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.	No adverse effects on conservation objectives or site integrity alone. Further assessment required for in-combination effects with other options WRMPs and regulation releases.
Ramsar criterion 4: Run of migratory fish species Sea Lamprey *Petromyzon marinus* River lamprey *Lampetra fluviatilis* Twaite shad *Alosa. fallax* Allis shad *Alosa alosa* Atlantic salmon *Salmo salar* Sea trout *S. trutta* European eel *Anguilla anguilla*.	The feature will be considered to be in favourable condition when, subject to natural processes, each of the following conditions are met:	– 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; – 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; – iii. the abundance of prey species forming the principal food resources for the assemblage species within the	*Option 33Z* As above for sea and river lamprey.	None required.	No adverse effects on conservation objectives or site integrity
			Option 66 As above for sea and river lamprey.	None required.	No adverse effects on conservation objectives or site integrity.
			Option 303C The populations of three of the assemblage species (river lamprey, sea lamprey and twaite shad) are designated as features of the SAC for which separate specific objectives have been written. The populations of these species depend 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 and therefore these features can only be in favourable condition if the conservation objectives pertaining to the River Usk SAC and River Wye SAC are also met in full and there is a continued recorded presence of these species in the River Severn. The adverse effects of the Vyrnwy reservoir release on river lamprey, sea lamprey and twaite shad have been considered as qualifying features of the Severn Estuary SAC. Therefore, these three species have been excluded from further assessment of the Ramsar fish assemblage (refer to above	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 form the Vyrnwy Reservoir. The Maintained Flow and HoF needs to be reviewed to determine to what extent the compensation flow from the Vyrnwy reservoir is considered	No adverse effects on conservation objectives or site integrity alone. Further assessment required for in-combination effects with other options WRMPs and regulation releases.

[80] APEM (2020). STT Ecological Literature Review. APEM Scientific Report P00004288. Severn Thames Transfer Partnership, September 2020, v2.0 Final, 480 pp.

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on conservation objectives and site integrity
Ramsar criterion 8: fish of the whole estuarine and river system 110 species recorded		estuary, is maintained. – iv. Toxic contaminants in the water column and sediment are below levels which would pose a risk to the ecological objectives described above	sections for river lamprey, sea lamprey and twaite shad). Available baseline data indicate that within the River Vyrnwy the fish community also include Atlantic salmon and potentially sea trout. Atlantic salmon migrate upstream to spawn from November – December. Operationally there would be additional releases of 25Ml/d from Vyrnwy Reservoir for intermittent periods. These flow changes would continue along the River Severn to the re-abstraction location at Lickhill with no overall change in flows to the Severn Estuary. The increased flows downstream of the discharge during operation are not anticipated to result in adverse changes to water quality that could alter Atlantic salmon migration[81]. 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[82]. As such, water quality impacts on migration are considered negligible. There is limited information regarding the distribution of suitable spawning and juvenile salmonid habitat within the River Vyrnwy. Spawning habitat is known to be present upstream of the Banwy confluence and the low numbers of 0+ individual observed in the River Vyrnwy downstream of the confluence with the River Banwy possibly suggests that the habitats provide more of a nursery function. It is noted that this is based on very limited data (spatially and temporally). Data available for the tributaries in the reach of the River Vyrnwy from the confluence with the River Banwy to the confluence with the River Severn suggest that the River Vyrnwy provides a migratory route for some species. Historical data (pre 2005) suggest high abundances of Atlantic salmon in the lower reaches of the River Banwy. Similarly, high abundances of Atlantic salmon have also been recorded on the River Cain. Monitoring completed during trial releases for the STT SRO to inform physical losses, identified that a support release of 75Ml/d will not have a negative impact on velocity and depths. Further modelling for the STT SRO Gate 2 submission has shown that the potential changes in flow via a direct release of 25Ml/d into the Vyrnwy, is not considered to be distinct from the baseline pattern or substantial in magnitude and will likely be within the inter annual variations that would be observed under reference conditions. A 25Ml/d release is therefore unlikely to impact on migration. The review completed by APEM[83] suggest that eel populations are well documented and widespread throughout the River Severn catchment, despite the presence of partial barriers to migration. Elvers returning to mature within UK rivers between the months of February and May annually. The baseline data shows that European eel are widespread within the catchment including the main stem River Severn and tributaries. Elver migration is not directly linked to increased flow as for salmonids, however, directional cues are still taken from flow. Similar to salmonid smolt, silver eel migration is linked to periods of increased flow within the migration window. European eel are a robust species able to deal with a wide range of water temperatures and water quality. Elver are relatively weak swimming and increased velocities in the River Vyrnwy associated with the reservoir releases may affect upstream migration within the River Vyrnwy. Flow changes as a result of the 25Ml/d release is considered negligible in the River Severn and flows are not expected to impact on the migration of silver eel. Releases from the Vyrnwy Reservoir could result in a change in the suitable habitat (velocity, depth and substrate) for flow sensitive macroinvertebrate taxa in the River Vyrnwy above the confluence with the River Severn which could result in changes in the community structure. Baseline data suggest a macroinvertebrate community with a preference for fast flowing water and high sensitivity to reductions in flows. The magnitude of changes in the River Severn are expected to be within the current envelope of change and flow changes are not expected to result in changes in structure of the macroinvertebrate community. The macroinvertebrate communities present in the River Vyrnwy are associated with high flow velocities and are likely to be relatively tolerant of increases in flow velocity associated with operation of the option element. However due to the likely timing of the increased flows in summer (June – September) there is potential for reduced recruitment for river fly species due to washing out of eggs or more juvenile life stages which are more sensitive to increases in flow velocity. The increase in flows may also alter distribution of minor fish species such as minnow, juvenile salmonids which would be predated by migratory species such as eel or salmonids. Although it is unlikely to be significant change in the abundance or distribution of prey species which support the freshwater life stages of the anadromous fish species.	"abstractable" to further reduce the volume of releases from the Vyrnwy Reservoir.	
	Tidal regime and flows	– Riverine flows (Rivers Wye, Usk	*Option 33Z*	None required.	No adverse effects on

[81] Thames Water (2016), Severn Thames Transfer: Water Quality and Ecology Assessment - Phase 2: Main Project Report (issued October 2016). Report by Cascade Consulting and HR Wallingford on behalf of Thames Water.
[82] Ricardo Energy & Environment (2019). Vyrnwy water quality monitoring study Interim Report – September 2019. Report on behalf of Thames Water. 26 September 2019.
[83] APEM (2020). STT Ecological Literature Review. APEM Scientific Report P00004288. Severn Thames Transfer Partnership, September 2020, v2.0 Final, 480 pp

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on conservation objectives and site integrity
H1130 Estuaries (encompassing all sub-features)	(saline water and freshwater contributions)	and Severn) and estuarine flows must be sufficient to ensure Water Framework Directive target of Good Ecological Status (GES) is met.	This option would lead to the expansion of Shelton WTW by 12Ml/d. 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. As a precautionary approach, this option would result in a 12Ml/d reduction in flows on the River Severn downstream of the Shelton WTW intake. 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 386.2Ml/d and the Q70 is 646Ml/d. A reduction in these flows by 12 Ml/d would lead to a 3.2% reduction and 1.9% 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. 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 33Z. The Q95 flows at Haw Bridge are 1805.8Ml/d and Q70 flows are 3594.2Ml/d. A reduction of these flows by up to 12Ml/d would lead to a 0.7% reduction in Q95 flows and a 0.3% reduction in Q70 flows. These reductions would have negligible impacts on the Severn Estuary. It should be noted that the abstraction at Shelton WTW at low flows would be supported by the River Severn regulation releases so the impact at Q95, at either the abstraction point or Severn estuary, would not be realised.		conservation objectives or site integrity.
			Option 66 This scheme is to expand Strensham Water Treatment Works (WTW) by 30Ml/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 30Ml/d. 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 1342.7Ml/d and the Q70 is 2661.1Ml/d. A reduction in these flows by 30Ml/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. 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 1805.8Ml/d and Q70 flows are 3594.2Ml/d. A reduction of these flows by up to 30Ml/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. 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.	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.	*In-combination: Options 33Z, 66 and 303C* Options 33Z and 303C, when operated at the same time, would lead to a 25Ml/d input of water to the River Severn (via the River Vyrnwy) from Vyrnwy Reservoir and a ~12Ml/d reduction flows based on increased abstraction at the Shelton WTW intake. Simplistically, without accounting for flow losses of the Vyrnwy Reservoir input, this would lead to a net ~13Ml/d increase in flows downstream of the Shelton WTW intake. 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 386.2Ml/d and the Q70 is 646Ml/d. The increase in these flows would lead to a 3.4% increase in Q95 flows and a 2% increase in Q70 flows. These flow increases would be insufficient to cause any pathways to impact the aquatic ecology in the River Severn. The inputted water from Lake Vyrnwy would be re-abstracted at Severn Trent's Lickhill abstraction point, which is upstream of the proposed new intake associated with the increased capacity of Strensham WTW (Option 66). As such, there would be no cumulative impact between Option 303C and Option 66 on the River Severn. There would be a cumulative impact between Option 33Z and Option 66 downstream of the new intake on the River Severn with there being a total reduction in flow downstream of this point by ~42 Ml/d. The Severn at Saxons Lode NRFA flow gauge (54032) can be used to give a good estimation of the	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 form the Vyrnwy Reservoir. 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.	No adverse effects on conservation objectives or site integrity within Severn Trent WRMP anticipated. Further assessment required for in-combination effects with other company WRMPs and regulation releases.
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 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. −			

Qualifying Feature	Attribute	Target	Potential Effects	Mitigation	Effect on conservation objectives and site integrity
			baseline flows downstream of the proposed intake for Option 66. Based on this, the Q95 at the abstraction point 1342.7Ml/d and the Q70 is 2661.1Ml/d. A reduction in these flows by 42Ml/d would lead to a 3% and a 2% 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. 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 this cumulative impact. Based on the additional abstraction from the River Severn associated with Option 33Z and Option 66, there would be a reduction in flow by up to 42Ml/d compared to baseline conditions. The Q95 flows at Haw Bridge are 1805.8Ml/d and Q70 flows are 3594.2Ml/d. A reduction of these flows by up to 12Ml/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. It is also worth noting that the Q95 flows into the Severn Estuary are protected by the hands-off flow condition at Deerhurst so these impacts would not actually be realised.		

9. STAGE 2 APPROPRIATE ASSESSMENT: RIVER CLUN SAC

9.1 INTRODUCTION

9.1.1 Preferred Programme period 2025-2049

The following 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**
- 303C UU release from Vyrnwy - 25Ml/d: **operation**

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*

9.1.2 Preferred Programme period 2051/51+ and alternatives

Those options beyond the 25 year period and/or are within the alternative programmes which could also give rise to effects are as follows:

- 143 W.Midlands Raw Water Storage: **construction and operation**
- 303A UU release from Vyrnwy - 75Ml/d (alternative): **operation**
- 429 Mythe WTW DO Recovery (alternative): **operation**

These have not been subject to a Stage 2 Appropriate Assessment as there is sufficient time to complete assessments of the options within the next cycle of the WRMP process, allowing the latest baseline and condition status to be included, and development of hydrological models for those watercourses that will be impacted by changes/new abstractions. The potential impacts to the Atlantic salmon populations are interlinked with the work required for the Severn Estuary/Môr Hafren SAC and Ramsar as discussed in Section 8.

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.

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 during construction 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 Unite 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 Plan[84] 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.

[84] 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 conservation objectives and site integrity
CONSTRUCTION PHASE				
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	*Offsite habitat degradation* 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. 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. *Contamination - dust and NOx* 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[85],[86]. 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. 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 loading[87]. An increase in N loading is considered likely given the potential works in the road and requirement to hold traffic during construction work. 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 experienced[88]) 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. 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. *Biological Disturbance – Invasive non-native species* 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.	*Offsite habitat loss and degradation* • 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. *Contamination – dust and NOx* • 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 *Non-native invasive species* • 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. *General* • 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

[85] Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction. IAQM, London
[86] Technical Statement TS/AQ1, Association of British Ports (ABP), 2000
[87] NE Internal Guidance – Approach to Advising Competent Authorities on Road Traffic Emissions and HRAs V1.4 Final - June 2018
[88] Highways England. Design Manual for Roads and Bridges Volume 11 Section 3, Part 1 - Air Quality

Attribute	Target	Potential Effects	Mitigation	Effect on conservation objectives and 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 conservation objectives and site integrity
CONSTRUCTION PHASE				
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	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.	*Offsite habitat loss and degradation* • 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. *General* • 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

12. STAGE 2 APPROPRIATE ASSESSMENT: RIVER MEASE SAC

12.1 INTRODUCTION

12.1.1 Preferred Programme period 2025-2049

The following option has been screened in as potentially impacting the River Mease SAC within the statutory 25-year planning period:

- Option 44 New R Sow abstraction and WTW near Stafford

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 *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
- **S1149 Spined loach *Cobitis taenia***
- **S1163 Bullhead *Cottus gobio***
- **S1092 White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes***
- **S1355 Otter *Lutra lutra***

12.1.2 Preferred Programme period 2050/51+ and alternatives

Those options beyond the 25 year period and/or are within the alternative programmes which could also give rise to effects are as follows:

- Option 64 Rehabilitation Milton groundwater source: **operation**
- Option 31D E.Midlands Raw Water Storage: **operation**

These options have not been subject to a Stage 2 Appropriate Assessment as there is sufficient time to complete assessments within the next cycle of the WRMP process, allowing the latest baseline and condition status to be included.

Further development of the design and engineering specification is required on **Option 64** including confirmation of the location of the four proposed new replacement groundwater sources to allow consideration of the geology/hydrogeology and any interaction with the River Trent, and potential offsite functionally linked habitat to the River Mease SAC.

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 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 predation[89].

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 waters[90].

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.

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

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

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 crustacean[91]. 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 England[92]. Populations are known within South Wales, Suffolk, East Midlands, Dorset, Somerset, Gloucestershire, Exmoor and the North York Moors[93].

WCC can live for more than 10 years[94]. Breeding occurs in the autumn and early winter when the water temperature drops below 10ºC 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 months[94]. 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 6.5-9.0[94].

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 desiccation[91].

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 location[95].

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 habitat[96] as male have been known to have a home range encompassing up to 50km of river[97]. 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 resource[98]. 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 couches[98]. 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 year[98]. Females use a breeding site within their home range that is undisturbed, away from flooding and close to a good food supply[99]. 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 rivers[98].

---

[91] Peay, S. (2002). *Guidance on Habitat for White-clawed Crayfish and its Restoration.* English Nature and the Environment Agency.
[92] 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.
[93] Buglife. (2015). *Crayfish Identification, Distribution and Legislation.* Environment Agency.
[94] Holdich, D. (2003). *Ecology of the White-clawed Crayfish*. Conserving Natura 2000 Rivers. Ecology Series No. 1. English Nature.
[95] Jacobs (March 2012) *River Mease SSSI/SAC Restoration Plan Technical Report*. For Natural England and the Environment Agency.
[96] 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.
[97] Chanin P., 2003. *Ecology of the European Otter*. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough.
[98] Chanin P., 2003. *Ecology of the European Otter*. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough.
[99] Liles G., 2003. *Otter Breeding Sites. Conservation and Management*. Conserving Natura 2000 Rivers Conservation Techniques Series No. 5. English Nature, Peterborough.

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 UK[98].

There is no specific details 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 Harlaston 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; 2) physical modifications including over dredging, weirs or other impoundments, non-native species lack of river bank vegetation, lack of macrophtye species density and composition; and 3) over abstraction[100].

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 Plan[101]:

- 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**.

[100] Natural England's Designates Site View – River Mease SSSI. Designated Sites View (naturalengland.org.uk). Accessed on 25 August 2022.

[101] 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.	The precise scope of the construction requirements for each option (including location, timing, materials, extent, duration, etc.) cannot be precisely defined at this point. 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) 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*". 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[102,103], and therefore confines the population extent. 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. 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.	▪ 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]	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 Trent catchment and potential off-site supporting habitats. 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. 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.	▪ 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 effect on site integrity
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	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 he 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. As above regarding site-derived pollution and sediments.	▪ 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	No adverse effects on site integrity from any option

[102] 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,
[103] 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?
				the implementation of mitigation and monitoring of the water environment.	
	Population (of the feature): Population health	Restore the absence of non-native crayfish species from within the SAC and the catchment surrounding the site Restore the absence of individuals within the site infected with crayfish plague or porcelain disease Ensure human activities within or around the SAC do not pose a significant risk of plague transfer to the crayfish population	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 *Pacifastacus leniusculus* on River Trent, upstream on the River Mease[104]. 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. 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. Taking into account the proposed mitigation no adverse effects on site integrity are anticipated due to invasive species.	▪ 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	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.	▪ 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.
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.	Option 44 would involve a new abstraction of 25Ml/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 78.4Ml/d and Q75 of 135.9Ml/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. 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. The flow immediately downstream of the River Trent and River Sow increases to 207.1Ml/d and 317.4Ml/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. 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.	▪ 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

[104] NBN Atlas. https://nbnatlas.org/ Accessed September 2022.

13. STAGE 2 APPROPRIATE ASSESSMENT: MIDLANDS MERES AND MOSSES PHASE 2 RAMSAR

13.1 INTRODUCTION

13.1.1 Alternative options

Option 112A Croxton GW to Hob Hill DSR is an alternative to the preferred programme, however would potentially be required in 2045-2046 under the Ofwat Core programme.

Theoretical pathways for effects exist through:

- 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.
- Permanent change in habitats as a result of drying from increased abstraction.

The Midlands Meres and Mosses Phase 2 Ramsar is designated under **Ramsar criterion 2a** for "*supports a number of rare species of plants associated with wetlands, including the nationally scarce cowbane Cicuta virosa and elongated sedge Carex elongata. Also present are nationally scarce bryophytes Dicranum affine and Shagnum pulchrum"*.

13.2 SITE SUMMARY

There is limited information available for the Midlands Meres and Mosses Phase 2 Ramsar, with no Site Improvement Plan or SACO.

Information on the underlying Cops Meres SSSI has been reviewed, with a summary of the site description as follows[105].

The Meres & Mosses of the north west Midlands form a nationally important series of open water and peatland sites. Most have developed in natural depressions in the glacial drift left by the ice sheets which covered the Cheshire-Shropshire plain some 15,000 years ago. There are more than 60 open water bodies known as 'meres' or 'pools' and a smaller number of peatland sites or mires known as 'mosses'. They range in depth from about one metre to 27 metres and have areas varying between less than a hectare to 70 hectares. Although the majority of the meres are eutrophic (nutrient rich) the water chemistry is very variable reflecting the heterogeneous nature of the surrounding drift deposits. Associated fringing habitats such as reedswamp, fen, carr and damp pasture add to the value of the meres. The development of these habitats is associated with peat accumulation which in some cases has led to the complete infilling of the basin. During this process the nutrient status of the peat surface changes and typically becomes oligotrophic (nutrient poor) and acidic thus allowing species such as the bog mosses Sphagnum spp. to colonise it. The resulting peat bogs are the 'mosses'. In a few cases colonisation of the water surface by floating vegetation has resulted in the formation of a quaking bog known as a 'schwingmoor'.

Cop Mere is a shallow lake lying in a hollow in Keuper Marl. In many respects it is an outlier of the series of meres concentrated in North Shropshire and Cheshire. However, it differs from many of the meres in having a distinct inflow and outflow, the River Sow, which enters the mere at the western end and leaves at the eastern end.

There are four units monitored, with two being considered a proxy for the Ramsar features; standing open water and canals and neutral grassland (the remaining units are woodland habitats). Both are in unfavourable-recovering condition, with key threats and pressures being undergrazing (grassland) and water pollution (standing water habitat), with WFD water quality targets being exceeded during the last site condition assessment (March 2022).

[105] Cop Mere Site of Special Scientific Interest citation (1986). Accessed at https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1000057.pdf

13.3 ASSESSMENT OF EFFECTS

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 13.1**:

13.4 UNCERTAINTIES

Although the main water supply to Cop Mere's appears to be the River Sow, further assessment of the hydrogeology is required to ensure increased abstraction will not cause localised drying of the habitats or result in a reduction in surface water flow. The WFD assessment has recorded a non-compliance for the abstraction, due to potential impacts to groundwater and surface water flow, and associated groundwater dependent terrestrial ecosystems. As such, uncertainty remains at the draft WRMP as to whether this option can proceed as a viable alternative given the HRA cannot conclude no adverse effects at this stage.

Table 13.1 Information to inform an assessment of adverse effects on Midland Meres and Mosses Phase 2 Ramsar

Qualifying Feature	Potential Effect	Mitigation	Effect on site integrity?
CONSTRUCTION PHASE			
Ramsar 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
	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 Ramsar boundary, seeds and plant fragments could be transported through the wider River Sow catchment and potential off-site supporting habitats. 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. Standard best practice mitigation measures are considered to be available to prevent the introduction of aquatic or riparian invasive species to the Ramsar or supporting habitats. Taking into account the proposed mitigation no adverse effects on site integrity are anticipated due to invasive species.	▪ 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 effect on conservation objectives or site integrity
OPERATION PHASE			
Ramsar site	The WFD has concluded non-compliance for the Staffordshire Trent Valley – PT Sandstone Bishops Wood (GB40401G300200) groundwater body due to potential for deterioration in dependent surface water body status, groundwater dependent terrestrial ecosystems and water balance status as a result of the abstraction. Groundwater drawdown modelling has not been completed. With this option set for implementation in 2045-46, outside of this planning period, there are likely to be significant changes to the baseline	▪ Positing on groundwater source to minimise impact to wetland habitats. ▪ Change in abstraction pattern to reduce impact to wetland habitats	Uncertain

Qualifying Feature	Potential Effect	Mitigation	Effect on site integrity?
	and several WRMP cycles prior to this implementation date in which this assessment can be completed.	and chances in flow within the River Sow.	

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

14.1 INTRODUCTION

14.1.1 Alternative programme

Within the preferred programme, Option 190 is required in 2050/51, however within the Climate Adjustment alternative programme, the option is required in 2040/41 and as such is subject to a Stage 2 Appropriate Assessment.

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 (Third Party Reservoir) that will rely on project-level mitigation (and so cannot be 'screened out').

14.2 SITE SUMMARY

14.2.1 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.

14.2.2 Qualifying features screened into Stage 2 Appropriate Assessment: baseline

14.2.2.1 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.

14.2.2.2 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.

14.2.2.3 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

14.2.2.4 Eye Brook Reservoir SSSI

Given the proximity of Eye Brook Reservoir SSSI 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."*

14.2.3 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' condition[106].

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 Plan[107]:

- 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*

[106] Natural England's Designated Site View – Rutland Water SSSI. SSSI detail (naturalengland.org.uk) Accessed on 7 September 2022.
[107] 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."[108]

14.3 ASSESSMENT OF EFFECTS

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 14.1**.

[108] 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). Accessed on 28 September 2022.

Table 14.1 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	*Noise and visual disturbance* 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). 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. However, mitigation measures are considered to be available to avoid adverse effects. *Contamination – dust and NOx loading* 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. Guidance provided by the Institute of Air Quality Management[109] 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 mitigation[110]. 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. *Biological disturbance – invasive non-native species* 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. 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. Standard best practice mitigation measures are considered to be available to prevent the introduction of aquatic or riparian invasive species to the reservoir.	*Noise and visual disturbance* • 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. *Contamination – dust and NOx* • 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. *INNS* • 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. *General* • 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

[109] Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction. IAQM, London
[110] Technical Statement TS/AQ1, Association of British Ports (ABP), 2000.

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

15.1 INTRODUCTION

15.1.1 Preferred Programme period 2025-2049

The following option 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, within the statutory 25-year planning period:

- Option 66 Strensham WTW Expansion

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

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 important[111].

15.2.2 Qualifying features screened into Stage 2 Appropriate Assessment: baseline

15.2.2.1 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 beetle[112].

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.

15.2.3 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.

[111] 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.

[112] Natural England (2018) European Site Conservation Objectives:Supplementary advice on conserving and restoring site featuresBredon Hill Special Area of Conservation (SAC)Site code: UK0012587.

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 dWRMP24:

- Forestry and woodland management – Formulate and implement a wood mould continuity strategy for the Violet click beetle population.
- Feature location/ extent/ condition unknown - survey of Violet click beetle, to identify site distribution[113].

15.3 ASSESSMENT OF EFFECTS

An assessment of effects against the relevant SACO attributes and targets is provided in **Table 15.1**.

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

Table 15.1 Information to inform an assessment of adverse effects on Bredon Hill SAC and Dixton 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.	*Loss of offsite functionally linked habitat* The proposed pipeline route and WTW are located c.2km to the west of Bredon Hill SAC, and 10.1km from Dixton 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 woodlsnd 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). 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. Mitigation measures are considered to be available to avoid adverse effects, even though there is uncertainty as to the presence of the qualifying feature.	*Potential loss of offsite functionally linked habitat* • 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. *General* • A Construction Management Plan will be drawn up to detail all exclusion and protection measures.	No adverse effects on conservation objectives or site integrity

16. STRATEGIC IN-COMBINATION ASSESSMENT

16.1 BETWEEN-OPTION 'IN-COMBINATION' EFFECTS

The effects of the draft WRMP24 options operating 'in-combination' have been explored through the screening and appropriate assessment phases (see from Section 5 to Section 12). 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.

16.2 IN-COMBINATION EFFECTS WITH OTHER SEVERN TRENT WATER PLANS

16.2.1 Drought Plan

STW published its Draft Final Drought Plan in 2022. The Drought Plan provides a comprehensive statement of the actions that STW 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 Plan[114], these are summarised in **Table 16.1.**

Table 16.1 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 Ml/d (or 92 Ml/d when flow at Derby is <340 Ml/d) to 51 Ml/d. Reduce compensation water flow releases from Ladybower Reservoir from 54 Ml/d to 34 Ml/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 Ml/d at Ambergate when the flow in the River Derwent at Derby is not less than 500 Ml/d, rather than the normal flow of 680 Ml/d.
Tittesworth Reservoir and River Churnet (Drought Order only)	Scenario 1: 8 Ml/d compensation release from Tittesworth Reservoir, 3.3 Ml/d augmentation release from Abbey Green groundwater source. Under this scenario there would be no augmentation requirement from Deep Hayes groundwater source. Scenario 2: 8 Ml/d compensation release from Tittesworth, 0 Ml/d augmentation release from Abbey Green. As for Scenario 1 there would be no augmentation requirement from Deep Hayes groundwater source.
Brownsover on River Avon	Reduce the hands-off flow conditions in the River Avon at Stareton from 45 Ml/d to 35 Ml/d exclusively to allow transfer of additional water from the River Avon at Brownsover into Draycote reservoir.

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

Name	Description
Eathorpe on River Leam	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. Relax the prescribed flow requirement in the River Leam at Princes Drive Weir in Leamington from 18 Ml/d to 12 Ml/d.
Site on River Severn	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). 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 Ml/d (maximum River Severn Regulation) to 431Ml/d, and the seasonal abstraction licence limits equivalent to 273 Ml/d (abstraction licences No's. 110 and 163) and 303 Ml/d (abstraction licences No's.110, 163 and 584) will be temporarily suspended.
River Dove	The proposed drought permit increases the aggregate annual abstraction volume from 73,200Ml/a to 77,200Ml/a. The abstraction rate should be such that a residual flow of at least 159Ml/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 90Ml/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 programme 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.

16.2.1.1 STW's Drainage and Waste Management Plan (DWMP)[115]

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

The DWMP was published in June 2022 and publication of the completed DWMP expected 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". STW 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 STWs 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 draft 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 draft 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.

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

16.3 BETWEEN-COMPANY IN-COMBINATION EFFECTS

16.3.1 WRMPs

Other water company plans are currently in preparation, and so an 'in-combination' assessment cannot be completed at this stage. The South Staffordshire Water draft WRMP24 includes demand management options only, therefore there is no potential for in-combination effects. The emerging United Utilities plan does not impact the same European sites, and therefore no in-combination effects are currently anticipated.

With regards the Humber Estuary European Marine Site, Yorkshire Water's preferred programme 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. However, this will be reviewed between draft and final to fully determine the potential for adverse effects.

16.3.2 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.

16.4 IN-COMBINATION EFFECTS WITH OTHER PLANS AND PROGRAMMES

16.4.1 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.

16.4.2 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 dWRMP24 and determination of future deficits.

Reference has been made to the Planning Inspectorates National Infrastructure Projects (NSIP) database[116] 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 Project[117]. 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.

16.4.3 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.

16.4.4 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.

[116] https://infrastructure.planninginspectorate.gov.uk/projects/
[117] Oaklands Solar Farm | About the Project | BayWa r.e. (baywa-re.co.uk)

17. DRAFT HRA CONCLUSIONS

17.1 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 draft 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 draft 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 plans, and required before 2050, the assessment comprises:

- a 'screening' of European sites within the study area to identify those sites and features where there will self-evidently be 'no effect', 'no likely significant effects', or positive effects due to the option[118], 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).

For those options within the preferred plan or alternative plans required after 2050, a higher level assessment has been completed as there is sufficient time and subsequent WRMP cycles to assess these options, some of which will require bespoke hydrological modelling to fully understand the effects alone and in-combination, including with other WRMPs.

Severn Trent has identified 43 options within its preferred programme and 5 additional alternative programme options to maintain supplies to customers. Of these:

- 12 are in use before 2050 for at least one of the preferred plan/alternative plans (11 preferred plan options and one alternative option). These have been subject to HRA Stage 1 Screening and where necessary Stage 2 Appropriate Assessment (alone and in-combination). The exception is Option 6 which is part of the RAPID Gated process, and therefore already being assessed via this process. As such, a Stage 2 Appropriate Assessment will be completed between draft and final WRMP incorporating this information.
- 12 options (8 preferred plan options and four alternative plan options) are in use after 2050 and therefore have been assessed at a higher level, with an indication of mitigation measures and further assessment work required to support any Stage 2 Appropriate Assessments.
- 26 preferred plan options do not require HRA Stage 2 Appropriate Assessments.
- 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 will be required for the Humber Estuary EMS, and the Severn Estuary EMS as draft WRMPs from other water companies are made available. Given the complexities of the abstraction and discharges on these watercourses, additional hydrological modelling may be required, to confirm effects.

17.2 PREFERRED PLAN AND ALTERNATIVE 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.

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

Table 17.1 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 river WTW nr. Stafford	Yes – alone (construction)
Dixton Wood SAC	66: Strensham WTW Expansion	Yes – alone (construction)
Fen Pool SAC	79: Wolves-Bham Strategic Link Main (large)	Yes – alone (construction)
Humber Estuary SAC and Ramsar	29: Homesford Conjunctive Use	In-combination with other water company WRMPs
	426: Little Eaton WTW DO Recovery	In-combination with other water company WRMPs
	64: Rehabilitation Milton groundwater source	In-combination with other water company WRMPs
Midland Meres and Mosses Phase 2 Ramsar	112A: Croxton GW to Hob Hill DSR	Yes – alone (construction and operation)
Pasturefields Salt Marsh SAC	44: New river WTW nr. Stafford	Yes – alone (construction)
Peak District Dales SAC	6: Derwent Valley Storage Increase	Yes – alone and in-combination (construction and operation)
	29: Homesford Conjunctive Use	Yes – alone and in-combination (construction and operation)
	95: Ogston WTW Output Increase	Yes – alone and in-combination (operation)
	128: Carsington to Tittesworth main (large)	Yes – alone and in-combination (construction)
	128Z: Carsington to Tittesworth main (small)	Yes – alone and in-combination (construction)
	187B: Expand Carsington Reservoir (16000 Ml) (alt.)	Uncertain – alone and in-combination (operation)
	187C: Expand Carsington Reservoir (25000 Ml)	Uncertain – alone and in-combination (operation)
	305: Heathy Lea to North Notts transfer	Yes – alone and in-combination (construction)
	426: Little Eaton WTW DO Recovery	Yes – alone and in-combination (construction and operation)
Peak District Moors (South Pennine Moors Phase 1) SPA	6: Derwent Valley Storage Increase	Yes – likely to have adverse effects
	123B: Raise Dam at Tittesworth Reservoir by 25%	Yes – alone and in-combination (construction)
	128: Carsington to Tittesworth main (large)	Yes – alone and in-combination (construction)
	128Z: Carsington to Tittesworth main (small)	Yes – alone and in-combination (construction)
	305: Heathy Lea to North Notts transfer	Yes – alone and in-combination (construction)
River Clun SAC	33Z: Shelton WTW Expansion	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)
	303A: UU release from Vyrnwy (75 Ml/d) (alt.)	Yes – alone and IC (operation)
	303C: UU release from Vyrnwy (25 Ml/d)	Yes – alone and IC (operation)

European site	Options	Alone or in-combination with other WRMP options?
	429: Mythe WTW DO Recovery (alt.)	Yes – alone and IC (operation)
River Mease SAC	31D: E.Midlands Raw Water Storage (31D)	Yes – alone and IC (operation)
	44: New river WTW nr. Stafford	Yes – alone and IC (operation)
	64: Rehabilitation Milton groundwater source	Yes – alone and IC (operation)
	556: ASL Capacity Increase - Hallgates to Oldbury (alt.)	Yes – alone and IC (operation)
Rutland Water SPA and Ramsar	190: Third party reservoir purchase and new WTW's	Yes – alone (construction)
Severn Estuary/Môr Hafren SAC and Ramsar	33Z: Shelton WTW Expansion	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)
	303A: UU release from Vyrnwy (75 Ml/d) (alt.)	Yes – alone and IC (operation)
	303C: UU release from Vyrnwy (25 Ml/d)	Yes – alone and IC (operation)
	429: Mythe WTW DO Recovery (alt.)	Yes – alone and IC (operation)
South Pennine Moors SAC	6: Derwent Valley Storage Increase	Yes – likely to have adverse effects
	305: Heathy Lea to North Notts transfer	Yes – alone (construction)

17.3 PREFFERED 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 an alternative programme, and are required prior to 2050.

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; 112 Croxton groundwater sources as the abstraction location of the groundwater sources is not confirmed, and further hydrogeological assessment will be required to understand the impacts to the River Sow and Midland Meres and Mosses Phase 2 Ramsar. However, this is an alternative option, and if required will not be developed until 2045/46, therefore there is sufficient time and subsequent WRMP cycles to confirm effects.

Further work on in-combination effects on the Humber Estuary European Marine Site, with other water company plans, is required between draft and final WRMP submission. Similarly, given the complexity of the

flow regime on the River Severn in particular, use of the hydrological model developed for the STT SRO would be beneficial to fully understand the potential for adverse effects on Severn Trent's options alone, and in-combination with other WRMPs and the Environment Agency's regulation releases.

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 area[119].

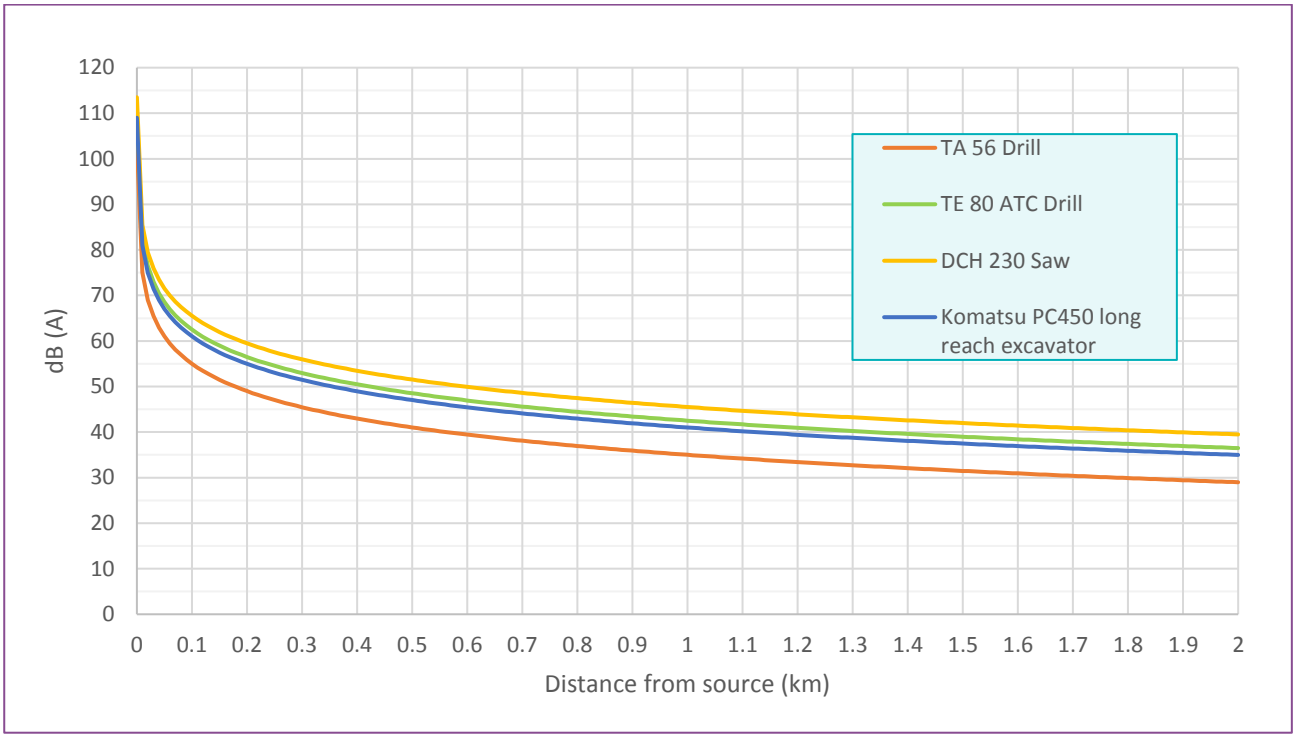
The sensitivity of the interest features will depend on their behavioural characteristics, their general tolerance / habituation to existing or new activities at a site, and the extent to which avoidance behaviours are achievable. This may also vary during the year (for example, most bird species will 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)[120] within 600m due to distance alone (see Figure A.1).

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

[120] 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)[121] 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)

[121] 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 Notes[122], 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);

[122] 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.

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	This scheme is to transfer of water between the raw water inlet to Bamford WTW and Carsington Reservoir. This will enable water from the Derwent Valley Reservoirs to be transferred southwards to Carsington Reservoir during wet years and pumped back from Carsington Reservoir northwards to Bamford WTW during dry years. Bamford WTW and Carsington Reservoirs have a similar elevation at around 200m AOD, providing an opportunity to complete transfer with minimal pumping provided that pipeline elevation increases can be minimised along the route. The scheme will require a new pipeline and a pumping station located at a suitable point to transfer up to 80Ml/d northwards and up to 30Ml/d southwards. The following new assets has been proposed to enable this transfer. - 36.2km of 1050mm diameter pipeline between Bamford and Carsington (including 8.5km of pipe(s) within a tunnel) - New tunnel 8.5km of 2800mm diameter to accommodate a section of pipeline route. - 1,355kW pumping station at Carsington Reservoir - 250kW pumping station at Bamford WTW	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 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.

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
6	Derwent Valley Storage Increase	The concept of this scheme is to increase the storage at Howden Reservoir in the Derwent Valley Reservoirs complex by increasing the height of the existing Howden Dam. This will enable storage of more raw water in the Derwent Reservoirs, and enable a higher output from Bamford WTW to be maintained for longer into dry seasons. For the purpose of the WRMP scheme a 10m raising has been selected. The proposed construction methodology assumed for the raising is the use of post tensioned anchors to add a structure onto the crest of the existing dam.	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/functional 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 District Dales SAC is hydrologically connected. The River Derwent is therefore likely to provide functionally linked	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. 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 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.	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?
					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.				
22	Elmhurst GW Recommissioning (Potable)	This scheme will recommission the disused Elmhurst GWS and associated WTW to deploy ~2 Ml/d. The scheme includes the following activities: - Recommission the disused Elmhurst GWS groundwater source. Involving groundwater source testing, rehabilitation/ redrilling (if appropriate) and installation of a new groundwater source= pump. - A new nitrate removal plant and UV disinfection plant at Elmhurst GW. Also the upgrade of peripheral assets such as dosing rigs, power and telemetry to return the abandoned site to supply. These other upgrades are a raw water balancing tank; UV disinfection; a chlorination system; a phosphate dosing system; final water pH adjustment and a final balance tank. - Disposal of nitrate treatment plant waste stream (estimated at 0.2Ml/d) to Leek Sewage Treatment Works (STW) through construction of 10.3 km of 150mm dia pumped transfer main with associated 5 kW pumping station at Elmhurst GW.	South Pennine Moors SAC Peak District Moors (South Pennine Moors Phase 1) SPA	7km 7km	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.	No LSEs anticipated	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.	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		- Deployment of the treated water though a new 2.2km pumped main with an associated 90kW pumping station.							
29	Homesford Conjunctive Use	The scheme is to increase the capacity of Homesford WTW to 54Ml/d to enable treatment of the high flows from the source which are understood to be primarily during spring/summer. Treated water is then to be deployed via a new booster station. The scheme requires the following: - Chlorine and Phosphate dosing - Storage reservoir of 800m3 - 325kW pumping station - Ultrafiltration system	Peak District Dales SAC Gang Mine SAC Bee's Nest and Green Clay Pits SAC Humber Estuary SAC, SPA and Ramsar	3.7km 8.4km 3.7km Downstream receptor (c.96km)	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. Gang Mine SAC and Bee's Nest and Green Clay Pits SAC are both within 10km of the proposed construction site (8.4km and 3.7km respectively), however are at sufficient distance (based on standard distance thresholds for noise, visual etc) the no LSEs are anticipated.	No LSEs anticipated	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. 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. Should this option be taken forward to the	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?
							preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken. 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).		
31C	E.Midlands Raw Water Storage (31C)	This scheme will provide provision of additional raw water storage in the Strategic Grid WRZ by converting an existing quarry into a raw water storage reservoir. The new reservoir will be supplied with raw water abstracted from River Soar. Raw water in the reservoir will be abstracted and treated at new WTW adjacent to the site and deployed to the Strategic Grid WRZ. The scheme requires the following: - Conversion of the quarry to enable storage of raw water including grout curtains, face and overburden stabilisation, and other engineering works. - 50Ml/d raw water intake and pumping	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: *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.*	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?
		station on the River Soar - 0.5km of new 1050mm dia raw water pipeline from the new intake to the quarry - New 50Ml/d WTW at the quarry - 1,289kW pumping solution (potentially floating pontoon pumps) to lift water out of the quarry and transfer to the new WTW - Connecting pipework between the quarry abstraction pumps and WTW. - 7.9km of 1050mm diameter pipeline . - 780kW pumping station to transfer water.					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).		
31D	E.Midlands Raw Water Storage (31D)	This scheme will provide provision of additional raw water storage in the Strategic Grid WRZ by converting an existing quarry into a raw water storage reservoir. This new reservoir will be supplied with raw water abstracted from the River Trent near Weston-on-Trent. Raw water in the reservoir will be abstracted and treated at new WTW adjacent to the site and deployed to the Strategic Grid WRZ. The scheme requires the following: - Conversion of the quarry to enable storage of raw water - 50Ml/d raw water intake and pumping station on the River Trent - 19km of 1050mm raw water pipeline from the new intake to the quarry - New 50Ml/d WTW at the quarry - 726kW pumping solution (potentially floating pontoon pumps) to lift water out of the quarry and transfer to the new WTW. - Connecting pipework between the quarry abstraction pumps and WTW. - 10.2km of 1050mm pipeline from WTW - 686kW pumping station to transfer potable water	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 options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken. 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: *Distribution of sea*	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?
							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).		
32	Little Eaton Conjunctive Use	This scheme is to upgrade Little Eaton WTW to treat an additional 30Ml/d to enable the site to achieve its intended 120Ml/d maximum output. Co-ordinating the release of raw water from Carsington Reservoir will enable a support abstraction of 120Ml/d from the River Derwent to be achieved for longer periods. The additional treated water from the upgraded WTW will be deployed into Strategic Grid via a new pumping station at the WTW outlet and an associated pipeline. The following new assets have been proposed to enable this concept. - Upgrade existing Little Eaton WTW - New 3.1km pipeline from Little Eaton WTW. - New pumping station to transfer treated water to the DVA.	Peak District Dales SAC Humber Estuary SAC, SPA and Ramsar	Hydrological pathway to potentially functionally linked habitat Downstream receptor (>100km)	There are no European sites within 10km of the scheme components. The WTW site is sufficiently distant from the River Derwent (c.0.5km) with no hydrological connectivity, such that pollution incidents and releases of suspended sediment are considered unlikely (which could affect fish populations of Peak District Dales SAC). 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 WFD assessment considered the additional abstraction proposed with the scheme, and the downstream impacts. A change in flow was predicted downstream within the River Derwent, and within part of the River Trent to Colwick. This reduction in flow could impact the fish populations of the Peak District Dales SAC (bullhead and brook lamprey) and the River Mease SAC (spined loach and bullhead). The maximum percentage change in flows within the River Derwent is 7.8% and in the River Trent 7.5%, both at Q95. The CAMS indicates that water is not available for licensing in the River Derwent, and is restricted in the River Trent. As such, the hydrological impact is identified as major. There is uncertainty as to the use of the lower River Derwent, and River Trent by the qualifying features. LSEs cannot be ruled out due uncertainty over the operational regime and how this may affect fish species movement to the upstream	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?
							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. 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).		
33Z	Shelton WTW Expansion	This scheme is to utilise the full existing River Severn abstraction licence at the Shelton WTW site and construct a new 10Ml/d process stream at or near Shelton WTW to treat the additional water. This new treatment stream will be connected to the existing network through integration with the existing Shelton WTW and connections to the existing network. Water will be deployed into the Shelton WRZ using the existing network.	Midlands Meres and Mosses Phase 1 Ramsar Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar	3.3km Downstream receptor (>100km)/functional habitat Downstream receptor (>100km)/functional habitat	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). It is unclear whether the existing raw water intake from the River Severn will be used, or whether a new structure	LSEs identified	The proposed scheme involves an additional 10Ml/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 (*Petromyzon*	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?
					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.		*marinus*), river lamprey (*Lampetra fluviatilis*) and twaite shad (*Alosa fallax*)) 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 (*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.		

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
38	Minworth effluent re-use (Large scheme)	Minworth Sewage Treatment Works (STW) discharges final effluent into the River Tame and forms a large proportion of the river flow. This concept of this scheme is to intercept a proportion of this flow before it is discharged to the river. To enable this scheme it is proposed that an effluent re-use plant at Minworth STW will be installed to treat water to potable standard which will be deployed into the Strategic Grid WRZ. It is anticipated that treated water will be transferred via new pipelines and pumping stations. The scheme requires the following: - 90Ml/d new water treatment works at Minworth STW, to convert treated final effluent to potable water standards. - 15.8km of new 900mm dia pipeline from Minworth - 18.3km of new 700mm dia pipeline from Minworth. - A new 445kW pumping station to transfer water - A new 486kW pumping station to transfer water	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	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 90Ml/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 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)	Minworth Sewage Treatment Works (STW) discharges final effluent into the River Tame and forms a large proportion of the river flow. This concept of this scheme is to intercept a proportion of this flow before it is discharged to the river. To enable this scheme it is proposed that effluent re-use plant at Minworth STW will be installed to treat water to potable standard which will be deployed into the Strategic Grid WRZ. It is anticipated that 30Ml/d of treated water will be transferred via a new pipeline and pumping station. The scheme requires the following: - 30Ml/d new water treatment works at Minworth STW, to convert treated final effluent to potable water standards. - 18.3km of new 700mm dia pipeline from Minworth STW - A new 486kW pumping station to transfer water	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 30Ml/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
44	New river WTW nr. Stafford	This scheme will provide benefit to Stafford WRZ which is currently supplied exclusively by groundwater sources. The notional scheme is to construct a new abstraction point on the River Sow near Little Haywood with an adjacent WTW and transfer of treated water to the existing network. The scheme requires the following: - 25Ml/d raw water intake and pumping station on the River Sow - 25Ml/d new water treatment works - 14.9km (total) of new 700mm diameter pipelines connecting the river intake to the WTW and the WTW to the existing network.	Cannock Chase SAC Pasturefields Saltmarsh SAC West Midlands Mosses SAC, and Midlands Meres and Mosses Phase 1 Ramsar Midlands Meres and Mosses Ramsar - Phase 2 River Mease SAC Humber Estuary SAC, SPA and Ramsar	0km - directly adjacent (despite re-routing, new pipeline route is located along Cannock SAC for a length of 565m) 1.4km, possible functional habitat closer 5.5km 9.9km Downstream receptor (c.21km)/functional habitat (River Trent) Downstream receptor (>100km)	There are six European designated sites within 10km; Cannock Chase SAC, Pasturefields Saltmarsh SAC, West Midlands Mosses SAC, Midlands Meres and Mosses Phases 1 and 2 Ramsar, 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). Significant construction effects cannot obviously be excluded with standard measures and construction may require bespoke mitigation or detailed design inputs at the	LSEs identified	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.	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?
		- A new 515kW pumping station to transfer the potable water			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 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 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 no adversely affect these areas of saltmarsh. 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 it 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. The River Trent is hydrologically connected to the Humber Estuary SAC. However, the watercourse has not		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. Similarly, a long-term reduction 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 options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken. 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).		

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
					been 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.				
54	River Soar to Cropston WTW	This scheme is to provide new raw water source of supply to Cropston WTW within the Strategic Grid WRZ. Raw water will be abstracted from the River Soar and transferred to the existing Cropston WTW inlet, where it will be treated and deployed to the Strategic Grid network using existing assets. The scheme requires the following: - 17Ml/d raw water intake and pumping station on the River Soar - 52Ml capacity settlement tank near to Cropston WTW to accept the raw water before connecting to Cropston WTW inlet. - 6.5km of new 600mm dia pipelines between the River Soar and the settlement tank and then to Cropston WTW - A new 26kW pumping station to transfer water from the settlement tank to Cropston WTW	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: *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).	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)
58	River Weaver to Stoke	This scheme is to provide an additional source of supply into North Staffordshire WRZ. The scheme involves constructing a new abstraction point and WTW at the River Weaver near Nantwich. The treated water will be deployed into the existing network using an existing pipeline. The scheme requires	Midlands Meres and Mosses Phase 1 Ramsar West Midlands Mosses SAC Mersey Estuary SPA and Ramsar	4.5km 4.5km 42km	There are two European designated site 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	No LSEs anticipated	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	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		the following: - A new 20Ml/d river intake and pumping station (626kW) on the River Weaver, south of Nantwich. - A new settlement tank to accept the raw water prior to the WTW - 20 Ml/d new water treatment works close to the settlement tank and abstraction point. - A new 626kW pumping station and 460m of pipeline to connect to the existing main. - Connecting pipework between the river abstraction point, settlement tank and the WTW.			scheme components (based on standard distance thresholds e.g. noise, visual etc) such that no LSEs are anticipated. 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.		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	The scheme concept is to recommission the STWL Milton groundwater source and use the raw water to support Melbourne Water Treatment Works (WTW) and supply the Strategic Grid WRZ. The scheme requires rehabilitation of Milton source (re-drill groundwater sources if necessary) and abandon the Stanton by Bridge groundwater source. A new pipeline (2.1 km length) will be required to connect the Milton site to existing pipeline infrastructure that connects with Melbourne WTW. A new pumping station will be required to lift raw water from Milton through the new pipeline and into the existing mains to Melbourne WTW.	River Mease SAC Humber Estuary SAC, SPA and Ramsar	11km (20km upstream receptor/functionally linked habitat) Downstream receptor (>100km)	The component requires recommission of Milton groundwater source and new pipeline to connect Milton BPS and Melbourne STW, 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 *Lutra lutra*), 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.	No LSEs anticipated	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. 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	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?
							Assessment would need to be undertaken.		
66	Strensham WTW Expansion	This scheme is to expand Strensham Water Treatment Works (WTW) by 30Ml/d and is to include the construction of a new intake at Upton-upon-Severn. This additional water will be transferred to the expanded Strensham WTW predominantly in winter when there is greater water availability in the River Severn. The following activities are required for the scheme. - New 30Ml/d river intake and pumping station on the River Severn near Upton-upon-Severn. - 5km of 800mm diameter pipeline from the River Severn Intake to Strensham WTW. - 30Ml/d expansion of Strensham WTW to treat additional water. - Pumping Station at Strensham WTW.	Bredon Hill SAC Dixton Hill SAC Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar	2km Functionally linked Downstream receptor (35km)/functional habitat (River Severn) Downstream receptor (35km)/functional habitat (River Severn)	There is one European designated site within 10km; Bredon Hill SAC. The closest component is located c.2km to the west of the site. Dixton 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. 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.	LSEs identified	The new 30Ml/d intake on the River Severn would result in a 2% reduction in Q95 flows. 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 to be affected. This includes the Annex II species listed under the SAC (sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and twaite shad (*Alosa fallax*)) 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 (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.	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?
							Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.		
79A&B	Wolves-Birmingham Strategic Link Main (A 20Ml/d, B 10Ml/dl)	This scheme is to connect Frankley WTW in the Strategic Grid WRZ to Tettenhall Pumping Station in the Wolverhampton WRZ via Goldthorne Hill DSR. To enable this transfer, both existing and new assets will be utilised and some modification and recommissioning will be carried out of existing assets. This scheme is sized for a maximum 20Ml/d transfer. The scheme will require: - Internal cleaning of existing 600mm mains in the network between - New tee onto the existing network for connection of a new pipeline and new Pressure Reducing Valve (PRV) - 18.9km of new 750mm (large) and 450mm (small) pipeline - Recommission Cell 1 at an existing DSR - 7.7km of new 750mm pipeline from Goldthorne Hill DSR to Tettenhall Pumping Station - Pipework and pump control modifications to allow bi-directional flow at Tettenhall Pumping Station	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	
84A	Minor Dam Extensions (Stanford Reservoir)	This scheme is to increase storage capacity of Stanford Reservoir by 11%. This is achieved by increasing the Top Water Level (TWL) at the reservoir by 0.22m from 110.76m AOD to 110.98m AOD. The increased water level would add 147.4 Ml of capacity to Stanford Reservoir. To enable this increase in volume of the reservoir, the following works are required: - Raise the overflow	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	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		weir sill by 0.22m - Apply a 75mm thick screed to the floor of the control room					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.		
84B	Minor Dam Extensions (Lower Shustoke Reservoir)	This scheme is to increase the storage capacity of Lower Shustoke reservoir by 10%. This is achieved by increasing the Top Water Level (TWL) of the reservoir by 0.52m from 79.90m AOD to 80.42m AOD. The increased water level would add 192 Ml of capacity to Shustoke Reservoir. To enable this increase in volume of the reservoir, the following works are required: - Construction of a 400mm high reinforced concrete (RC) wave wall along the embankment crest. - Modification to the pipework between the upper and lower reservoirs. This would take the form of a non-return valve, allowing the WL to be kept higher in the lower reservoir.	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: *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).	Negligible	Y - abstractions affecting freshwater input to the Humber Estuary (freshwater input is an attribute/target in the SACO for the estuaries feature)
84C	Minor Dam Extensions (Whitacre Reservoir)	The increase in storage capacity of Whitacre reservoir by 5% is to be achieved by increasing the Top Water Level (TWL) at the reservoir by 0.17m from 70.00m AOD to 70.17m AOD. The increased water level would add 7.8 Ml of capacity to Whitacre Reservoir. To enable this increase in volume of the reservoir, the following works are required: - Raise the spillway crest level by 170mm - 500mm high RC wave	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 know 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	Negligible	The CAMS indicates that there is water available for abstraction from the River Tame which may be required to supplement the reservoir. 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*	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?
		wall along the embankment crest			and therefore considered to be sufficiently distanced such that construction related issues (increases in suspended sediments) would not adversely affect the site.		*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).		
88	River Weaver to Tittesworth WTW	This scheme is to establish a new raw water source for Tittesworth Reservoir and WTW. The proposal is to establish a new abstraction point on the River Weaver, approximately 25km west of Tittesworth. Raw water will be transferred to a new settlement lagoon near Tittesworth WTW prior to treatment and deployment into the network using existing assets. This scheme will enable the use of Tittesworth WTW for longer periods during dry seasons by enabling Tittesworth Reservoir abstractions to be operated differently and training higher storage levels for longer. The scheme requires the following works: - 48 Ml/d intake and pumping station (1085kW) on the River Weaver - 38km pipeline from the new river intake to the settlement lagoon near Tittesworth WTW. - A new 48Ml primary settlement lagoon to accept the raw water - Upgrades to Tittesworth WTW treatment processes for the change in raw water quality.	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	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
95B	Ogston WTW Output Increase	This scheme is to expand Ogston WTW and make better use of raw water in the River Derwent sources. Ogston WTW is supplied with raw water from Ogston Reservoir that in turn receives both natural inflow and a pumped supply from the River Derwent (or transfer from Carsington Reservoir). The additional output from Ogston WTW can be used to support customers in the Strategic Grid WRZ and incorporate an element of operational flexibility with the large number of groundwater sources to the east of Mansfield (in Nottinghamshire WRZ). To enable the additional transfer, treatment and deployment of water from Ogston WTW, it is anticipated that the following will be required: - Modify raw water pumps at the Ambergate River Derwent intake to achieve a reliable 130Ml/d peak winter transfer to Ogston Reservoir and 110Ml/d from Carsington Reservoir direct to Ogston in the summer periods (Carsington licence may need to be modified). - Upgrade the existing New Ogston WTW to achieve 55Ml/d - Build a third 40 Ml/d WTW process stream at Ogston WTW, giving a total output of 120Ml/d (including 25 Ml/d from Old works and 55 Ml/d from New works with software modifications). It should be possible to deploy up to 30 Ml/d peak via the existing main. - If required, clean mains between to enable flows to be reversed in winter. - Install any pipelines/boosters required to transfer an additional 40 Ml/d summer output from Ogston WTW	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	9.8km 5.8km 6.1km and functional habitat (River Derwent) 9.6km 9.6km	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 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 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 alongside a Stage 2 Appropriate Assessment. Although hydrologically linked to the Humber Estuary SAC, qualifying features are not known to be present on the River Trent.	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?
101	Kinsall additional resource	This scheme is to import 1Ml/d from United Utilities' Vyrnwy Aqueduct to serve customers in the Kinsall WRZ. The scheme requires re-enabling an existing connection (that will be renewed) between the Vyrnwy Aqueduct and the STWL network. The imported water will be distributed into the STWL network. The network will be operated in an open manner, with water from Kinsall GW, Rednall GW and the UU import mixing within the supply network and balance points being established in keeping with the specified total daily supply from each source. The scheme requires the following: - New cross connection between Vyrnwy Aqueduct and existing network - Cleaning of existing pipelines between. - Installation of a new pressure reducing valve (PRV) and flow meter for this supply.	Midland Meres and Mosses Phase 2 Ramsar Midland Meres and Mosses Phase 1 Ramsar River Dee and Bala Lake SAC	7.8km 4.5km 5.9km	There are three European designated sites within 10km of the scheme components; Midland Meres and Mosses Phase 1 Ramsar, Midland Meres and Mosses Phase 2 Ramsar and River Dee and Bala Lake SAC. All are sufficiently distanced, based on standard thresholds (e.g. noise, dust) such that construction impacts are unlikely. As such, no LSEs are anticipated	No LSEs anticipated	The scheme is a supply link transferring water from the existing Vyrnwy aqueduct. As such no increase in abstraction is required, and therefore 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, enabled by a surplus of supply in Shelton WRZ that is either currently present or will be created by other schemes. This is achieved through operating the existing pipeline (~5km of 250mm dia) linking the WRZs 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. The scheme does not produce any net additional water. The scheme requires the installation of a new 6kW pumping station to enable this transfer.	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	This scheme is to transfer water from	Humber Estuary SAC, SPA and Ramsar	Downstream receptor (c.54km)	There are no European designated sites within	No LSEs anticipated	The scheme involves an interzonal transfer	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		Nottinghamshire WRZ to Newark WRZ, enabled by a surplus of supply in Nottinghamshire WRZ that is either currently present or will be created by other schemes. The transfer will be enabled by making a new connection the Nottinghamshire WRZ and the Newark WRZ capable of transferring 5Ml/d. The scheme requires the following: - 12.4km of new 500mm dia pipeline that will operate by gravity.			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.		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.		
105	Ruyton Support Link	This scheme is the transfer water from Shelton WRZ to Ruyton WRZ, enabled by a surplus of supply in Shelton WRZ that is either currently present of will be created by other schemes. The transfer will be enabled by making a new connection between Pentre WTW in the Shelton WRZ and the Ruyton WRZ capable of transferring up to 2Ml/d. The scheme requires the following: - 3.5km of new 300mm dia main to convey up to an average 1Ml/d of water and up to 2Ml/d during an emergency/summer peaks. - It is assumed that Pentre WTW pumping station provide sufficient head without additional pumping infrastructure requirements.	Midlands Meres and Mosses Phase 1 Ramsar Midlands Meres and Mosses Phase 2 Ramsar Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar	5.4km 9.1km Downstream receptor (>100km)/functional habitat Downstream receptor (>100km)/functional habitat	This scheme is to provide a pipeline connection to allow transfer of water resources. There are two designated sites within 10km; Midlands Meres and Mosses Phase 1 Ramsar, and Midlands Meres and Mosses Phase 2 Ramsar. 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.	No LSEs anticipated	The scheme does not involve any additional 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?
108	Stoke to Stafford Link	This scheme is to transfer water from North Staffs WRZ to the Stafford WRZ, enabled by a surplus of supply in North Staffs WRZ that is either currently present or will be created by other schemes. The transfer will be enabled by making a new connection from North Staffs WRZ the Stafford WRZ capable of transferring up to 15Ml/d. The pipeline will also pass through two other STWL sites aiding operational flexibility. These existing operational sites can also provide suitable sites for the construction of new pumping stations. The scheme requires the following: - 4.9km of new 600mm dia pipeline. - 7.1km of new 600mm dia pipeline. - New 104kW pumping station to transfer 15Ml/d . - 11.9km of new 600mm dia pipeline. - New 31kW pumping station to transfer 15Ml/d.	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 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	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)

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
					pollution incidents and suspended sediment releases.				
110	Wolverhampton-Staffs Link	This scheme is to transfer water from Wolverhampton WRZ to Stafford WRZ and North Staffs WRZ, enabled by a surplus of supply in Wolverhampton WRZ that is either currently present or will be created by other schemes. The transfer will be enabled by making a new connection in Wolverhampton WRZ to Stafford WRZ (sized at 30Ml/d) to North Staffs WRZ (sized at 25Ml/d). The scheme requires the following: - 30km of new 800mm dia pipeline - 13.6km of new 700mm dia pipeline - A new 570kW pumping station - A new 140kW pumping station	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	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?
					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.				
111	Melbourne to Staffs Link	This scheme is to transfer water from the Strategic Grid WRZ to Stafford WRZ and North Staffs WRZ, enabled by a surplus of supply in the Strategic Grid WRZ that is either currently present or will be created by other schemes. The transfer will be enabled by making a new connection from Melbourne WTW in the Strategic Grid WRZ and Stafford WRZ (sized at 32Mld) and then to North Staffs WRZ (sized at 25Ml/d) and Stafford WRZ (sized at 7Ml/d). The scheme requires the following: - 50.9km of new 800mm dia pipeline from Melbourne WTW - 13.6km of new 700mm dia pipeline - 11.9km of new 450mm dia pipeline - A new 921kW pumping station at Melbourne WTW - A new 24kW pumping station - A new 570kW pumping station	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	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	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
					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 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.				
112	Croxton GW to Hob Hill	This scheme is to refurbish the existing Croxton groundwater sources (GWS) in North Staffs WRZ and transfer 3Ml/d of potable water to Stafford WRZ via a new pipeline and pumping station. The scheme requires the following: - Re-drilling Croxton groundwater sources - Treatment of raw water from Croxton groundwater sources within the existing GWS and WTW site. - 10.4kW (3Ml/d) pumping station - 7.8km of new 300mm diameter pipeline	Midland Meres and Mosses Phase 2 Ramsar	0.85km	The scheme is c.0.85km north west of the Midland Meres and Mosses Phase 2 Ramsar at its closest point, and is hydrologically connected via the River Sow. Standard measures and best practice mitigation would be implemented during construction to reduce the risk of pollution incidents and suspended sediment releases. It is unclear what the hydrological catchment area of the Midland Meres and Mosses Phase 2 Ramsar site is, and therefore whether the pipeline construction could alter surface and	LSEs identified	The scheme proposes the redrilling of the Croxton groundwater sources. Given the proximity of the boreholes to the Midland Meres and Mosses Phase 2 Ramsar (Cop Mere SSSI), and the reliance of this habitat on groundwater levels, LSEs cannot be ruled out. 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	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
					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.				
117	Peckforton Bulk Import	This scheme is to import treated water from United Utilities' (UU's) Vyrnwy aqueduct close to the existing STWL site at Peckforton. The existing main will be used to transfer up to 5Ml/d of imported additional water. This enables the imported water to support demand and reduce reliance on the groundwater source sites of Peckforton, Tower Wood and Tattenhall. The scheme requires the following: - Reinstate and reuse the existing (disused) connection and link main between Peckforton WTW and the Vyrnwy aqueduct in the reverse direction. This is currently cut and capped. - Install/upgrade network chlorination at two existing sites. - Decommission existing booster chlorination stations. - Upscale chlorination plant. - Install a new 282kW pumping station.	Midlands Meres and Mosses Phase 2 Ramsar Midlands Meres and Mosses Phase 1 Ramsar	3.2km 9.5km	There are two European designated sites within 10km of the scheme components; Midland Meres and Mosses Phase 1 Ramsar and Midland Meres and Mosses Phase 2 Ramsar. All are sufficiently distanced, based on standard thresholds (e.g. noise, dust) such that construction impacts are unlikely. As such, no LSEs are anticipated	No LSEs anticipated	The scheme is a supply link transferring water from the existing Vyrnwy aqueduct. As such no increase in abstraction is required, and therefore no LSEs are anticipated.	No LSEs anticipated	
120	Middle Severn to Draycote (120A)	This scheme enables a complex series of operations to manage raw water across various sources. After a dry winter, there is large amount of unused spare storage capacity at Draycote Reservoir and the asset is underused. The concept behind this	Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar	Downstream receptor (c.64km)/functional habitat (River Avon and other tributaries of the River Severn)	There are no European designated sites within 10km of the scheme components, or impact pathways over a greater distance. The pipelines are not within 30km of any SAC designated for bat species. A new intake and outfall structure is required on the River Avon, a	LSEs identified	A change in discharge from Coleshill STW and abstraction on the River Avon needs to be considered with regard 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	LSEs identified and likely adverse effects	-

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		scheme is to make use of this spare storage capacity at Draycote Reservoir by licensing an additional winter quantity at the River Severn's Trimpley intake. A flow of 62Ml/d would be transferred to Draycote Reservoir during the period 7.5months prior to a drought. This will be pumped from the intake at Trimpley to Draycote via boosters at Frankley, Sugarbrook and Eathorpe. This scheme requires the 6% Draycote Reservoir expansion (scheme 122A). During the first 146 days of a drought, 62Ml/d will be released from Draycote towards the site of Longbridge Sewage Treatment Works (STW) where it will be joined by 80Ml/d abstracted from the River Avon, before being transferred (142Ml/d) to Frankley WTW for treatment. The abstraction from the River Avon will be supported through the release of 88Ml/d final effluent into the River Avon from Minworth STW, that will require new infrastructure to facilitate. During the closing 34 days of a drought event the release from Draycote Reservoir will be suspended, being replaced by 62Ml/d from the River Severn Trimpley intake, and the 80Ml/d River Avon abstraction will be transferred to Frankley WTW. The following capital assets are proposed for this scheme: - 27.3km of 1200mm diameter main from Minworth WwTW to River Avon - 1230kW pumping station at Minworth - 1632kW raw water abstraction pumping station at River Avon - 2MW bidirectional pumping station at Longbridge - 36km of 1500mm			tributary of the River Severn which could provide functionally linked habitat to the migratory fish species of the Severn Estuary/Môr Hafren SAC. The pipelines also cross several watercourses which are hydrologically linked to the River Severn; River Alne, River Arrow, River Leam, and River Avon. The pipeline also crosses the Stratford-upon-Avon Canal and Worcester and Birmingham canal. A crossing is also required on the River Blythe which is hydrologically connected to the Humber Estuary SAC. 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 and other watercourses support spawning populations of the migratory fish species, and therefore whether works would 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 to allow pipeline construction.		(*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and twaite shad (*Alosa fallax*)) 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. A new discharge will also need to be carefully designed to avoid adverse effects and impacts to water quality further understood. 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.		

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		diameter pipeline from Longbridge to Sugarbrook - 7800kW bi-directional pumping station at Sugarbrook - 18.6km of 1500mm diameter pipeline between Frankley and Sugarbrook - 1342kW pumping station at Frankley to transfer water to Sugarbrook - 12.7km of 1050mm diameter pipeline from Longbridge to Willes Meadows - 14.7km of 800mm diameter pipeline from Willes Meadows to Draycote Reservoir - 792kW pumping station at Eathorpe to transfer water between Longbridge and Draycote							
121	Mythe to Mitcheldean main	This scheme makes use of existing unused licence capacity on the River Severn at the Mythe WTW abstraction point and delivers the surplus raw water (sized at a maximum 16Ml/d) to Mitcheldean WTW. The scheme has been developed as to counter potential reductions to River Wye abstractions which would severely limit Mitcheldean WTW output during dry years. The scheme requires the following: - Modification to raw water abstraction outlet at Mythe WTW - A new 1,230kW pumping station at Mythe WTW to transfer raw water to Mitcheldean WTW - 29.7km of new 600mm dia raw water pipeline from Mythe WTW to Mitcheldean WTW - Additional chlorine dosing and associated contact tank at 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 Severn Estuary SPA and Ramsar River Clun SAC	6.9km 8.8km 0.65km 7.9km 5.3km 8.2km Downstream receptor (c.28km)/functional habitat Downstream receptor (c.28km)/functional habitat Functional link (salmon)	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 Mine SSSI. The Core Sustenance 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.	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 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 (*Petromyzon marinus*), river lamprey (L*ampetra fluviatilis*) and twaite shad (*Alosa fallax*)) but also the fish assemblage under the Estuaries feature which includes the following migratory species; salmon, eel, sea trout and allis shad (also part	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?
					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.		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 (*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.		
122A	Raise water levels at Draycote Reservoir	The scheme is to increase the storage capacity of Draycote Reservoir by 6% by raising the top water level (TWL) by 0.6m from 93.88m AOD to 94.48m AOD. This increase in water level will add 1,400 Ml of capacity to the current reservoir capacity of 22,730Ml. The additional raw water will be treated at Draycote WTW and deployed to the Strategic Grid WRZ. The scheme requires the following activities:	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	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		- Raise the overflow weir sill by 0.6m - Raise a bridge by 0.6m to retain its existing clearance from the water.							
122B	Raise water levels at Draycote Reservoir	The scheme is to increase the storage capacity of Draycote Reservoir by 25% by raising Top Water Level (TWL) by 2.5m from 93.88m AOD to 96.38m AOD. The increased water level would add 5,800 Ml of capacity to Draycote Reservoir. The additional raw water will be treated at Draycote WTW and deployed to the Strategic Grid WRZ. The scheme requires the following activities to increase the TWL of Draycote Reservoir by 2.5m by raising all 6 embankments: - Demolish the existing wave wall. - Raise the existing embankment (clay core, shoulder fill and rip rap) by 2.5m. - Construct a new concrete wave wall at the crest of the raised embankments - Modify the spillway arrangements. Includes raising the concrete weir block by 2.5m and increasing the height of the spillway channel side walls. - Complete replacement of the high level draw-off. - Modifications to the draw-off tower including extension of pipework, reconstruction of the control house and provision of additional valves. - Installation of an internal lining to strengthen the draw-off culvert. - Provision of a longer access bridge from the raised crest levels. - Construction of 4.6km of perimeter road around the reservoir. The majority of existing road will be submerged by increased water level.	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	Raise water levels at Draycote Reservoir	The scheme is to increase the storage	Severn Estuary/Môr Hafren SAC	Downstream receptor (>150km)	There are no European designated sites within	No LSEs anticipated	There are unlikely to be any impacts on the	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		capacity of Draycote Reservoir by 50% by raising the Top Water Level (TWL) at the reservoir by 5m from 93.88m AOD to 98.88m AOD. The increased water level would add 11,500 Ml of capacity to Draycote Reservoir. The additional raw water will be treated at Draycote WTW and deployed to the Strategic Grid WRZ. The following activities are required: - Demolish the existing wave wall. - Raise the existing embankment (clay core, shoulder fill and rip rap) by 5m. - Construct a new concrete wave wall at the crest of the raised embankments. - Modify the spillway arrangements. Includes raising the concrete weir block by 5m and increasing the height of the spillway channel side walls. - Complete replacement of the high level draw-off. - Modifications to the draw-off tower including extension of pipework, reconstruction of the control house and provision of additional valves. - Installation of an internal lining to strengthen the draw-off culvert. - Provision of a longer access bridge from the raised crest levels. - Construction of 4.6km of perimeter road around the reservoir. Majority of existing road will be submerged by the increased water level. - Placement of rip rap along the toe of the M45 embankment near to the expanded reservoir	Severn Estuary SPA and Ramsar River Clun SAC	Downstream receptor (>150km) Functional link (salmon)	10km of the scheme components, or impact pathways over a greater distance.		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.		

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
123A	Raise dam at Tittesworth by 5%	"This scheme is to increase the storage capacity of Tittesworth Reservoir by 5%. The capacity increase will enable additional water in Tittesworth Reservoir to be conserved for dry periods thus enabling Tittesworth WTW to operate at higher capacity longer into dry seasons. The additional raw water will be treated at Tittesworth WTW and deployed to the North Staffs WRZ. This scheme will raise the top water level (TWL) by 0.42m from 196.90m AOD to 197.32m AOD. This increase in water level will add 320 Ml of storage to the current reservoir (6,400Ml). The scheme requires the following: - Enhance the water tightness of the wave wall and raise it by 0.2m which allows raising the top water level (TWL) by 0.42m. - Modify the concrete bellmouth spillway to raise its crest level by 0.42m."	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 a 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.
123B	Raise Dam at Tittesworth Reservoir by 25%	This scheme is to increase the storage capacity of Tittesworth Reservoir by 25%. The capacity increase will enable additional water in Tittesworth Reservoir to be conserved for dry periods thus enabling Tittesworth WTW to operate at higher capacity longer into dry seasons. The additional raw water will be treated at Tittesworth WTW and deployed to the North Staffs WRZ. This scheme will raise the top water level (TWL) by 2.3m from 196.90m AOD to 199.2m AOD. This increase in water level will add 1,610 Ml	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	LSEs identified	The WFD has concluded a 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	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?
		of storage to the current reservoir (6,400Ml). The scheme requires the following: - Demolishing the existing wave wall and constructing a new wall. - Raise existing embankment by 2.3m. - Increase bellmouth weir crest level. - Modify the draw-off tower with extension of pipework, reconstruction of control house and provision of additional valves. - Install an internal lining to strengthen the draw-off culvert. - Provide a longer access bridge from the raised crest levels. - Placement of rip rap along the toe of the road embankment near to the expanded reservoir.			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.		Stage 2 Appropriate Assessment would need to be undertaken.		
128	Carsington to Tittesworth main	This scheme is to enable the transfer of raw water from the River Derwent and Carsington Reservoir to Tittesworth WTW through the provision of a new pumped raw water pipeline. The additional raw water will enable water in Tittesworth Reservoir to be conserved for dry periods thus enabling Tittesworth WTW to operate longer into dry seasons. Additional potable water will be deployed into the North Staffs WRZ. The scheme is sized for a maximum raw water transfer of 30Ml/d. A new treated water pipeline is proposed within the scheme due to anticipated network constraints. The scheme requires: - 42.6km of new 800mm dia pipeline between Carsington Reservoir and Tittesworth WTW with an associated new 30Ml/d pumping station. - New settlement lagoon near to Tittesworth Reservoir to receive raw water from Carsington Reservoir. - Connection to the inlet of Tittesworth WTW. - New pumping station.	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	2.8km 5.9km 4.03km/functional habitat (River Dove) 2.9km 2.9km	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. Bee's Nest and Green Clay Pits SAC, Gang Mine SAC and South Pennine Moors SAC are all sufficiently distant (based on standard thresholds) that construction activities will not cause impacts. 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	LSEs identified	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.	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		- 14.8km of new 700mm pipeline .			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. 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 breeding bird period, and habitat reinstatement.				
128Z	Carsington to Tittesworth main	"This scheme is to enable the transfer of raw water from the River Derwent and Carsington Reservoir to Tittesworth WTW through the provision of a new pumped raw water pipeline. The additional raw water will enable water in Tittesworth Reservoir to be conserved for dry periods thus enabling Tittesworth WTW to operate longer into dry seasons. Additional potable water will be deployed into the North Staffs WRZ. The scheme is sized for a maximum raw water transfer of 14Ml/d. Deployment is expected to be from Tittesworth WTW to Meir DSR via Ladderedge DSR. A new treated water pipeline from Ladderedge DSR to Meir DSR is proposed	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	2.8km 5.9km 4.03km/functional habitat (River Dove) 2.9km 2.9km	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. Bee's Nest and Green Clay Pits SAC, Gang Mine SAC and South Pennine Moors SAC are all sufficiently distant (based on standard thresholds) that construction activities will not cause impacts. 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	LSEs identified	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.	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		within the scheme due to anticipated network constraints. The scheme requires: - 42.6km of new 600mm dia pipeline between Carsington Reservoir and Tittesworth WTW with an associated new 14Ml/d pumping station. - New settlement lagoon near to Tittesworth Reservoir to receive raw water from Carsington Reservoir. - Connection to the inlet of Tittesworth WTW."			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. 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 breeding bird period, and habitat reinstatement.				
132	Whaddon to Forest Transfer	This scheme sets out to transfer up to 5Ml/d of potable water from the Strategic Grid WRZ to the Forest and Stroud WRZ , enabled by a surplus of supply in the Strategic Grid WRZ that is either currently present or will be created by other schemes. This will enable Mythe WTW supply to be transferred to Westrip DSR. The scheme does not require any capital works, as the assets have been installed previously. However, it	Bredon Hill SAC Cotswold Beechwoods SAC Dixton Wood SAC Rodborough Common SAC Wye Valley and Forest of Dean Bat Sites/Safleoedd Ystlumod Dyffryn Gwy a Fforest y Ddena SAC Wye Valley Woodlands/Coetiroedd Dyffryn Gwy SAC	6.6km 2.5km 8.1km 3.3km 0.4km 7.7km	The component utilises existing infrastructure, and requires no physical works, but requires operational changes to be made at Mythe WTW pumping station to allow release of an extra 5Ml/d from the Strategic Grid WRZ to the Forest and Stroud WRZ. The pumping station at Mythe WTW already has capacity to accommodate this. Therefore, although there are 10 European designated sites within 10km of the scheme	No LSEs anticipated	This component involves the transfer of treated water in the network. It is assumed there will be no change in abstraction or discharges to watercourses. 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?
		requires operational changes to be made at Mythe WTW to allow release of an extra 5Ml/d from the Strategic Grid WRZ to the Forest and Stroud WRZ. It will also require control and operational changes at the pumps to enable the transfer.	River Wye/Afon Gwy SAC Severn Estuary/Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar River Clun SAC	5.2km Downstream receptor (c.28km)/functional habitat Downstream receptor (c.28km)/functional habitat Functional link (salmon)	components, no LSEs are anticipated.				
134A	Use Blackbrook reservoir to provide additional supply of raw water to Cropston WTW	This scheme is to provide an additional source of raw water to Cropston WTW. Blackbrook Reservoir has been identified with the surplus resource available which could be transferred and utilised at Cropston WTW. The scheme is the 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 of the additional 8Ml/d during seasons of peak raw water availability. The treated water will be deployed via the existing supply network. The scheme requires the following: - Recommission the raw water intake at Blackbrook Reservoir for 8Ml/d - Minimal repair / maintenance works will be required to bring the draw-off works back into operation - A new 13.2km, 500mm diameter pipeline between Blackbrook Reservoir and Cropston WTW and an associated new pumping station. - Upsizing of Cropston WTW treatment processes.	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 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.	No LSEs anticipated	
142	Use Linacre reservoirs and abstraction licence as a supply to the gird either permanently or as a temporary drought resilience option	The concept of this scheme is to utilise raw water at Linacre reservoir for potable supply. Raw water will be abstracted from the reservoir and treated at a new WTW (sized for up to 6.85Ml/d)	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	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	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		constructed adjacent to the site. Treated water will be deployed to Linacre Distribution Service Reservoir (DSR) for deployment to customers in Chesterfield. The scheme requires the following: - A new raw water intake structure at Linacre Reservoir and associated 40kW pumping station. - A new WTW close to Linacre Reservoir - 500m of new 350mm dia pipeline from the new WTW to existing Linacre DSR - A new 40kW pumping station to transfer water from the new WTW to Linacre DSR			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.		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.		
143	W.Midlands Raw Water Storage	This scheme is to convert an existing third-party owned quarry site (Haughmond Hill Quarry) to a pumped raw water storage reservoir. To achieve a water resource benefit, the scheme will enable raw water abstraction of 100 Ml/d at times of high flow in the River Severn that can be stored until such times as there are low flows when a return release of up to 50Ml/d can be made to the River Severn. In turn this will be used to support existing abstractions downstream at Trimpley or Lickhill, near Kidderminster, where water can be transferred for treatment at Frankley Water Treatment Works (WTW). This option includes the construction of a dam around part of the quarry structure. Initial estimates of working volume provided by this option will be approximately 4,900Ml subject to the ground	Midland Meres and Mosses Phase 2 Ramsar Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar River Clun SAC	3.7km 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 of the scheme components; Midlands Meres and Mosses Phase 1 Ramsar. The components are c.3.7km to the south east (at the closest point) and therefore sufficiently distant such that adverse effects from construction are considered unlikely. A new abstraction would be required on the River Severn which is hydrologically connected to the Severn Estuary/Môr Hafren SAC and Severn Estuary SPA and Ramsar and likely to provide functionally linked habitat for the migratory fish species. 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	LSEs identified	The scheme will increase abstraction on the River Severn by c.100Ml/d during periods of high flow only. The scheme would also operate to meet the requirements of the HoF of 850 Ml/d at Bewdley. 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. 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 (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and twaite shad (*Alosa fallax*)) but	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?
		levels once mineral extraction ceases. The scheme comprises the following functional components: - A new abstraction site on the River Severn with associated structure. - New bi-directional pipeline and associated pumping station. - Discharge mechanism into the quarry. - Quarry conversion and dam, with emergency drawdown provision as required. - Abstraction from the quarry and connection into the bidirectional pipeline - Discharge into the River Severn - Abstraction from the River Severn for treatment and subsequent distribution of potable supply to customers.			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.		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 (*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.		
150	Little Haywood new WTW on Upper Trent	This scheme is to develop a new source of water for Stafford WRZ. The scheme is the construction of a new abstraction point on the River Trent to the east of Stafford that supports a new WTW (sized for up to 30Ml/d) for onward deployment to customers. The scheme requires the following: - A new abstraction point and intake structure on the River Trent with associated 134kW pumping station. - 1.3km of new 600mm dia pipeline between the abstraction point and the new WTW. - A new WTW at a suitable location close to the new abstraction point - 10km of new 600mm dia pipeline.	Cannock Chase SAC Pasturefields Salt Marsh SAC West Midlands Mosses SAC Midlands Meres and Mosses Phase 1 and 2 Ramsar River Mease SAC Humber Estuary SAC, SPA and Ramsar	2.1km 1.3km 5.1km 5.1km Downstream receptor (c.22km)/functional habitat Downstream receptor (>100km)	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. 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.	LSEs identified	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. 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.	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?
		- A new 686kW pumping station			Consideration will need to be given to positioning and routing structures to ensure changes to local hydrology do no adversely affect these areas of saltmarsh. 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.		Similarly, a long-term reduction 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 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. 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.		
152	Use currently under utilised R. Severn abstraction licences. We may choose to consolidate these licence entitlements at Hampton Loade or at other existing river intakes/ WTWs on the R. Severn	This scheme is to make use of the under utilised licence capacity at the River Severn at Hampton Loade WTW. Additional water will be abstracted from River Severn and after treatment at a new, separate WTW process stream (sized at 50Ml/d) near to Hampton Loade WTW will be transferred through a new pipeline and pumping station. The scheme requires the following: - A new abstraction point on the River Severn near Hampton Loade WTW - A new 150Ml capacity bankside storage reservoir close to the abstraction site. - A new 210kW pumping station to transfer raw water from the bankside storage to the new WTW, with associated connecting pipework between the	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,	LSEs identified	The scheme will increase abstraction on the 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 (Petromyzon marinus), river lamprey (Lampetra fluviatilis) and twaite shad (Alosa fallax)) 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	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?
		storage and the WTW. - A new WTW near to the existing Hampton Loade WTW - 20.9km of new 900mm dia pipeline from the new WTW - A new 3,128kW pumping station to transfer water - Expansion of Sedgley Beacon capacity by 30Ml			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.		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 (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.		
169	Termination of transfer to Yorkshire Water	This scheme is to completely terminate the Derwent Valley Reservoirs export agreement with Yorkshire Water Service Limited (YWSL). This will provide STWL with an anticipated additional 21,550Ml/yr (59Ml/d) raw water in the Derwent Reservoirs. This additional water will be stored and utilised during dry periods. This will enable STWL to keep operating Bamford WTW at higher capacity during dry seasons. No capital works are required by STWL for this scheme, although there will be an operational change associated with abstracting and treating additional raw water.	Peak District Dales SAC South Pennine Moors SAC Peak District Moors SPA (South Pennine Moors Phase 1) Humber Estuary SAC, SPA and Ramsar	10.7km (13km downstream receptor) 0.06km (adjacent) Downstream receptor (>200km)	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.	No LSEs anticipated	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). There are uncertainties regarding downstream spill regime into lower reservoirs and therefore potential impacts on flows within the River Derwent. As 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	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
							functionally linked habitat. Engineering feedback has confirmed no change to the existing spill regime. Therefore no LSEs anticipated.		
187A, B and C	A: Expand Carsington (10,500Ml) B: Expand Carsington (16,000Ml) C: Expand Carsington (24,500Ml)	This option involves enlargement of the existing Carsington Reservoir to provide an additional: 187A: 10,500 Ml. This will require raising the reservoir full supply level by approximately 4.0 m.	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, as such no LSEs are anticipated.	No LSEs anticipated	
190	Third party reservoir and new WTW's	This scheme is to agree purchase of an existing reservoir located to the north-west of Corby. The reservoir would provide raw water to a new 18Ml/d WTW constructed close to the reservoir. Treated water will be deployed to the existing trunk main system and also towards customers in Market Harborough via two new pipelines. The scheme requires: - Engagement with existing owners and	Rutland Water SPA and Ramsar The Wash and North Norfolk Coast SAC The Wash SPA and Ramsar	2.9km Downstream receptor (c.62km) Downstream receptor (c.62km)	There is one European designated site within 10km of the scheme components, Rutland Water SPA and Ramsar, and two hydrologically connected sites; The Wash SPA and Ramsar, and The Wash and North Norfolk Coast SAC (via River Welland). Based on the proximity of the Reservoir to Rutland Water SPA, it is considered to provide offsite functionally	LSEs identified	The use of 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. The current level of abstraction by Tata Steel is 7Ml/d, whilst the licenced abstraction is 36Ml/d from the River Welland. The ultimate	LSEs identified	? - no other schemes affecting The Wash within programme but may need to assess with other water company WRMPs/DPs and plans.

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		subsequent purchase of the reservoir - A new intake structure at the reservoir and new 226kW raw water pumping station. - A new 18Ml/d WTW located near the reservoir with pipeline connection to the new intake. - 7km of new 600mm dia pipeline from the new WTW to the trunk main - A new 570kW pumping station to transfer water from the new WTW to the trunk main - 13.4km of new 450mm dia pipeline from the new WTW to the runk main - A new 137kW pumping station to transfer water from the new WTW to customers in Beanfield and Market Harborough - Reline 3km of existing pipeline - Clean 4km of existing pipeline in Market Harborough.			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. 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.		downstream receptor of is the The Wash and North Norfolk Coast European Marine Site. There is no attribute or target within the Regulation 33 package for freshwater input to support any of the qualifying features. An understanding of the potential impacts of changes in flows from the scheme into The Wash has been undertaken. The catchment area of Reservoir at the base of the dam covers ~59km^2. Compared to the catchment of the River Welland (within which the reservoir is located and Eye Brook is a tributary of) of 1,274km^2, the Reservoir covers 4.6% of this area. Considering the wider catchment area draining into The Wash of 15,547km^2 (the seaward extent of The Wash being defined by the Ramsar boundary), the 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 ~64m^3/s (5,529Ml/d). When compared to the proposed 0.21m^3/s (18Ml/d) reservoir abstraction this is only 0.3% of the total daily mean flow. 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.		

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
							Given this and no freshwater attribute in the SACO, no LSEs on The Wash are anticipated.		
301A	UU import to Shelton - 12Ml/d (301A) and 25Ml/d (301B)	This scheme is to import 12Ml/d or 25Ml/d from United Utilities' Llanforda WTW using the existing booster pumping station to serve customers in and around Oswestry in the Shelton WRZ. It is expected the import will fully replace the existing sources of supply enabling them to be utilised elsewhere in the WRZ. The scheme requires the following: - New agreement to be established with UU for this import. It is assumed that water will be available. - Pumping station upgrade at the Llanforda booster pumping station to deliver 12Ml/dor 25Ml/d. - The connection between the existing booster pumping station and STWL network is to be investigated to establish the requirements of potential upgrades. - Hydraulic modelling to confirm the operational requirements regarding deployment of imported water.	Montgomery Canal SAC Midlands Meres and Mosses Phase 2 Ramsar River Dee and Bala Lake SAC Tanat and Vyrnwy Bat Sites SAC Midlands Meres and Mosses Phase 1 Ramsar Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar	8.6km 5.8km 7.5km 11km 3.3km Downstream receptor (>100km)/functional habitat Downstream receptor (>100km)/functional habitat	There are three European designated sites within 10km of Llanforda WTW; Montgomery Canal SAC, River Dee and Bala Lake SAC and Midlands Meres and Mosses Phase 2 Ramsar. The Tanat and Vyrnwy Bat Sites SAC is approximately 11km to the south west. There is one designated site within 10km of Shelton WTW; Midlands Meres and Mosses Phase 1 Ramsar, and the Severn Estuary EMS is further downstream. It is assumed that only minor network interventions are required to receive the bulk supply, and that these will be carried out in the site, with minimal construction works required. All designated sites 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). As such, no LSEs are anticipated.	No LSEs anticipated	It is assumed that UU have the water available to allow the transfer, and have completed their own HRA. This component involves the transfer of treated water into the network via new pipeline connections. There are no proposed changes to abstraction within Severn Trent's water resource zones, and therefore no LSEs are anticipated.	No LSEs anticipated	
303A	UU release from Vyrnwy - 75Ml/d	This scheme is to enable managed release of an additional 75Ml/d of 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). Abstracted water will be treated at Frankley WTW and deployed to customers in the Strategic Grid WRZ via the existing network. No new assets are proposed for the release, abstraction, transfer, treatment and deployment of water. The additional raw water release will only occur when flows in the River Severn are unable to accommodate	Berwyn and South Clywd Mountains/Berwyn a Mynyddoedd De Clwyd SAC Berwyn SPA Tanat and Vyrnwy Bat Sites / Safleoedd Ystlumod Tanat ac Efyrnwy SAC Montgomery Canal SAC Severn Estuary/Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar	Adjacent to Lake Vyrnwy Adjacent to Lake Vyrnwy 0.6km to River Vyrnwy 0.1km to River Vyrnwy Downstream receptor (c.28km)/functional habitat Downstream receptor (c.28km)/functional habitat Functional link (salmon)	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 anticipated	It is assumed that UU have the water available to allow the transfer, and have completed their own HRA. 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	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?
		the Lickhill abstraction. This transfer is proposed to be utilised for 55 days per year. This scheme assumes 10% transmission losses, enabling 68Ml/d of additional raw water at Frankley WTW.	River Clun SAC				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. 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 (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and twaite shad (*Alosa fallax*)) 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). Changes in the volume of water and flow into the Severn Estuary could also impact		

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
							salmon movement to the River Clun SAC, designated for freshwater pearl mussel (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.		
303B	UU release from Vyrnwy - 40Ml/d	This scheme is to enable managed release of an additional 40Ml/d of 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). Abstracted water will be treated at Frankley WTW and deployed to customers in the Strategic Grid WRZ via the existing network. No new assets are proposed for the release, abstraction, transfer, treatment and deployment of water. The additional raw water release will only occur when flows in the River Severn are unable to accommodate the Lickhill abstraction. This transfer is proposed to be utilised for 55 days per year. This scheme assumes 10% transmission losses, enabling 36Ml/d of additional raw water at Frankley WTW.	Berwyn and South Clywd Mountains/Berwyn a Mynyddoedd De Clwyd SAC Berwyn SPA Tanat and Vyrnwy Bat Sites / Safleoedd Ystlumod Tanat ac Efyrnwy SAC Montgomery Canal SAC Severn Estuary/Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar River Clun SAC	Adjacent to Lake Vyrnwy Adjacent to Lake Vyrnwy 0.6km to River Vyrnwy 0.1km to River Vyrnwy Downstream receptor (c.28km)/functional habitat Downstream receptor (c.28km)/functional habitat Functional link (salmon)	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 anticipated	It is assumed that UU have the water available to allow the transfer, and have completed their own HRA. 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	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?
							habitats. As such, no LSEs are anticipated for these designated sites. 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 (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and twaite shad (*Alosa fallax*)) 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). 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 (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		

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
							Stage 2 Appropriate Assessment would need to be undertaken.		
303C	UU release from Vyrnwy - 25Ml/d	This scheme is to enable managed release of an additional 75Ml/d of 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). Abstracted water will be treated at Frankley WTW and deployed to customers in the Strategic Grid WRZ via the existing network. No new assets are proposed for the release, abstraction, transfer, treatment and deployment of water. The additional raw water release will only occur when flows in the River Severn are unable to accommodate the Lickhill abstraction. This transfer is proposed to be utilised for 55 days per year. This scheme assumes 10% transmission losses, enabling 68Ml/d of additional raw water at Frankley WTW.	Berwyn and South Clywd Mountains/Berwyn a Mynyddoedd De Clwyd SAC Berwyn SPA Tanat and Vyrnwy Bat Sites / Safleoedd Ystlumod Tanat ac Efyrnwy SAC Montgomery Canal SAC Severn Estuary/Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar River Clun SAC	Adjacent to Lake Vyrnwy Adjacent to Lake Vyrnwy 0.6km to River Vyrnwy 0.1km to River Vyrnwy Downstream receptor (c.28km)/functional habitat Downstream receptor (c.28km)/functional habitat Functional link (salmon)	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 anticipated	It is assumed that UU have the water available to allow the transfer, and have completed their own HRA. 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. 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	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?
							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 (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and twaite shad (*Alosa fallax*)) 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). 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 (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.		

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
304	Ambergate to Mid-Notts transfer	This scheme is to transfer water from the Strategic Grid WRZ to Nottinghamshire WRZ, enabled by a surplus of supply in the Strategic Grid WRZ that is either currently present or will be created by other schemes. The transfer will be enabled by making a new connection from the Derwent Valley Aqueduct (DVA) in the Strategic Grid WRZ to Nottinghamshire WRZ (sized at a maximum transfer of 30Ml/d). The scheme requires the following: - 15km of new 750mm dia pipeline. - 6km of new 750mm dia pipeline. - A new 112kW pumping station. The onward transfer will be conveyed by gravity.	Gang Mine SAC Peak District Dales SAC	6.9km 7.3km	There are two European designated sites within 10km of the scheme components; Gang Mine SAC and Peak District Dales SAC. Both are at sufficient distance (>6km) such that construction related impacts are considered unlikely.	No LSEs anticipated	This component involves the transfer of treated water in the network, with no changes in abstraction or discharges. As such, no LSEs are anticipated.	No LSEs anticipated	
305	Heathy Lea to North Notts transfer	This scheme is to transfer water from the Strategic Grid WRZ to Nottinghamshire WRZ, enabled by a surplus of supply in the Strategic Grid WRZ that is either currently present or will be created by other schemes. The transfer will be enabled by making a new connection from the Strategic Grid WRZ to the Nottinghamshire WRZ (sized at a maximum transfer of 25Ml/d). The scheme requires the following: - 36.9km of new 700mm dia pipeline. - A new 633kW pumping station.	Peak District Dales SAC South Pennine Moors SAC Peak District Moor (South Pennine Moors Phase 1) SPA	4.2km/ hydrological connectivity <0.1km <0.1km	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. 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	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	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
					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. 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				
309&309Z	Transfer from Hampton Loade WTW (SSW) to Nurton (309 = 18Ml/d, 309Z = 10Ml/d)	This scheme is to redirect some of the potable supply received from Hampton Loade WTW towards the Shelton WRZ instead of it being delivered to Wolverhampton WRZ. The intention is to deliver up to 18Ml/d or 10Ml/d to Shelton WRZ, essentially achieving a transfer of water from the Wolverhampton WRZ to the Shelton WRZ. The resulting reduction of supply to Wolverhampton WRZ will need to be absorbed within an existing surplus or be substituted by another scheme. The scheme requires the following: - Using the existing pipelines from Hampton Loade WTW to for part of the distance to Shelton WRZ. - At a suitable location a new connection will be made to one or both of these mains - 11.7km of new 600mm dia pipeline will be connected to the new	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	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
		connection and transfer water to Shelton WRZ.							
313	DVA improvements to Heathy Lea (for 27Ml/d)	This scheme is to improve conveyance in the existing Derwent Valley Aqueduct to increase maximum output flows from Bamford WTW by approximately 27Ml/d, from 175Ml/d to 202Ml/d, releasing constrained treatment capacity. Localised upgrades to interstage pumping at Bamford WTW will also be required. The current understanding is that the existing DVA has hydraulic capacity for up to 185Ml/d and an additional 17Ml/d will be enabled by the scheme through: - DVA syphon pipes being triplicated by 5.5km of new 600mm diameter main. - 140kW 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. 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).	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 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.

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
					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.				
314	DVA Bamford to Ambergate enhancement plus Bamford expansion (60Ml/d)	This scheme is to increase the output from Bamford WTW up to 235Ml/d by increasing conveyance capacity in the potable supply network and upgrading Bamford WTW. The existing Derwent Valley Aqueduct (DVA) will be enhanced to achieve 202Ml/d and an additional pipeline will enable deployment of a further 33Ml/d. The scheme requires: - Development of a new process stream and upgrades to Bamford WTW (including 140kW interstage pumping on the existing WTW) to produce up to 235Ml/d - 5.5km of 600mm diameter main. - 46.3km of new 700mm dia pipeline, to include 14.4km of 2800mm dia tunnel. - 708kW pumping station to transfer water from Bamford WTW	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	0.031km directly adjacent 2.4km 0.065km 0.78km 0.78km	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	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 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.

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
					mitigation or detailed design inputs at the WRMP level. 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. 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. 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.				
406	New abstraction and WTW on River Trent	This scheme provides additional resource to Nottinghamshire WRZ by establishing a new abstraction point (up to 100Ml/d) on the River Trent with associated raw water storage reservoir near to Stoke Bardolph to supply raw water to a new WTW (sized for up to 50Ml/d) near to the abstraction site. Potable water will	Humber Estuary SAC, SPA and Ramsar	Downstream receptor (>100km)	There are no European designated sites within 10km of the scheme components. 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	No LSEs anticipated	The WFD has concluded that in Q95 conditions there would be a flow reduction of c.4% 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	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?
		be deployed to the existing network located north of Nottingham. The scheme requires: - New 100 Ml/d intake on the River Trent and associated intake pumping station - 2 new bank side storage reservoirs to total 8000Ml capacity offering 160 days of storage - Low lift pumps and pipelines to transfer raw water from the storage to the new WTW. - A new 50Ml/d WTW - A new 1,805kW high lift pumping station for potable water - 9km of new 900mm diameter pipeline from the new WTW to Redhill DSR			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.		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* 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	This scheme is to increase Campion Hills WTW treatment capacity to enable the site to sustainably operate at 23Ml/d output. The current maximum sustainable capacity is estimated at 17.5Ml/d. The scheme requires: - groundwater source pumps (2 x pumps operating duty/standby capable of operating 4.3Ml/d) - Telemetry outstation - New 620m3 backwashing tanks - Granular activated carbon adsorbers (3 x GAC adsorbers the same size as those already installed) - Rapid gravity filters (2x RGF the same size as those already installed) - Replacement of high lift pumps (3 x pumps to delivery 22.6 Ml/d) - Lamella clarifier (2 x Hopper Bottomed Clarifiers the same size as those already installed) - 178kW New pumping station for Kenilworth pumps for 10Ml/d transfer	Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar	Downstream receptor (c.77km)/functional habitat (River Severn) Downstream receptor (c.77km)/functional habitat (River Severn)	There are no European designated sites within 10km of the scheme components, or impact pathways over a greater distance.	No LSEs anticipated	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.	No LSEs anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
423	Draycote WTW DO Recovery	This scheme is to increase Draycote WTW treatment capacity to enable the site to sustainably operate at 35Ml/d output. The current maximum sustainable capacity is estimated at 26.9Ml/d. The scheme requires: - Dissolved air flotation plant (Assumed size for 6Ml/d) - Granular Activated Carbon (GAC) adsorbers (3 x GAC adsorber units, the same size as those already installed) - Phosphate Dosing - Flash Mixer (Replacement of flocculator paddle) - Intake pumping station (6Ml/d to increase existing pump capacity) - Emergency storage capacity increase (450m3)	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	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.	No LSEs anticipated	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
426	Little Eaton WTW DO Recovery	This scheme is increase Little Eaton WTW treatment capacity to enable the site to sustainably operate at 88Ml/d output. The current maximum capacity is estimated at 78Ml/d. The scheme requires: - Two new GAC adsorbers to give total GAC throughput of 98Ml/d - One Lamella clarifier (same size as the ones currently installed). Total throughput of 97Ml/d - Rapid gravity filters. Total throughput capacity of 95Ml/d - WRc thickeners sufficiently sized for increased flow	Peak District Dales SAC	Upstream receptor (c.17.6km)/functional habitat	There are no European designates sites within 10km of the scheme components. 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.	No LSEs anticipated	The scheme upgrades to increase deployable output are unlikely to require additional abstraction beyond existing licenced volumes, however an increase (from c.78Ml/d to 88Ml/d, within the existing average daily licence of 90Ml/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. Although hydrologically	LSEs identified	Y - abstractions affecting the Peak District Dales SAC functionally linked habitat. 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?
							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).		
429	Mythe WTW DO Recovery	This scheme is to increase Mythe WTW treatment capacity to enable the site to sustainably operate at 125Ml/d output (which includes a sweetening flow from Strensham of ~5Ml/d). The current maximum sustainable capacity is estimated at 104Ml/d which is less than the abstraction licence of 136Ml/d (of which 120 Ml/d is for public water supply). The scheme requires: - UV disinfection plant (Currently there are 2 Nr. D/D reactor. This is additional reactor to bring the treatable flow up to 140Ml/d) - Actiflo Clarifiers (3 x new clarifiers with total capacity of 22.5Ml/d) - Renewal of booster pumps (Increase capacity up to 48Ml/d)	Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar River Clun SAC	Downstream receptor (>40km) Downstream receptor (>40km) Functional link (salmon)	There are no European designated sites within 10km of the scheme components. The Severn Estuary EMS is the ultimate downstream receptor. It is unlikely that construction works would be required outside the WTW site, with the additional capacity to be achieved through upgrades to various process streams. However, downstream effects (e.g. suspended sediment, pollution incidents) could be controlled through standard best practice and mitigation measures. As such, no LSEs are anticipated	No LSEs anticipated	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. 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 (*Petromyzon marinus*), river lamprey *(Lampetra fluviatilis*) and twaite	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?
							shad (*Alosa fallax*)) 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). 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 (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.		
430	Ogston WTW DO Recovery	This scheme is to increase Ogston WTW treatment capacity to enable the site to sustainably operate at 74Ml/d output. The current maximum capacity is estimated at 69Ml/d. The scheme requires: - 12.6Ml/d additional capacity Dissolved air flotation plant (DAF) - Flocculation tank - 10.7Ml/d new GAC adsorbers - New Whatborough supply pumps - Flash mixers	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: *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.*	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?
							- River lamprey: *Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey.*		
431	Shelton WTW DO Recovery	This scheme is to increase Ogston WTW treatment capacity to enable the site to sustainably operate at 38Ml/d output. The current maximum capacity is estimated at 34Ml/d. The scheme requires: - Rapid gravity filters (2 more RGF units to increase capacity to 32Ml/d) - RGF clarifiers (2 x flat bottom clarifiers for an additional 9.6Ml/d) - Upgrade GAC final pumps (Upgrade pumps to delivery additional 8Ml/d and achieve total capacity of 32Ml/d) - Sodium Hydroxide dosing (Replacement of existing dosing rig – 32Ml/d maximum flow to be treated) - Sludge holding tank (164m3 new tank for additional 22.5Ml/d)	Midlands Meres and Mosses Phase 1 and 2 Ramsar Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar	3.2km Downstream receptor (>100km)/functional habitat Downstream receptor (>100km)/functional habitat	There is one European designated site within 10km; Midlands Meres and Mosses Phase 1 and 2 Ramsar. The closest area of the designation being 3.2km to the north east. No construction works are required outside the Shelton WTW site, with the additional capacity (4Ml/d) to be achieved through upgrades to various process streams. As such, no LSEs are anticipated. The Shelton WTW is sufficiently set back from the River Severn, and separated by an urban area, such the pollution incidents and suspended sediments are unlikely to enter the watercourse. Works are the intake are not proposed as part of the scheme. As such, no LSEs to the Severn Estuary EMS and functionally linked habitat is anticipated.	No LSEs anticipated	The scheme aims to operate Shelton WTW at design capacity (38Ml/d), increasing the output by 4Ml/d. This would only be by a small amount (<2% flow change at Q95 conditions), however, the CAMS assessment indicates that there is no water available for abstraction at Q95 conditions. 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 (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and twaite shad (*Alosa fallax*)) 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). 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 (*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.	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?
							Should this option be taken forward to the preferred options stage, scheme level investigations and Stage 2 Appropriate Assessment would need to be undertaken.		
434	Trimpley WTW DO Recovery	This scheme is to increase Trimpley WTW treatment capacity remove these constraints to enable the site to sustainably operate at 60Ml/d output. The current maximum sustainable capacity is estimated at 52Ml/d. The scheme requires: - Rapid Gravity Filters (RGFs) (Install 2 x RGF the same size as already installed to increase RGF throughput capacity to 78.6Ml/d) - Replacement of current interstage pumps (Replace four interstage pumps to increase the capacity to 75.9Ml/d) - Granular Activated Carbon (GAC) adsorbers (2 x new adsorbers to increase capacity to 79.5Ml/d) - Washwater tank (540m3)	Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar	Downstream receptor (c.90km)/functional habitat Downstream receptor (c.90km)/functional habitat	There are no European designated sites within 10km of the scheme components, or impact pathways over a greater distance. 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.	No LSEs anticipated	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.	No LSEs anticipated	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
435	Whitacre WTW DO Recovery	This scheme is to increase Whitacre WTW treatment capacity to enable the site to sustainably operate at 49Ml/d output. The current maximum sustainable capacity is estimated at 41Ml/d. The scheme requires: - Granular activated carbon adsorbers (4nr GAC adsorbers to give a total capacity of 50.4Ml/d) - Low lift pumps at Whitacre reservoir (2 x new low lift pumps to replace existing pumps at Whitacre reservoir) - Replacement of existing interstage pumps (like for like pump replacement for delivering 27.9Ml/d) - Additional 2 x new pumps at River Blythe PS - Additional capacity of Eel screen	River Mease SAC Humber Estuary SAC, SPA and Ramsar	Downstream receptor (c.30km)/functional habitat Downstream receptor (>100km)	There are no European designated sites within 10km of the scheme components, or impact pathways over a greater distance. 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.	No LSEs anticipated	The confluence of the River Mease SAC with the River Trent is approximately 30km downstream of Whiteacre 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 . 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*	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?
							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.*		
437	Transfer from Hampton Loade WTW (SSW) to Nurton DSR (10 Ml/d)-Finham FE to Draycote -Draycote WTW Expansion	This scheme is to make use of treated final effluent produced at Finham Sewage Treatment Works (STW) to support the raw water availability at Draycote WTW. The scheme will use the enhanced effluent treatment facility at Finham STW that STWL are progressing separately. The final effluent will be transferred to Draycote Reservoir that is subject to expansion by scheme 122A (considered separately). The existing Draycote WTW will be expanded and existing processes enhanced to treat the blended Draycote Reservoir and Finham treated final effluent water. The treated potable water will be deployed via a new pumping station and pipeline into the Strategic Grid WRZ. The scheme requires: - Enhanced effluent treatment at Finham STW & water quality monitoring in the River Sowe and River Avon that is to be delivered by STWL separately. - Capture and attenuation of treated effluent from Finham STW ready to deliver to Draycote Reservoir. - 15.7km of new 900mm dia pipeline from Finham STW to Draycote Reservoir to transfer a maximum flow of 30Ml/d - A new 428kW pumping station to transfer treated final effluent from Finham	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 (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and twaite shad (*Alosa fallax*)) 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). 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 (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.	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?
		STW to Draycote Reservoir - Raw water storage at Draycote Reservoir (Assumed that WRMP24 Scheme 122A will deliver the required storage for this scheme) - Draycote WTW upgrades (including an AOP plant) and expansion. - 11.7km of new 700mm dia pipeline between Draycote WTW and the existing network near Coventry - A new 314kW pumping station to transfer potable water from Draycote WTW to the existing network					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.		
439	Longdon Marsh Reservoir -Increase Frankley WTW by 190Ml/d	This scheme is formed of two main parts. Firstly the construction of a new 125Mm3 (usable storage 99Mm3) raw water reservoir at Longdon Marsh, Gloucestershire that will be used to store water from the River Severn. There will be a new 350Ml/d abstraction point on the River Severn and associated infrastructure to fill the reservoir. Abstraction infrastructure will be installed at the new reservoir to transfer up to 190Ml/d of raw water to Frankley WTW. The second part of the scheme is to upgrade Frankley WTW to treat the additional raw water and the deployment infrastructure to deploy the treated water into the Strategic Grid. This scheme will provide additional 190Ml/d to Strategic Grid WRZ via Frankley WTW. The scheme requires the following: - Construction of a dam and reservoir at Longdon Marsh with total volume 125,000 Ml and live storage of 99,000Ml - A new 350Ml/d abstraction point on the River Severn with associated pumping infrastructure. - 3.9km of new 1800mm	Bredon Hill SAC Lyppard Grange Ponds SAC Severn Estuary/Môr Hafren SAC Severn Estuary SPA and Ramsar River Clun SAC Humber Estuary SAC, SPA and Ramsar	6.4km 1.7km Downstream receptor (c.31km)/functional habitat (River Severn) Downstream receptor (c.31km)/functional habitat (River Severn) Functional link (salmon) Downstream receptor (>100km)	There are two European designated site 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. 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	LSEs identified	The new 350Ml/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 2568Ml/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. 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 (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and twaite	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?
		dia raw water pipeline from River Severn to Longdon Marsh Reservoir - 54km of 1800mm diameter pipeline from Longdon Marsh Reservoir to Frankley WTW - A new 15,543kW pumping station to transfer raw water from Longdon Marsh Reservoir to Frankley WTW - Upgrade of Frankley WTW to enable treatment of additional 190Ml/d - 14.1km of new 1500mm diameter potable water pipeline from Frankley WTW to Highters Heath DSR - A new 2,557kW pumping station to transfer potable water from Frankley WTW to Highters Heath DSR - 23.4km of new 1050mm dia potable water pipeline from Highters Heath DSR to Meriden DSR - A new 246kW pumping station to transfer potable water from Highters Heath DSR to Meriden DSR			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. 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 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.		shad (*Alosa fallax*)) 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 (*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. 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.		

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
523	Mow Cop GW - treated water transfer or licence trade with United Utilities	This option is a treated water import from UU Mow Cop GW source to STWL. Mow Cop Service Reservoir. The assessment only consider the water supply once located within Mow Cop Service ReservoirSTW's network and the dedicated pumping main that would be required to Mow Cop SR. No further abstraction than the one held by UU would be required as part of this option. No inter catchment transfers are proposed and water provided by UU would be used through the network.	Midland Meres & Mosses Phase 1 Ramsar Midland Meres & Mosses Phase 2 Ramsar	9km 9km	The option would require the construction of a dedicated pumping station to allow treatment of the water transferred by UU. Due to the distance between the option and Midland Meres & Mosses Phase 1 & 2 Ramsar, and due to the lack of hydrological connectivity (both are located upstream of the option), no LSE are anticipated from construction works.	No LSEs anticipated	No further abstraction required for this option, and due to the distance between the option and Midland Meres & Mosses Phase 1 & 2 Ramsar, and due to the lack of hydrological connectivity (both are located upstream of the option), no LSE are anticipated from construction works.	No LSEs anticipated	No
528	New Source - Soar - PT sandstone	This scheme is to establish two new production groundwater sources in the Soar - PT sandstone groundwater body located to north of Coalville. Approximately 5Ml/d raw water will be abstracted from these new groundwater sources and will be transferred to Melbourne WTW using new pumps and pipeline. The scheme requires the following: - Establish suitable site and drill two new groundwater sources - 2 new 85kW borehole pump sets and headworks - 2.2km of new 350mm dia pipeline from the groundwater sources to Melbourne WTW - A new 24.4kW pumping station to lift water from the groundwater sources to Melbourne WTW	River Mease SAC Humber Estuary SAC, SPA and Ramsar	8.8km Downstream receptor (>200km)	The closest European site is the River Mease SAC; this site will almost certainly be unaffected by construction due to separate surface water catchment and distance. No LSEs are anticipated upon Humber Estuary SAC, SPA and Ramsar and Severn Estuary SAC/SPA/Ramsar due to the distance (over 200km)	No LSEs anticipated	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. 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.* An LSE to the Humber Estuary alone, from changes in freshwater volume, is considered unlikely, based on the volumes and CAMS data indicating water	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?
							availability from the aquifer.		
549A	Raw water import from Congleton to Tittesworth (from UU)	This scheme is to import raw water from a United Utilities source in Congleton to support Tittesworth Reservoir. Raw water is to be transferred to Tittesworth Reservoir where it will be stored thus increasing raw water availability throughout the year. The raw water import of up to 10Ml/d to Tittesworth Reservoir will enable increased utilisation of Tittesworth WTW, particularly during dry seasons. There are no capital assets proposed within the STWL scheme and it includes only the import costs that will be charged by UU to STWL. All required assets for the transfer will be delivered by a UU WMRP scheme.	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 STW'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 import from Congleton to Tittesworth (from UU)	This scheme is to import treated water from a United Utilities source in Congleton to Tittesworth WTW. Potable water is to be transferred to the outlet of Tittesworth WTW and during operation will enable water production at Tittesworth WTW to be reduced, thereby reducing draw down at Tittesworth Reservoir, whilst maintaining treated water output to customers. The treated water import of up to 10Ml/d will help to secure increased raw water availability at Tittesworth WTW, particularly during dry seasons. There are no capital assets proposed within the STWL scheme and it includes	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 STW'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	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?
		only the import costs that will be charged by UU to STWL. All required assets for the transfer will be delivered by a UU WMRP scheme.			measures and best practice mitigation would be implemented during construction to reduce the risk.				
552	UU Bearstone treated water Import	Treated water transfer from UU's Bearstone groundwater sources to STW's existing network. UUs Option ID is WR420. The connection will be made by UU to the Severn Trent Water network. No capital works required for STWL.	Midlands Meres and Mosses Phase 2 Ramsar	7.6km	No capital works are required by Severn Trent. Therefore no LSEs are anticipated.	No LSEs anticipated	This component involves the movement of treated water within a network between United Utilities Water and Severn Trent. It is assumed that UU have completed the necessary HRA assessments to confirm the supply of water without adverse effects.	No LSEs anticipated	
556	Hallgates to Oldbury	This scheme is to increase the capacity in the STWL Strategic Grid potable supply network. The scheme will provide capacity of up to 65Ml/d enabling potable supply surplus in the eastern grid to be transferred to the southern parts of the Strategic Grid. The scheme will serve to increase the existing capacity of strategic trunk mains. The scheme requires the following: - 32.3km of new 1000mm dia pipeline from Melbourne WTW - A new 1,409kW pumping station at Melbourne WTW - A new break pressure tank - A new 764kW booster station on the pipeline	River Mease SAC Ensor's Pool SAC Humber Estuary SAC, SPA and Ramsar	2.4km 5.1km Downstream receptor (>200km)	There are two European designated sites within 10km of the component 556 which would require the construction of new assets (pipeline, pumping station, booster station and tank). 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. 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.. Ensor's Pool SAC is described as isolated from river systems and is therefore a 'refuge'	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 anticipated	

ID	Name	Description	European Sites	Approximate distance (km)	Construction Commentary	Construction LSE?	Operational Commentary	Operation LSE?	In-combination assessment required?
					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. 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.				
557	Oldbury to Meriden	This scheme is to increase the capacity of part of the STWL Strategic Grid potable supply network. The scheme will increase the capacity by 65Ml/d to provide a maximum transfer capacity of 120Ml/d. This will enable surplus sources of water in the eastern grid to be transferred to the southern parts of the Strategic Grid and vice versa as need arises. The scheme will require duplication of an existing pipeline. The flow from will be conveyed by gravity, whilst the reversal of flow will require a new pumping station. The scheme requires the following: - 14.4km of new 1000mm dia pipeline - A new 666kW pumping station	Ensor's Pool SAC Humber Estuary SAC, SPA and Ramsar Severn Estuary SAC, SPA and Ramsar	4.4km Downstream receptor (>200km) Downstream receptor (>150km)	There is one European designated site within 10km of the component 557 which would require the construction of new assets (pipeline and pumping station). 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. 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.	No LSEs anticipated	The option will not require additional abstraction and therefore operational activities are not considered to have a significant impact upon the SAC.	No LSEs anticipated	

T: +44 (0) 1235 75 3000
E: enquiry@ricardo.com
W: ee.ricardo.com